CITY OF GRAND JUNCTION
MUNICIPAL CODE

Volume II

A Codification of the General Ordinances

of the City of Grand Junction, Colorado

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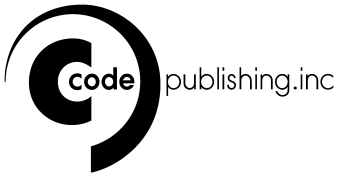

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Title 21

ZONING AND DEVELOPMENT CODE

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Chapter 21.01

GENERAL PROVISIONS

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21.01.010 Title.

These regulations shall be known and cited as the City of Grand Junction zoning and development code ("code"). The code has been adopted pursuant to Ordinance No. 4419 dated April 5, 2010, and as amended thereto.

(Ord. 4419, 4-5-10)

21.01.020 Authority.

The City of Grand Junction ("City") is authorized by its home rule powers pursuant to the Colorado Constitution and the City of Grand Junction Charter. The City Council chooses to exercise broad powers including the regulation of zoning, planning, and subdivision of land. In addition, the City Council intends that all other available powers shall support this code including those powers and those provided by State law, such as but not limited to municipal powers, planning and zoning § 31-23-101 C.R.S., et seq.; § 30-28-201 C.R.S., et seq.; § 29-20-101 C.R.S., et seq.; the power to designate and administer areas and activities of State interest, § 24-65.1-101 C.R.S., et seq.; regulation of planned unit development, § 24-67-101 C.R.S., et seq. If other authority is available because of changes in statutory and case law, State and federal, the City Council intends to avail itself of those resources as well.

(Ord. 4419, 4-5-10)

21.01.030 Application.

This code shall apply to all territory, uses and facilities within the City's limits, and to public and private lands, all uses thereon, and all structures and buildings over which the City has jurisdiction under the constitution and laws of the State of Colorado of the United States or pursuant to the City's powers. No person shall begin or change a land use or development in the City without first obtaining a permit or approval from the Director. Uses not allowed or permitted are prohibited (see Use Table, GJMC 21.04.010).

(Ord. 4546, 7-18-12; Ord. 4419, 4-5-10)

21.01.040 Purpose.

The code is intended to enable the City to uniformly and consistently evaluate, improve and approve, as appropriate, development, changes to existing uses, future uses and activities and to promote the health, safety and general welfare of the citizens and residents of the City. Not all situations will fall into easily

identifiable processes and requirements. This code provides flexibility in dealing with situations in general, and especially those which do not fit well with typical processes and standard requirements. The elements that make up this code are interrelated and cannot be taken in isolation; all provisions and regulations must be taken within the context and intent of the entire code.

(Ord. 4419, 4-5-10)

21.01.050 Severability.

The provisions of this code shall be severable. If any provision is declared invalid by a court of competent jurisdiction, the effect of such decision shall be limited to that provision or provisions which are expressly stated in the decision to be invalid; and such decision shall not affect, impair or nullify this code as a whole or any other part thereof.

(Ord. 4419, 4-5-10)

21.01.060 Consistency with Comprehensive Plan.

The code is intended to implement the goals and policies of the Grand Junction Comprehensive Plan, as amended ("Comprehensive Plan") and to be consistent with the Comprehensive Plan.

(Ord. 4419, 4-5-10)

21.01.070 Minimum standards.

This code sets the minimum requirements necessary for the promotion of public health, safety, and welfare. In many instances, the public is best served when such minimums are exceeded. If any other applicable law, rule, contract, resolution or regulation of the City, County, State or federal government contains standards covering the same subject matter, the more restrictive requirement or higher standard shall control.

(Ord. 4419, 4-5-10)

21.01.080 Private restrictions.

This code is not intended to affect any private agreement or condition such as a deed restriction or covenant. If any provision of this code is more restrictive or imposes a higher standard than any such private restriction, the requirements of this code shall control. Where the provisions of any private restriction are more restrictive or impose higher standards than the provisions of this code, the City has no duty to enforce such private restrictions, but may do so if otherwise authorized.

(Ord. 4419, 4-5-10)

21.01.090 Application of regulations during local emergency.

The Director may waive any or all provisions of this code during a local emergency declared by the City's Mayor or City Manager. A wildfire, flood or other catastrophic situations are examples of a local emergency.

(Ord. 4419, 4-5-10)

21.01.100 Violations under prior code.

Any person who violates any provision of the prior code shall be subject to the provisions of that code which shall remain in effect for these purposes.

(Ord. 4419, 4-5-10)

21.01.110 Nonconformities under prior code.

A lawful nonconformity under the previous code may remain as a nonconformity, so long as use or location is continuous. Any expansion or increase that is not permitted by this code is unlawful.

(Ord. 4419, 4-5-10)

21.01.120 Applicability.

(a) 2010 Zoning and Development Code. The 2010 code shall apply:

(1) To each application for which an application is made after April 5, 2010; and each development approved after April 5, 2010; and

(2) If the Planning Commission or City Council finds that the development schedule has not been met, the development has been abandoned, or is not in compliance with the 2000 or former zoning and development code.

(3) An applicant may elect to use the provisions of the 2010 code any time after the effective date; however, an election to use the new code shall lock the applicant into the 2010 code.

(b) 2000 Zoning and Development Code. The 2000 code shall apply:

(1) To each application for which an application was made after July 26, 2000, and approved prior to April 5, 2010; and

(2) If the Planning Commission or City Council finds that the development schedule has not been met, the development has been abandoned, or is not in compliance with the former code.

(3) An applicant may elect to use the provisions of the 2000 code any time after the effective date; however, an election to use the new code shall lock the applicant into the 2010 code.

(c) Appeals. A decision by either the Planning Commission or the City Council to apply this code or the former code is not appealable other than in accordance with Colorado Rule of Civil Procedure 106.

(Ord. 4419, 4-5-10)

21.01.130 Decision-making authority.

(a) City Council. In addition to the powers and duties in City Charter Article VI, the City Council shall:

(1) Appoint members to the Planning Commission, the Zoning Board of Appeals, and the Historic Preservation Board.

(2) As it deems appropriate, decide, adopt and/or amend a:

(i) Comprehensive plan;

(ii) Area, corridor, neighborhood, circulation, street or annexation plan;

(iii) Vacation of right-of-way and of lesser interest in land such as an easement;

(iv) Designation of a local historic site, structure and/or district, and revocation of such designation;

(v) Fee to pay for, at least in part, the impacts of development.

(3) Hear and decide requests for:

(i) Annexation and change to the City's limits;

(ii) Zoning and/or change to zone or a zoning map, including a planned development zone;

(iii) Special permit;

(iv) Planned development outline development plan or change thereto;

(v) Preliminary plan for a planned development without a valid outline development plan;

(vi) Revocable permit for use or occupancy of a City right-of-way or public place (except that the City Council may delegate such authority to the Director for minor or temporary uses or occupancies such as landscaping or irrigation facilities);

(vii) Vested right as provided in this code for a site-specific development plan;

(viii) Appeal of Planning Commission and Director decisions as provided in this code;

(ix) Street name change;

(x) Fee in lieu of land dedication waiver;

(xi) Sewer variance;

(xii) Appeal of decisions of Historic Preservation Board.

(b) Planning Commission.

(1) Composition. The Planning Commission shall consist of seven regular members and two alternate members. Alternate members shall attend Planning Commission meetings, and shall serve and vote as may be required during the temporary unavailability of any regular member. The City Council shall, at the time of appointment, designate a first alternate and a second alternate; each shall fill in during the temporary absence of a regular member according to the priority.

(2) Member Qualifications. Regular and alternate members shall be residents of the City of Grand Junction and shall represent the interests of the City as a whole. No member shall be employed by the City, hold any other City office, or be a contractor with the City. The members shall be selected from the fields of engineering, planning, architecture, construction trades, and/or law, and from citizens at large.

(3) Term. Members shall serve terms of four years. Members are limited to two consecutive terms.

(4) Vacancies. When there is a vacancy among the regular members of the Commission, the first alternate shall be appointed to fill it, the second alternate shall become the first alternate, and a new second alternate shall be appointed. All vacancies shall be filled by appointment by the City Council. If a member ceases to reside in the City, his/her membership on the Commission shall immediately terminate and an appointment made to fill the unexpired term.

(5) Removal. Members may be removed after public hearing by the City Council on grounds of inefficiency, neglect of duty, malfeasance or misfeasance in office. The City Council shall make public a written statement of reasons for removal prior to any public hearing seeking removal of a member.

(6) Meetings. Planning Commission meetings shall be regularly scheduled not fewer than one time per month, provided there are pending items or matters to be brought before the Commission, at a time and place designated annually by resolution of the City Council. Special meetings may be held as provided by rules of procedure adopted by the Commission and/or this code or law.

(7) Voting. The presence of four voting members shall constitute a quorum. All recommendations to the City Council and all final decisions of the Planning Commission shall require an affirmative vote of no fewer than four members (a majority of the seven members of the Commission, which may be comprised of regular, or regular plus alternate, members).

(8) Compensation. Members shall be compensated at a rate established by the City Council by resolution.

(9) Powers and Duties. Except as otherwise provided by this code, or by ordinance, rule, policy or regulation of the City Council, the Commission shall be governed by § 31-23-201 C.R.S., et seq. and shall have the powers provided therein. The Commission's actions shall be governed by the procedures set forth in this code, and/or law, ordinance, rule, regulation or policy of the City Council. The powers and duties of the Planning Commission include, but are not limited to:

(i) Provide a recommendation to the City Council on adoption of or amendment to any of the following:

(A) Comprehensive Plan;

(B) Area, Corridor, neighborhood, Circulation or traffic plan;

(C) Code provision;

(D) Zoning;

(E) Review fee;

(F) Impact fee.

(ii) Hear and make a recommendation to the City Council upon any request for a:

(A) Vacation of public right-of-way or easement;

(B) Zoning or change to a zone or zoning map, including planned development zoning;

(C) Special permit;

(D) Planned development outline development plan or major amendment thereto;

(E) Vested right as provided in this code for a site-specific development plan;

(F) Sewer variance.

(iii) Decide:

(A) An appeal from an administrative decision as provided in this code;

(B) Plat vacation;

(C) Conditional use permit;

(D) Variance as provided by this code;

(E) Other tasks as assigned by the City Council.

(c) Zoning Board of Appeals.

(1) Composition. The Zoning Board of Appeals shall consist of three members who shall represent the interests of the City as a whole. Members shall be appointed by the City Council.

(2) Member Qualifications. Each member shall be a resident of the City, and shall be drawn from the fields of engineering, law, surveying, development, planning, architecture, construction, and from citizens at large.

(3) Term. Members shall serve terms of four years and shall be limited to two consecutive terms.

(4) Vacancies. All vacancies shall be filled by appointment by the City Council. If a member ceases to reside in the City, that seat shall be deemed vacant.

(5) Removal. The City Council may, after a public hearing, remove any member of the Board for good cause including inefficiency, neglect of duty, malfeasance or misfeasance in office. The City Council shall make public a written statement of the reasons for the removal prior to the public hearing.

(6) Meetings. The Board shall meet at least once a month, provided there is business to be brought before the Board. Special meetings may be held as provided by rules of procedure adopted by the Board.

(7) Voting. The presence of two members shall constitute a quorum of the Board. A majority of a quorum of the Board shall be sufficient to conduct the business of the Board. A lesser number than a quorum may act to adjourn or continue a meeting.

(8) Compensation. Members shall be compensated at a rate established by the City Council by resolution.

(9) Powers and Duties. Except as otherwise provided by this code, ordinance, rule, policy, or regulation of the City Council, the Zoning Board of Appeals shall be governed by § 31-23-307 C.R.S. The Board shall have the power and duty to decide:

(i) Appeals as provided in this code;

(ii) Requests to vary from the bulk, performance, accessory use, use-specific or sign standards or regulations of this code;

(iii) Requests for relief from the nonconforming provisions established in Chapter 21.08 GJMC;

(iv) Other variances as provided in this code, including those not assigned to a review body.

(d) Building Code Board of Appeals. For appeals relating to building codes, see the International Building Code (IBC) in effect at the time of the appeal.

(e) Director. For purposes of administration of this code, the Director shall be designated by and shall serve at the direction of the City Manager. The Director shall serve as staff to the Planning Commission, the Zoning Board of Appeals and the Historic Preservation Board and shall have such other duties and responsibilities as specifically prescribed in this code.

(1) Powers and Duties. The Director shall render the decision on every request for a:

(i) Planning clearance;

(ii) Home occupation permit;

(iii) Temporary use permit;

(iv) Change of use permit;

(v) Site plan review (major or minor);

(vi) Fence permit;

(vii) Sign permit and sign package;

(viii) Boundary adjustment;

(ix) Floodplain development permit;

(x) Subdivision plat;

(xi) Major subdivision construction plan;

(xii) Major subdivision preliminary plan;

(xiii) Minor exception subdivision;

(xiv) Planned development final plan and minor amendment thereto;

(xv) Minor deviation from any zoning district bulk standard;

(xvi) Development improvement agreement;

(xvii) Administrative adjustment as authorized by this code;

(xviii) Revocable permit for landscaping and irrigation in the public right-of-way and other such use of the right-of-way as delegated by the City Council;

(xix) TEDS exception as authorized in GJMC Title 29;

(xx) Administrative change to the Comprehensive Plan.

(f) Historic Preservation Board.

(1) Composition. The Historic Board shall consist of not fewer than five nor more than seven members appointed by the City Council. The City Council shall determine the number of members when it makes an appointment. Members shall be appointed to provide a balanced, community-wide representation.

(2) Member Qualifications. When there are more than five members, at least four shall be professionals or have expertise in a preservation-related discipline such as history, architecture, planning or archaeology; when there are five members, at least three shall have such qualifications. One member shall be a member of the Downtown Development Authority (DDA) board or an employee of the DDA.

(3) Term. Members shall serve four-year terms. City Council shall stagger the terms from the date of appointment. A member may continue to serve until his or her successor has been appointed.

(4) Vacancies. Vacancies shall be filled by appointment by the City Council.

(5) Removal. Members may be removed by the City Council without cause.

(6) Meetings. The Historic Board shall establish a regular meeting schedule. Minutes shall be kept of all proceedings. The Board shall conduct its business in accordance with the Open Meetings and Public Records Acts and other laws applicable to public bodies.

(7) Voting. A quorum shall require three members if the Historic Board consists of five members; four if it consists of more than five members. A quorum shall be required for the Board to conduct any business, and an affirmative vote of the majority of those present shall be required to pass any motion.

(8) Compensation. Members serve without compensation, except that the City Council may authorize, in advance, payment of such amounts it determines appropriate to offset expenses incurred in the performance of Board duties.

(9) Powers and Duties. The Historic Board shall, after public notice and solicitation of public comment:

(i) Recommend eligibility criteria for the designation of historic resources and for review of proposals to alter designated resources;

(ii) Review and determine qualifications of properties nominated for designation as either an historic structure, site or district and recommend to City Council approval or denial of a designation;

(iii) Upon property owner's request, review and make recommendations to the owner on proposed alterations to a designated historic structure, site or district;

(iv) Advise and assist owners of historic properties on physical and financial aspects of preservation, renovation, rehabilitation and reuse, including nomination to the City Register, the State Register and the National Register of Historic Places;

(v) Develop and assist in public education programs including, but not limited to, walking tours, brochures, a marker program for historic properties, lectures, exhibits and conferences;

(vi) Conduct surveys of historic sites, properties and areas for the purpose of defining those of historic significance and prioritizing the importance of identified historic areas. The Historic Board may create a list of structures of historical or archeological merit which have not been designated;

(vii) Advise the City Council on matters related to preserving the historic character and substance of the City and recommend easements, covenants, licenses and other methods which would implement the completion of the purposes of this section;

(viii) Actively pursue financial assistance for preservation-related programs;

(ix) Review and decide applications for a Certificate of Appropriateness for alteration to a site and/or structure in the North Seventh Street Historic Residential District;

(x) Review and decide applications for changes to other historic sites and structures as specifically prescribed by this code for a duly designated historic site, district or area.

(g) Summary of Authority. The following table summarizes the review and approval authority provided in this code. If there is a discrepancy between this table and the text where the authority is specifically prescribed, the text shall control.

Sec.	Procedure	Director	Planning Commission	HPB	City Council	ZBOA
R = Review D = Decision A = Appeal						
21.02.070	Administrative development permit, all administrative permits not listed herein	D	A			
21.02.070	Subdivision	D			A	
21.02.090	Vacation of plat without public right-of-way or easement	R	D		A	
21.02.090	Vacation of plat with public right-of-way or easement	R	R		D	
21.02.100	Vacation of public right-of-way or easement	R	R		D	
21.02.110	Conditional use permit	R	D		A	
21.02.120	Special permit	R	R		D	
21.02.130(d)	Administrative changes to Comprehensive Plan	D			A	
21.02.130(e)	Comprehensive Plan amendment, plan amendments	R	R		D	
21.02.140	Code amendment and rezoning	R	R		D	
21.02.150	Planned development	R	R		D	
21.02.160	Annexation	R			D	
21.02.170	Vested property rights	R	R		D	
21.02.180	Revocable permit – Landscaping and irrigation	D			A	
21.02.180	Revocable permit, other	R			D	
21.02.190	Institutional and civic facility master plans	R	R		D	
21.02.200	Variance	R				D

Sec.	Procedure	Director	Planning Commission	HPB	City Council	ZBOA
R = Review D = Decision A = Appeal						
21.04.030(p)(1)	Fraternity or sorority	D				A
21.04.030(p)(2)	Group living facility (*except where a conditional use permit is required, see "Conditional use permit")	D*				A*
21.04.030(p)(2)(iv)(C)(b)	Group living facility – Sex offenders		D			
21.07.040(d) and (h)	Designation of historic structures, sites and districts and revocation of designation	R		R	D	
21.07.040(g)(2)	Certificate of Appropriateness, N. Seventh Street Historic District	R		D		

(Ord. 4815, 9-5-18)

Chapter 21.02

ADMINISTRATION AND PROCEDURES

Sections:
21.02.010 *Repealed.*
21.02.020 *Repealed.*
21.02.030 *Repealed.*
21.02.040 *Repealed.*
21.02.050 *Repealed.*
21.02.060 *Repealed.*
21.02.070 Administrative development permits.
21.02.080 Permits requiring a public hearing.
21.02.090 Vacation of plat.
21.02.100 Vacation of public right-of-way or easement.
21.02.110 Conditional use permit (CUP).
21.02.120 Special permit.
21.02.130 Comprehensive Plan amendment (CPA).
21.02.140 Code amendment and rezoning.
21.02.150 Planned development (PD).
21.02.160 Annexation.
21.02.170 Vested property rights.
21.02.180 Revocable permit.
21.02.190 Institutional and civic facility master plans.
21.02.200 Variance.
21.02.210 Rehearing and appeal.

21.02.010 City Council.

Repealed by Ord. 4815.

(Ord. 4419, 4-5-10)

21.02.020 Planning Commission.

Repealed by Ord. 4815.

(Ord. 4419, 4-5-10)

21.02.030 Zoning Board of Appeals (ZBOA).

Repealed by Ord. 4815.

(Ord. 4766, 10-4-17; Ord. 4419, 4-5-10)

21.02.040 Building Code Board of Appeals.

Repealed by Ord. 4815.

(Ord. 4419, 4-5-10)

21.02.050 Director of Public Works and Planning.

Repealed by Ord. 4815.

(Ord. 4419, 4-5-10)

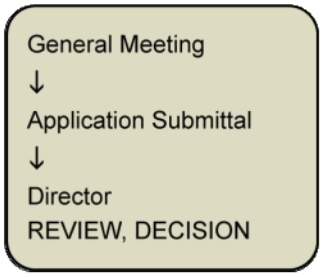
21.02.060 Summary of authority.

Repealed by Ord. 4815.

(Ord. 4744, 4-5-17; amended during 2010 codification; Ord. 4419, 4-5-10)

21.02.070 Administrative development permits.

(a) Common Elements of Administrative Development Permits. The following procedures apply unless modified by more specific provisions elsewhere. The times for the City to act are maximum number of working days. The Director may shorten any time frame specified herein.



(1) General Meeting/Preapplication Conference.

(i) General Meeting. The general meeting allows the applicant to meet informally with the staff to discuss a project and provide feedback and ideas. Based on the detail and information provided, the staff will give direction on the merits, procedures and issues on a proposed project. A development application may not be submitted until after the general meeting is completed if required by the Director.

(ii) Preapplication Conference. A preapplication conference with City staff is highly recommended for most subdivisions, multifamily, commercial and industrial projects. The general purposes of a preapplication conference are to:

(A) Understand the proposed project and the applicant's specific objectives;

(B) Identify applicant time goals such as property closing dates, construction starts, and operation dates;

(C) Identify City approvals needed before any development starts;

(D) Identify documents, plans, drawings, fees and process other materials necessary for a complete application;

(E) Identify significant issues likely to arise to be dealt with; and

(F) Begin to familiarize the applicant with City requirements, and this code.

(2) Application Requirements.

(i) Materials, Deadlines. Application materials and deadlines are available from the Director and are contained in the Submittal Standards for Improvements and Development manual.

(ii) Application Fees. The City Council sets fees to recover some of the costs of processing, publicizing, and reviewing applications. The City Council may, by resolution, modify any fee at any Council meeting.

(iii) Completeness. The Director shall decide if the application is complete. If the application is not deemed complete, the Director shall notify the applicant and the submittal shall be returned.

(iv) Neighborhood Meeting. A neighborhood meeting is required for subdivision applications except for simple subdivisions and minor exemption subdivisions. See GJMC 21.02.080(e) for neighborhood meeting requirements.

(3) Notice.

(i) Public notice is not required for administrative permits except for subdivision and major site plan applications. The duty to provide notice, when required, is always the applicant's.

(ii) Notice is provided as follows:

(A) Within five working days of receipt of a complete application, the Director shall give notice, at the applicant's cost, by U.S. mail to each person shown as an owner within 500 feet and at the address by the County Assessor.

(B) Notice should include a general description of the proposal and the location of the property.

(C) The Director's failure to send any notice does not mean the proposal is approved since it is always the applicant's ultimate responsibility to see that all City rules, requirements and procedures are followed. The Director may require the applicant pay for additional notice, in any form for any type of proposal if such notice will further the purpose or intent of this code.

Type of Submittal or Request	Published Notice	Mailed Notice	Sign Notice
Administrative Development Application	–	–	–
Development Application Requiring Public Hearing	7 days	Owners within 500 feet	Yes
Comprehensive Plan Text Amendment	7 days	–	–
Code Text Amendment	7 days	–	–
Historic Preservation	7 days	–	–
Grand Junction Circulation Plan Amendment	7 days	–	–
Revocable Permit	–	–	–
Vested Rights	Within 10 days of approval	–	–
Subdivisions and Major Site Plan	–	Owners within 500 feet	Yes

(4) General Procedures.

(i) The Director shall evaluate each application for compliance with City requirements. The Director shall provide comments in writing to the applicant.

(ii) The Director may forward copies of the applications to various agencies for their input and review. Such other agencies include:

(A) Other City departments;

(B) Utilities;

(C) Law enforcement;

(D) Fire protection agencies;

(E) General purpose government;

(F) State agencies (e.g., Geologic Survey, Transportation, Natural Resources, Wildlife); and

(G) Federal agencies (e.g., Federal Emergency Management Agency, Bureau of Land Management, U.S. Army Corps of Engineers).

(iii) Agency review and input is advisory only.

(iv) An application submitted to the City for review must be diligently pursued and processed by the applicant. Accordingly, if the applicant, within 90 calendar days of mailing of the City's review comments on any submittal (or resubmittal) of an application for approval of a development application, does not resubmit revised documents to address comments from the City, the development application shall lapse and become null and void. The Director may grant two extensions of the foregoing 90-day requirement, not to exceed a total extension of 180 days.

(5) Comments – Time to Respond.

(i) The Director must approve, approve with conditions, or disapprove all complete applications for an administrative permit.

(ii) After receipt of the applicant's written response to comments/recommendations the Director shall, based on the applicable review criteria, approve, approve with conditions or disapprove the application. The Director may allow the applicant additional resubmittals and responses before the Director decides.

(6) General Approval Criteria. No permit may be approved by the Director unless all of the following criteria are satisfied:

(i) Compliance with the Comprehensive Plan and any applicable adopted plan.

(ii) Compliance with this zoning and development code.

(iii) Conditions of any prior approvals.

(iv) Public facilities and utilities shall be available concurrent with the development.

(v) Received all applicable local, State and federal permits.

(7) Amendments. A permit shall be amended through the process it was originally approved.

(8) *Repealed by Ord. 4890.*

(9) Validity.

(i) Administrative permits shall expire after the issue date according to the following table:

Permit Type	Expiration
Administrative Permits (except below)	One year
Planning Clearance	180 days
Fence Permit	180 days
Home Occupations	n/a
Preliminary Subdivision	Two years
Final Plat (unrecorded)	Two years
Minor and Major Site Plans	Two years

(ii) The Director may extend the permit for up to 180 more days if the applicant proves he/she can complete the project in conformance with currently adopted codes and policies, except the Director may grant one extension of 12 months for a preliminary subdivision or unrecorded final plat, in accordance with subsection (u)(4) of this section.

(b) Planning Clearance and Building Permit. No person shall establish, construct, modify or expand a use or a structure until both a planning clearance and a building permit, if required, have been issued. This section does not apply to a permit for a fence or sign, as both are otherwise regulated by this code.

(c) Home Occupation Permit.

(1) Purpose. Home occupation permits are needed to ensure that all home occupations are conducted in a safe manner without adverse effects on neighboring properties.

(2) Applicability. No person shall conduct a home occupation until the Director has issued a home occupation permit. A home occupation shall comply with the use-specific standards of GJMC 21.04.040(g).

(d) Temporary Use Permit.

(1) Purpose. A temporary use permit helps ensure that temporary uses, including special events, are safe and minimizes adverse impacts on City infrastructure and neighboring properties.

(2) Applicability. No person shall establish a temporary use for a period exceeding 48 hours without a temporary use permit. Special events and activities conducted on public property, such as school sites and City parks, which have the consent of the owner, shall be exempt from the provisions of this section. Only one temporary use is permitted at any given time on a parcel or lot.

(3) Use-Specific Standards. A temporary use shall comply with the use-specific standards of GJMC 21.04.050.

(e) Change of Use Permit.

(1) Applicability. No person shall change the use of a structure or property unless and until the Director has issued a change of use permit. Other permits (such as a CUP), review (such as a major or minor site plan review) or approvals may also be required when use of a land or structure has changed; this subsection does not limit or supplant other requirements of the code. A change from any use in the Household Living use category to any other use requires, at a minimum, a minor site plan review. For a change of use within the same principal use listing in the Use Table, GJMC 21.04.010 (for example, a change from one General Retail Sales, Indoor Operations use to another General Retail Sales, Indoor Operations use, or a change from a movie theater to a skating rink), a change of use permit is not required unless:

(i) The code requires more off-street parking for the new use than is available on the property;

(ii) There is any increase in traffic, actual or projected; or

(iii) The amount of stormwater runoff or impervious area is increased.

(f) Minor Site Plan.

(1) This review process may be used by the Director in lieu of the major site plan review process to review lesser-intensity projects if a limited review of zoning, parking, circulation, access and minor drainage changes will be adequate. Construction plans, based upon the approved final minor site plan and consisting of detailed specifications and diagrams illustrating the location, design and composition of all improvements identified in the final minor site plan and required by this code, shall be submitted to the City for any project that necessitates the construction, reconstruction or modification of new or existing improvements. These documents shall include complete plans and specifications of all required improvements identified and approved as part of the final site plan phase for minor site plan review. The City shall keep the plans as a permanent record of the required improvements.

(2) The Director may use this review process if the proposed project is limited to:

(i) A new structure of up to 1,000 gross square feet only for storage, mechanical room, etc., if water and sewer services are not provided and if no structures currently exist on the parcel;

(ii) An addition to a structure of up to 1,000 gross square feet or a new structure of up to 1,000 square feet on a lot with one or more structures;

(iii) An existing parking lot or existing work area to be paved with asphalt or concrete;

(iv) A temporary office trailer; or

(v) Similar low-impact uses.

(g) Major Site Plan. The Director reviews site plans to determine compliance with this code, the Comprehensive Plan, adopted corridor guidelines and other applicable regulations.

(1) Applicability.

(i) No person shall begin any development, pour any structure foundation or move earth in preparation for construction without receipt of the Director's approval of a site plan. Construction plans, based upon the approved final site plan and consisting of detailed specifications and diagrams illustrating the location, design and composition of all improvements identified in the final site plan and required by this code, shall be submitted to the City for any project that necessitates the construction, reconstruction or modification of new or existing improvements. These documents shall include complete plans and specifications of all required improvements identified and approved as part of the final site plan phase. The City shall keep the plans as a permanent record of the required improvements. All development requires major site plan review except:

(A) A structure with one or two dwellings;

(B) Nonresidential, interior remodeling which will cost 25 percent or less of the fair market value of the existing structure;

(C) An approved home occupation;

(D) An approved temporary use;

(E) An approved fence and a wall;

(F) An approved sign;

(G) An approved change of use;

(H) Minor site plan development; and

(I) A development which the Director determines does not require a major site plan review if the development will not adversely affect the neighborhood and meets the purpose and intent of this code.

(ii) Major site plan review shall be completed prior to issuance of a planning clearance and a building permit.

(h) Fence Permit.

(1) Applicability. No person shall erect or maintain a fence or wall unless the Director has issued a fence permit. A fence or wall that exceeds six feet in height is considered a structure and requires a planning clearance and building permit instead of a fence permit. Fences must comply with GJMC 21.04.040(i), any design guidelines and other conditions of approval.

(i) Sign Permit.

(1) Applicability. No person shall erect or display a nonexempt sign (see GJMC 21.06.070) unless the Director has issued a sign permit. An on-premises temporary sign may be erected without a permit if done as referred to in GJMC 21.06.070(d). Touching up or repainting existing letters, symbols, etc., is maintenance and does not require a permit.

(j) Floodplain Development Permit.

(1) Applicability. No person shall construct or maintain any use or structure nor make any development or topographically alter land for any purpose including agriculture that may adversely impact the floodplain or floodway or within any area of special flood hazard (GJMC 21.07.010) unless the Director of Public Works and Planning has issued a floodplain permit.

(2) Additional Approval Criteria. When base flood elevation data has not been provided in accordance with GJMC 21.07.010(c), the Director of Public Works and Planning may use any flood elevation and floodway data available from a federal, State or other source as criteria to decide how and if construction, substantial improvements, or other development in the floodplain may be permitted.

(k) Boundary Adjustments.

(1) Purpose. The process for boundary adjustments allows the Director to approve boundary line adjustments as allowed by State law.

(2) Additional Approval Criteria. A boundary adjustment pursuant to § 38-44-112 C.R.S., or as amended from time to time, is permitted if approved by the Director. The applicant must comply with the statute.

(l) Administrative Adjustment.

(1) The Director may permit deviation from any bulk standard, upon a finding of compliance with the criteria as set forth in this section. The purpose of this process is to permit inconsequential deviations from the zoning district bulk standards where deviation(s) are desirable but cannot be accommodated through a strict application of the bulk standards.

(i) Additions. Requests for an administrative adjustment to accommodate an addition to an existing structure shall comply with all of the following:

(A) Conforming locations for the addition are impractical, significantly more expensive or have a significant adverse impact on the site plan in terms of overall site design or relationships between site plan elements including, but not limited to, structures, patios, driveways and landscaping;

(B) The location of the addition represents a logical extension of the existing floor plan in terms of function and design;

(C) The location of the addition does not result in the creation of unsafe conditions or create circulation conflicts;

(D) The exterior design of the addition represents a logical extension of the existing structure and is consistent with the design of the existing structure;

(E) Site and structural design elements of the addition shall be considered. Such elements include, but are not limited to:

a. Height of the addition relative to neighboring structures;

b. The location, number and size of windows, doors, porches, balconies and outdoor lights;

c. The location of patios and walkways;

d. The location, size and types of hedges, walls and fences; and

e. The level of privacy to occupants of both neighboring properties and the addition. Such privacy shall be equal to or greater than that provided if the addition were located within the required setback;

(F) The requested deviation is only 10 percent or less; and

(G) The deviation shall not result in physical encroachment into an easement, right-of-way or neighboring property.

(ii) Construction Errors. Requests for an administrative adjustment to accommodate a construction error shall comply with all of the following:

(A) Complies will all building, fire and other adopted codes and policies;

(B) The requested deviation is only 10 percent or less;

(C) The deviation shall not result in physical encroachment into an easement, right-of-way or neighboring property;

(D) The error shall have been inadvertent; and

(E) The contractor responsible for the error shall not have been the recipient of another approved administrative adjustment in the past three years.

(2) The Director may permit an accessory structure, including a fence or retaining wall that are considered structures, in a required setback upon the finding that:

(i) There are unique or unusual conditions pertaining to the specific building or property; and

(ii) The granting of an adjustment would not be materially detrimental to the property owners in the vicinity; and

(iii) The deviation shall not result in physical encroachment into an easement, right-of-way or neighboring property.

(3) Decision-Maker.

(i) The Director shall approve, approve with conditions or deny all requests for an administrative adjustment.

(ii) Appeals from the Director shall be processed as a variance using the procedures provided in GJMC 21.02.200, but with the review criteria provided herein.

(4) Application and Review Procedure. Application requirements and processing procedures are described in subsection (a) of this section. In addition, the applicant shall provide proof that the requested administrative adjustment does not conflict with any recorded covenants applicable to the property, or demonstrate in writing that the entity responsible for enforcing the covenants has approved the requested deviation. In the event there is no single entity responsible for enforcing the covenants, and the requested administrative adjustment does not conform to the covenants, the applicant shall provide a written statement acknowledging the inconsistency and that he/she shall indemnify and hold the City harmless for any action, damages claims or suits brought in the event the administrative adjustment is approved.

(m) Development Improvements Agreement (DIA).

(1) Development Improvements Agreement Authorized. The Director may defer the requirement for the completion of required improvements if the applicant enters into a development improvements agreement (DIA) by which the applicant agrees to complete all required public improvements in accordance with an agreed schedule. The Director may require the applicant to complete and dedicate some required public improvements prior to approval of the final plat and to enter into a DIA for completion of the remainder of the required improvements. The City Attorney shall approve any DIA as to form.

(2) Agreement to Run with the Land. The development improvements agreement shall provide that the requirements contained therein shall run with the land and bind all successors, heirs, and assignees of the applicant. The DIA for subdivisions shall be recorded with the Mesa County Clerk and Recorder. All other DIAs may, at the Director's discretion, be recorded or

deposited with the City Clerk. All existing lien holders shall be required to subordinate their liens to the guarantees contained in the DIA.

(3) Performance Security.

(i) Whenever the Director permits an applicant to enter into a development improvements agreement, the applicant shall be required to provide sufficient security to ensure completion of the required public improvements. The security shall be in the form of a cash deposit made to the City, a letter of credit or disbursement agreement from an authorized financial institution, a subdivision bond, or a completed, unrecorded plat. The letter of credit, disbursement agreement, or subdivision bond shall be in a form approved by the City Attorney.

(ii) The guarantee shall be in an amount estimated by the Director as reflecting 120 percent of the cost of the improvements in the approved construction plan and shall be sufficient to cover all promises and conditions contained in the DIA.

(iii) In addition to all other security, when the City participates in the cost of an improvement, the applicant shall provide a performance bond from the contractor, with the City as a co-obligee.

(iv) The issuer of any guarantee shall be subject to the approval of the City in accordance with adopted policies.

(4) Maintenance Guarantee for DIA.

(i) The applicant shall guarantee the improvements against defects in workmanship and materials for a period of one year from the date of City acceptance of such improvements. The maintenance guarantee shall be secured by a letter of credit, cash escrow, maintenance bond, or other form acceptable to the Director.

(A) If the security is a letter of credit or cash escrow, then it shall be in an amount reflecting 20 percent of the cost of the completed improvements.

(B) If the form of security is a maintenance bond, it must be in a form acceptable to the City Attorney, in the principal amount of 20 percent of the value of the project's public improvements, for a period of one year from the date of final acceptance by the City of all improvements in the project, or as applicable, the phase or filing of a project for which improvements are constructed and accepted.

(C) If repairs, replacements or modifications to the project's public improvements are made by the applicant or are required to be made by the City during the one-year maintenance period, then the City, at its sole option and discretion, may require an extension of the security in an amount equal to the actual or estimated repair, replacement or modification costs plus 20 percent. If the Director has reason to believe that the security will be extended beyond the one-year initial term, then the Director shall notify the applicant in writing no later than 30 days before expiration of the security. Mailing of an extension notice shall cause the applicant to extend the security (bond, cash or letter of credit) for an additional 12 months. The extension shall be on the same terms as the security being extended. The security may be extended for one additional year as may be necessary for the bond to be called or for the improvements to be repaired, modified or replaced in a manner that satisfies the City. If the Director has reason to believe that the type or extent of the repair, replacement or modification does not warrant extension of the maintenance security, then the security may be released after the initial one-year period. In making the decision to extend the security the Director may consider any facts or information deemed relevant, which may include, but is not limited to, whether the failed improvements are above or below grade, whether the failed improvements may reasonably be found to constitute life, health and/or imminent safety hazard;

whether other phases or filings depend on the improvements and/or the degree of failure of the improvements.

(ii) If the applicant has not warranted and guaranteed required improvements pursuant to a DIA, the applicant shall give the City security equal to at least 50 percent of the cost of the required improvements.

(5) Offers to Dedicate Streets, Roads, and Other Lands.

(i) Acceptance of Dedication. The City Council, or its designees, may accept, accept with conditions, or reject any offer to dedicate any land or facility. Any offer to dedicate made pursuant to or as a condition of a review or approval pursuant to this code constitutes the owner irrevocable warranty that such owner has the right, title and interest to convey to the City and that no hazardous or other regulated substance is present on, under or in the property.

(ii) Acceptance of Maintenance. Approval of a subdivision does not mean the City will accept any road, street or public site for maintenance. The City shall not be obligated to maintain any land unless it explicitly agrees to do so in writing.

(6) Temporary Improvements. The Developer shall construct and pay for all costs of temporary improvements required by the City to protect the public, neighborhood or another person. The applicant shall maintain said temporary improvements for the period specified.

(7) Completion of Improvements.

(i) Construction of Required Improvements.

(A) Before construction begins, the developer must be familiar with the submittal, construction, plans and inspection requirements of each utility or agency.

(B) After the City and/or other utility providers has inspected and approved all or a portion of the required improvements, the developer may request, in writing, that the approved portion be accepted for maintenance by the appropriate agency. The City shall establish the developer's limits of responsibility for the improvements. The City may condition its acceptance and may require additional guarantees and assurances for at least one year following acceptance.

(C) Even if the City does not accept all or a portion of the required improvements, or delays any acceptance, the City may require the Developer to correct such defects or deficiencies identified by the City, in which case, final acceptance may be extended for one additional year.

(ii) Release of Improvements Agreement and Guarantee.

(A) The developer shall submit a written request for a release from the development improvements agreement for the improvements that have been accepted for maintenance by the appropriate agency. Proof of acceptance for maintenance and proof that there are no outstanding judgments or liens against the property shall accompany this request.

(B) The City Council, or its authorized representative, shall review the request. If the requirements of the DIA concerning that portion requested for release have been complied with, the appropriate document of release shall be recorded with the Mesa County Clerk and Recorder's Office.

(C) Release of the DIA does not constitute a certificate of completion and release of responsibility.

(iii) Certificate of Completion and Release of Responsibility. Upon expiration of the limits of responsibility established in this code, the developer may request a certificate of completion and release of responsibility from the appropriate agency.

(8) Extension of Development Improvements Agreement and Security.

(i) If the applicant is unable to complete all required improvements contained in an executed development improvements agreement within the time stated therein, he/she shall provide written notice of same to the Director at least 30 calendar days prior to the deadline of the milestones he will be unable to meet. The applicant shall make a formal written request for an extension of the completion date for performance in the DIA and security and provide a revised development schedule, which shall be reviewed by the Director. The Director shall approve, approve with conditions or deny the request for an extension. Based on the Director's decision the existing DIA may be amended, a new DIA drawn up and executed, or the Director may exercise any default provisions contained in the approved DIA. Any amendments or new agreements shall be recorded in the same manner as the original DIA, if required by the Director.

(ii) If the DIA is to be extended or a new DIA is to be executed, the applicant shall provide sufficient security which may be the same as or greater than the original security, up to 120 percent, as was required with the original guarantee. No amendment or replacement DIA shall be executed, recorded or effective until security acceptable to the Director is provided.

(n) Sign Package.

(1) Purpose. A sign package allows the review and approval of signs on a developed site or abutting developed sites that function as one with the sharing of vehicular access through, across, over, entrance onto, and/or exit from the site and/or parking.

(2) Applicability. The sign package provides detailed graphical information of the location, height, illumination, sign dimensions, and sign design, including but not limited to letter heights.

(3) Additional Approval Criteria.

(i) All signs included on the site shall be in conformance with the criteria set forth in GJMC 21.06.070(g), except as allowed to deviate based on the other criteria in this section.

(ii) The application of the sign package is not contrary to and better implements the goals and objectives of the Comprehensive Plan, including but not limited to applicable neighborhood plans, corridor plans, and other adopted plans.

(iii) The application of the sign package is not contrary to and better implements the goals and objectives of moderating the size and number of signs as well as the reduction of clutter and obtrusive placement of signs.

(4) Decision-Maker. The Director shall approve, conditionally approve or deny all applications for a sign package permit.

(5) Application and Review Procedures. Application requirements and processing procedures are described in subsection (a) of this section.

(6) Validity.

(i) The sign package permit must be established within 180 days of the approval by the Director. A sign package is established upon the installation of the first sign included within the package. Once established the sign package permit shall run with the land as long as a use on a site has not changed and the site continues to share vehicular access through, across, over, entrance onto, and/or exit from the site and/or parking. All the par-

cels functioning as one shall be considered the land to which the sign package permit is applicable.

(ii) A sign package permit limits the characteristics of each sign within the sign package. Any increase in any sign characteristic must be reviewed and approved as a new sign package. Any changes to the sign package permit, including modification or termination, other than termination due to change of use on a site or termination of the shared access or parking, shall require the written consent of all landowners of each of the sites included within the approved sign package.

(o) Minor Exemption Subdivisions.

(1) Purpose. The purpose of the minor exemption subdivision is the same as that for a major subdivision set forth in subsection (q)(1) of this section.

(2) Applicability. The minor exemption subdivision process allows for a subdivision of parcels 25 acres or larger into three or fewer lots each of which are two acres or larger in size in residential zones.

(3) Additional Approval Criteria. The Director shall approve a minor exemption subdivision if the applicant demonstrates that the application complies with the purpose of a minor exemption subdivision and with the following criteria:

(i) All lots comply with this code; except that the minimum density/intensity requirements of a zone district or the Comprehensive Plan do not apply except in the R-R zone and the sewer regulations pertaining to the extension of sewer as a condition of subdivision need not be complied with if the applicant can demonstrate the following:

(A) The applicant's Colorado professional engineer affirms in writing that the lot can be served by an individual septic disposal system (ISDS) constructed at or prior to use of the lot for uses allowed by the City code then in existence;

(B) The constructed ISDS system continues to function properly;

(C) Sewer is not constructed within 400 feet of any lot line of any lot or out lot or out parcel created under the minor exemption subdivision process; and

(D) The landowner executes a utility extension agreement in a form acceptable to the City. The utility extension agreement shall authorize the sewer to be extended by the City at a future date (all as provided herein) at the then landowner's expense and/or in accordance with financing provided by the City and/or the sewer system.

(ii) The applicant is not seeking a variance or is seeking only to vary the requirement of extending sewer. No other variances shall be considered with a minor exemption subdivision. (Any other variances requested shall require the application be processed as a simple subdivision under subsection (p) of this section or a major subdivision under subsection (q) of this section, whichever is applicable);

(iii) The proposed lot is two acres or larger in size on a gross acreage basis and is created from a parcel at least 25 acres in size;

(iv) The property from which the new lot is proposed has been taxed agriculturally for the five years preceding the minor exemption subdivision application; and

(v) The lot or originating parcel has not previously had a City minor exemption subdivision, City simple subdivision, a Mesa County minor subdivision, and/or Mesa County simple land division approval.

(4) Decision-Maker. The Director shall approve, conditionally approve, or deny all applications for minor exemption subdivisions. If the minor exemption subdivision does not comply with the sewer regulations at the time of approval, then the approval shall be a conditional approval

requiring the ISDS to be abandoned prior to the end of its useful life if a sewer is constructed either within 400 feet of the lot line of any lot or out lot or out parcel created under the minor exemption subdivision process, or if the ISDS fails, or a sewer improvement district is formed that includes the lot created and any out lot or parcel.

(5) Application and Review Procedures. The following notes are required on all minor exemption subdivision plats. The notes shall be conspicuous:

(i) "No more than a total of three lots (two lots plus the out parcel) out of the original tract of land may be created by the Minor Exemption Subdivision process."

(ii) "Any additional lot splits are required to be processed through applicable City subdivision processes. The property shown hereon may not be further subdivided without approval of the City in accordance with then applicable law."

(iii) "In accordance with a Utility Extension Agreement the City may require any ISDS on the property to be abandoned prior to the end of its useful life if a sewer is constructed within 400 feet of the lot line of any lot created under the Minor Exemption Subdivision process or the ISDS fails or a sewer improvement district is formed that includes the lot."

(p) Simple Subdivisions.

(1) Purpose. The simple subdivision process allows the Director to approve lot consolidations, boundary adjustments not in dispute, a lot split, and to correct a minor error on a plat.

(2) Applicability. If requested in writing by every owner and consented to by every lienor, the Director may allow the simple subdivision process to be used to:

(i) Consolidate one or more lots;

(ii) Create only one additional lot;

(iii) Change a nondisputed boundary line between abutting lots or parcels; or

(iv) Change a plat to:

(A) Correct an error in the description;

(B) Correct any monument; or

(C) Correct a scrivener or clerical error such as lot numbers, acreage, street names and identification of adjacent recorded plats.

(3) Additional Approval Criteria. The Director will approve a simple subdivision if the applicant demonstrates that:

(i) Any changes to existing easements or right-of-way have been completed in accordance with this code or otherwise allowed by law (additional easements or right-of-way may be dedicated);

(ii) The right-of-way shown on the Grand Junction Circulation Plan is not changed; and

(iii) If a new lot is being created, no portion of the property may have been the subject of a previous simple subdivision creating a new lot within the preceding 10 years or a minor exemption subdivision (see subsection (o) of this section).

(q) Subdivision.

(1) Purpose. No person shall record a plat of a subdivision nor prepare or execute any documents which purport to create or creates a new parcel or airspace unit, nor record or execute a deed of trust or a mortgage descriptive of the property other than all of a lot or parcel unless such plat, deed, deed of trust or mortgage has been approved by the City and unless it conforms to all of the provisions of this code. The purpose of this section is to:

(2) Ensure conformance with the Comprehensive Plan and other adopted plans including all corridor design guidelines;

(3) Assist orderly, efficient and integrated development;

(4) Promote the health, safety, and welfare of the residents of the City;

(5) Ensure conformance of land subdivision plans with the public improvement plans of the City, County and State;

(6) Ensure coordination of the public improvement plans and programs of the several area governmental entities;

(7) Encourage well-planned and well-built subdivisions by establishing minimal standards for design and improvement;

(8) Improve land survey monuments and records by establishing minimal standards for survey and plats;

(9) Safeguard the interests of the public, the homeowner, and the subdivider;

(10) Secure equitable handling of all subdivision plans by providing uniform procedures and standards;

(11) Ensure that pedestrian and bicycle paths and trails are extended in accordance with applicable City plans;

(12) Preserve natural vegetation and cover, and to promote the natural beauty of the City;

(13) Prevent and control erosion, sedimentation, and other pollution of surface and subsurface water;

(14) Prevent flood damage to persons and properties;

(15) Restrict building in areas poorly suited for building or construction;

(16) Prevent loss and injury from landslides, mudflows, and other geologic hazards;

(17) Ensure adequate public facilities and services are available or will be available concurrent with the projected impacts of the subdivision; and

(18) Ensure the proposal will not impose hardship or substantial inconvenience to nearby landowners or residents.

(r) Preliminary Subdivision Plan.

(1) Applicability. The preliminary subdivision plan provides general graphic information and text indicating property boundaries, easements, land use, streets, utilities, drainage, open space, parks and other information required to evaluate a proposed subdivision. A preliminary subdivision plan shall be required for every subdivision except as otherwise provided for herein.

(2) Approval Criteria. A preliminary subdivision plan shall not be approved unless the applicant proves compliance with the purpose portion of this section and with all of the following criteria:

(i) The preliminary subdivision plan will be in conformance with the Comprehensive Plan, Grand Junction Circulation Plan, and other adopted plans;

(ii) The subdivision standards in Chapter 21.06 GJMC;

(iii) The zoning standards in Chapters 21.03 and 21.04 GJMC;

(iv) Other standards and requirements of this code and other City policies and regulations;

(v) Adequate public facilities and services will be available concurrent with the subdivision;

(vi) The project will have little or no adverse or negative impacts upon the natural or social environment;

(vii) Compatibility with existing and proposed development on adjacent properties;

(viii) Adjacent agricultural property and land uses will not be harmed;

(ix) Is neither piecemeal development nor premature development of agricultural land or other unique areas;

(x) There is adequate land to dedicate for provision of public services; and

(xi) This project will not cause an undue burden on the City for maintenance or improvement of land and/or facilities.

(3) Decision-Maker. The Director is the decision-maker for all applications for preliminary subdivision plans.

(4) Application and Review Procedures.

(i) See subsection (a) of this section, Common Elements of Administrative Development Permits.

(ii) In an effort to expedite final plat approval, the applicant may provide more detailed information than is required for preliminary subdivision plan review.

(5) Notice.

(i) Public notice is not required for administrative permits except for subdivision and major site plan applications. The duty to provide notice, when required, is always the applicant's.

(ii) Notice is provided as follows:

(A) Within five working days of receipt of a complete application, the Director shall give notice, at the applicant's cost, by U.S. mail to each person shown as an owner within 500 feet and at the address by the County Assessor.

(B) Notice should include a general description of the proposal and the location of the property.

(C) The Director's failure to send any notice does not mean the proposal is approved since it is always the applicant's ultimate responsibility to see that all City rules, requirements and procedures are followed. The Director may require the applicant pay for additional notice, in any form for any type of proposal if such notice will further the purpose or intent of this code.

(6) Validity. The applicant may propose a development phasing schedule at the time of application for a preliminary subdivision plan for consideration by the Director. In the absence of an approved phasing schedule, a preliminary subdivision plan approval shall be valid for only two years, during which the applicant shall obtain final plat approval for all or a portion of the property. If a part of the property in the preliminary subdivision plan is final platted within two years, the preliminary subdivision plan approval shall be automatically renewed for an additional one year following the recording of each final plat, unless the Director notifies the applicant, in writing, to the contrary. The applicant shall plat the entire property included in the preliminary subdivision plan within six years of the initial plan approval date. After six years, approval of unplatted portions of the preliminary subdivision plan shall be considered void unless an extension is requested and approved by the decision-making body in accordance with subsection (u)(4) of this section.

(s) Final Plat.

(1) Applicability. The final plat provides detailed graphic information and associated text indicating property boundaries, easements, streets, utilities, drainage, and other information required for the maintenance of public records of the subdivision of land. A final plat shall be required for all subdivisions. The final plat shall conform to the approved preliminary subdivision plan. If a minor revision of a preliminary subdivision plan is required, the review of the revised preliminary subdivision plan may, at the discretion of the Director, proceed concurrently with final plat review.

(2) Approval Criteria. The final plat shall demonstrate compliance with all of the following:

(i) The same criteria as the preliminary subdivision plan in subsection (r) of this section; and

(ii) The preliminary subdivision plan approval and any conditions attached thereto. A part of the land area within the preliminary subdivision plan may be approved for platting.

(3) Decision-Maker. The Director shall approve, conditionally approve or deny all applications for a final plat.

(4) Additional Application and Review Procedures.

(i) If the subdivision is a "common interest community" as defined in § 38-33.3-103(8) C.R.S., then the following shall apply:

(A) The applicant shall include a declaration pursuant to §§ 38-33.3-201, 38-33.3-205 and 38-33.3-209 C.R.S.;

(B) The applicant shall address the exercise of development rights pursuant to Section 38-33.3-210, C.R.S.;

(C) The applicant shall include the association bylaws pursuant to § 38-33.3-306 C.R.S. as applicable; and

(D) An association shall be formed pursuant to § 38-33.3-301 C.R.S. and filed with the Colorado Secretary of State.

(ii) A title commitment no older than five days shall be provided before the filing of the final plat for all of the platted property.

(iii) Notice. Notice of a final plat is not required.

(iv) Form of Final Action. The form of final approval by the Director shall be the recording of the plat as provided in subsection (u) of this section. If the Director approves the final plat, then the applicant's surveyor or engineer shall then make any changes necessary or required to comply with final approval conditions. The plat shall then be recorded within two years of action by the Director or as directed in the approved phasing plan/development schedule, subject to extensions granted in accordance with subsection (u)(4) of this section.

(t) Construction Plans.

(1) Applicability. Construction plans, based upon the approved final plat and/or site plan and consisting of detailed specifications and diagrams illustrating the location, design and composition of all improvements identified in the final plat phase and required by this code, shall be submitted to the City for any project that necessitates the construction, reconstruction or modification of new or existing improvements. These documents shall include complete plans and specifications of all required improvements identified and approved as part of the final plat phase. The City shall keep the plans as a permanent record of the required improvements.

(2) Approval Criteria. The construction plans shall be prepared in conformance with the approved final plat and the City's adopted standards for public improvements including those contained in this code.

(3) Decision-Maker. The Director shall approve, conditionally approve or deny all subdivision construction plans.

(4) Application and Review Procedures. Application requirements and processing procedures shall comply with subsection (a) of this section. In addition, construction plans shall be prepared for all subdivision improvements and public improvements as required by and in accordance with this code, the Submittal Standards for Improvements and Development manual, the Transportation Engineering Design Standards manual (GJMC Title 29) and all other applicable adopted City codes and policies. A completed development improvements agreement (DIA) for the public improvements together with an acceptable financial guarantee must be submitted with the construction drawings. As-built plans must be submitted to the Director prior to acceptance of public improvements for City maintenance.

(u) Recording of Subdivisions. The Director shall record all final plats and related documents as follows:

(1) The original plat, together with any other required documentation such as, but not limited to, the following, shall be submitted for recording along with all necessary recording fees: a Mylar copy; improvements agreements; powers of attorney; easement or right-of-way dedications not shown on the plat; covenants; deeds conveying property to the homeowners' association; etc. The plat shall contain notarized signatures of each owner of the property, necessary engineer's and surveyor's signatures, and corporate seal, if required. All signatures and seals on the plat shall be in permanent black ink.

(2) The Director shall obtain the applicable signatures of public officials required on the plat. Upon review and payment of fees by the applicant, the Director shall record the plat at the office of the County Clerk and Recorder.

(3) Upon recording the plat, applications for planning clearances and building permits may be submitted in accordance with the provisions of this code.

(4) If the applicant does not complete all steps in preparation for recording a final plat within two years of approval of the preliminary subdivision plan, the preliminary subdivision plan shall require another review and processing as per this section and shall then meet all the required current code regulations at that time. One extension of 12 months may be granted by the Director so long as the plan is consistent with the Comprehensive Plan and current zoning requirements. Additional extensions may be granted by the Planning Commission so long as the plan is consistent with the Comprehensive Plan and current zoning requirements.

(v) Guarantees for Public Improvements.

(1) Except as provided herein, before the plat is recorded by the Director, all applicants shall be required to complete, to the satisfaction of the Director, all street, sanitary, and other public improvements, as well as lot improvements on the individual lots of the subdivision or addition as required by this code. The required improvements shall be those specified in the approved construction plans.

(2) The plat shall not be recorded until the improvements have been completed or as a condition of final plat approval, the City shall require the applicant to enter into a development improvements agreement and post a guarantee for the completion of all required improvements according to subsection (m) of this section.

(w) TEDS Exceptions. The Director has the authority to make exceptions to the requirements of the Transportation Engineering Design Standards (TEDS) manual (GJMC Title 29) in compliance with the procedure established in the manual. Special consideration shall be given to flexibility in inter-

pretation of the standards as applied in a Neighborhood Center, Village Center, Downtown or Mixed Use Opportunity Corridor designated on the Future Land Use Map of the Comprehensive Plan.

(Ord. 4890, 11-20-19; Ord. 4778, 1-3-18; Ord. 4737, 2-1-17; Ord. 4619, 2-5-14; Ord. 4546, 7-18-12; Ord. 4467, 5-16-11; Ord. 4419, 4-5-10)

21.02.080 Permits requiring a public hearing.

(a) Common Elements of Permits Requiring a Public Hearing. The following requirements are common to all applications.

(1) General Meeting. At a general meeting the applicant discusses the project with City staff in more depth to obtain general feedback and ideas. Based on the amount of detail and information the applicant presents, the staff shall attempt to give direction on a proposed project. After a general meeting a development application may be submitted. A general meeting is not required for all applications. The Director may waive the general meeting requirement if it is not likely to help the neighborhood or applicant.

(b) Preapplication Conference. A preapplication conference with City staff is highly recommended for most subdivisions, multifamily, commercial and industrial projects to:

(1) Understand the project and the applicant's objectives;

(2) Identify applicant deadlines such as property closing dates, preferred construction and operation dates;

(3) Identify the needed approvals;

(4) Identify the documents, plans, drawings, fees and other materials needed to complete the application;

(5) Identify the most significant issues; and

(6) Show the applicant how to meet the code and other requirements.

(c) Application Requirements. The Submittal Standards for Improvements and Development manual lists what is needed to apply for each type of permit. However, the particulars of a project may require different types or levels of information. At the preapplication conference, the Director will tell the applicant what information the applicant must supply to begin the assessment of the project. At any time during the process, the Director may require additional information to respond to issues or concerns. The Director will list the requirements/information told to the applicant at the preapplication conference and place the list in the file.

(1) Application Deadlines. Important application deadlines are in the Submittal Standards for Improvements and Development manual or by the Director's written policies.

(2) Application Fees. The City Council sets fees in amounts sufficient to recover all or a portion of the taxpayer costs spent processing, giving notice, and reviewing development applications.

(3) Completeness. The Director shall determine if the application is complete. If it is not complete, the Director shall notify the applicant and the submittal will be returned. The Director shall retain a copy of the checklist identifying any submittal deficiency.

(d) General Approval Criteria. No permit may be approved unless all of the following criteria are satisfied:

(1) Compliance with the Comprehensive Plan and any applicable adopted plan.

(2) Compliance with this zoning and development code.

(3) Conditions of any prior approvals.

(4) Public facilities and utilities shall be available concurrent with the development.

(5) Received all applicable local, State and federal permits.

(e) Neighborhood Meeting. A neighborhood meeting should produce a better project through dialogue between the developer and neighbors leading to consensus. A neighborhood meeting is intended to provide information about the project so neighbors may gauge significant impacts and propose reasonable changes to the project. Neighborhood meetings are required before an application is submitted.

(1) The Neighborhood. All properties any part of which is located within a radius of 500 feet of any portion of the project are considered "the neighborhood." Each homeowners' association, condominium association, other organized neighborhood group (such as a merchants' association), or any member's lot or parcel of which is within 1,000 feet of the project is part of the neighborhood, as are any other formal or informal organized groups known to the Director, which has registered with the Public Works and Planning Department also considered "the neighborhood." The Director will keep a list of the contact persons and addresses of such groups.

(2) Meeting Time and Location. The applicant must provide a meeting room and must conduct the meeting. Meetings must be held on a weekday evening that is not a holiday beginning between 5:30 p.m. and 8:00 p.m. in a location that is accessible to the affected neighborhood. The Director may approve other times and locations. The meeting date, time and location must be approved by the Director. To qualify, a meeting must be held not more than 180 days before the application is submitted.

(3) Meeting Content and Conduct. At the meeting, the applicant shall present a concept plan, describe project impacts, describe ways to mitigate impacts, and facilitate a discussion and answer questions. The concept plan shall, at a minimum, delineate access to the site; internal circulation, the range of density of the entire property or the maximum intensity (square footage and stories for all buildings). The applicant decides the format and conduct of the meeting so that attendees have an opportunity to speak and to make written comments. City staff should gather information and explain the rules and requirements. City staff shall provide information regarding the project's compliance with the Comprehensive Plan and any applicable adopted plan or ordinance. Included with the application submittal, the applicant must give the Director a written list of names and addresses of those given notice and those attending, along with a written summary of suggestions, comments, criticism and mitigating measures brought up by the applicant and attendees.

(4) Notice. The applicant shall provide written notice of the date, time, place and subject of the meeting to every owner and group in the neighborhood, as well as the City Public Works and Planning Department. The notice must be approved by the Director and shall be hand-delivered or delivered by U.S. mail. The notice must be hand-delivered or postmarked no later than 10 calendar days prior to the meeting.

(f) Procedures.

(1) Staff Review. Applications shall be reviewed by City staff and other appropriate agencies for compliance with City and agency codes and policies. Upon completion of staff review, the staff shall provide its comments in writing to the applicant.

(2) Review by Other Agencies. The staff shall forward copies of the applications to appropriate agencies for their comments. Examples of review agencies are:

(i) City departments;

(ii) Telecommunications, gas, electric and other utilities;

(iii) Irrigation, drainage, water and sewage, sewer provider special districts;

(iv) School and fire agencies;

(v) Law enforcement;

(vi) Mesa County staff, Planning Commission, or Board of Commissioners;

(vii) State agencies (e.g., Colorado Geologic Survey, Colorado Department of Transportation, Colorado Department of Natural Resources, Colorado Division of Wildlife, etc.); and

(viii) Federal agencies (e.g., Federal Emergency Management Agency, Bureau of Land Management, U.S. Army Corps of Engineers, etc.).

(3) Agency and Department Comments. The agencies' review will be advisory in character, and does not constitute approval or disapproval. All comments shall be forwarded to the applicant for response.

(4) Applicant's Response. An application submitted to the City for review must be diligently pursued and processed by the applicant. Accordingly, if the applicant, within 90 calendar days of mailing of the City's review, comments on any submittal (or resubmittal) of an application for approval of a development application, does not resubmit revised documents to address comments from the City, the development application shall lapse and become null and void. The Director may grant two extensions of the foregoing 90-day requirement, not to exceed a total extension of 180 days.

(5) Review of Response. The Director shall determine if sufficient information has been provided to schedule the application for a hearing. If the application is insufficient the applicant shall be notified. The applicant shall be allowed additional resubmittals and responses before the application is scheduled for a hearing.

(g) Notice.

(1) Purpose. Notice of public hearings allow for community input and due process (the opportunity to be heard) for the applicant and neighbors. Accordingly, nothing herein shall prohibit the Director from providing public notice beyond that legally required, at the applicant's cost.

(2) Published Notice.

(i) Unless otherwise provided in this section, a notice setting forth the date, time, place and purpose of such a public hearing, the name of the applicant and identification of the subject property must be published at least once. The Director shall be responsible for giving notice.

(ii) In computing notice time, the day of the hearing shall be excluded.

(iii) The applicant shall either provide the information for the notice, or pay the City to prepare the information.

(iv) All published notices shall be published in a local newspaper of general circulation recognized by the City.

(3) Mailed Notice of Public Hearing.

(i) The Director must mail notice of a public hearing, as required below, by U.S. mail at the applicant's cost to each owner at the address on file with the Mesa County, Colorado, Assessor.

(ii) At the applicant's cost, the Director shall also give notice to each person who attended any required neighborhood meeting.

(iii) Mailed notice shall state the date, time and place of the hearing, a general description of the proposal, the location of the project, a statement explaining that any person will be heard at the public hearing and other such requirements. Newspaper clippings of the

published notice shall not be used for mailed notice. Notice shall be delivered by U.S. mail.

(iv) All mailed notices must be sent no less than 10 days before a public hearing and must include each homeowners' association (HOA) or other group registered with the Public Works and Planning Department within 1,000 feet.

(4) Property Sign.

(i) When required below, the applicant shall post approved signs giving notice of the application. The applicant shall post at least one sign on each street frontage of the property at least 10 calendar days before the initial public hearing and remain posted until the day after the final hearing. The applicant shall maintain the sign on the property until the day after the final public hearing.

(ii) One sign per street frontage is required.

(5) Five Percent Notice. Mailed notice and sign posting is not required for Comprehensive Plan amendments, rezonings, or zones of annexations for requests relating to more than five percent of the area of the City and/or related to a Citywide or area plan process.

(6) Combined Notice. If a project requires action on several permits at the same hearing, the Director may provide for a single, combined notice.

(7) Substantial Compliance. Notice is sufficient if there is complete substantial compliance with the requirements of this section. For example, minor errors in the words of the notice, or in the number of signs on a property (where multiple signs are required) will not invalidate the notice. On the other hand, the requirements of the number of days of notice, the general type of notice for the correct time, date and place of a hearing, and the location of the property must be completely correct. If a question arises, the decision-making body shall decide if adequate notice was given.

Type of Submittal or Request	Published Notice	Mailed Notice	Sign Notice
Administrative Development Application	–	–	–
Development Application Requiring Public Hearing	7 days	Owners within 500 feet	Yes
Comprehensive Plan Text Amendment	7 days	–	–
Code Text Amendment	7 days	–	–
Historic Preservation	7 days	–	–
Grand Junction Circulation Plan Amendment	7 days	–	–
Revocable Permit	–	–	–
Vested Rights	Within 10 days of approval	–	–
Subdivisions	–	Owners within 500 feet	Yes

(h) Request for a Continuance Prior to Hearing.

(1) An applicant shall have the right to one continuance before the Planning Commission, Zoning Board of Appeals or City Council. A written request for the continuance shall be submitted by the applicant or their representative to the Director. A request for a continuance may also be made by the City staff, the Planning Commission or City Council.

(2) An applicant requesting a continuance shall make reasonable efforts to notify all persons previously advised of the hearing that a continuance has been requested. Reasonable efforts shall include, but not be limited to, personal notice, broadcast or print media notice and any other form of notice determined by the Director to be reasonable. The applicant shall reimburse the

City and provide all materials necessary to provide written notice of the rescheduled public hearing date to surrounding property owners in the same manner and with the same time schedule as the original date.

(3) The review body may grant one continuance to a time, place and date certain, without taking any testimony, except pertaining to the adequacy of the notice.

(i) Withdrawal of Application. Before a hearing on an application is opened, the applicant may request in writing that the application be withdrawn. Fees will not be refunded. An applicant may ask to withdraw after the hearing is opened, but the decision-making body will decide whether or not to approve the request.

(j) Public Hearing Procedures.

(1) Timing. The Director shall schedule an application for hearing only when all issues have been resolved and a determination of compliance with all codes and regulations is made.

(2) Applicant's Option. An applicant has the right to request a hearing at any time during the review process.

(3) Conduct of Hearing.

(i) Any person may offer relevant information in writing or in person. Every speaker representing one or more other persons shall state his/her name, street address, and if an organization or group, the name and mailing address of the organization or group.

(ii) The Director's written report and recommendations should be available three calendar days before the public hearing.

(iii) The Chair shall exclude testimony and evidence that is irrelevant, immaterial, unduly repetitious or disruptive. Ordinarily no one presenting testimony or evidence may ask questions of other persons appearing as witnesses; although the chairperson of the body may ask questions suggested by a person presenting testimony. At any point, members of the body conducting the hearing may ask questions of the applicant, staff or public.

(iv) No person shall knowingly make a false statement nor present false, deceptive or slanderous testimony, comment or remarks at a public hearing.

(4) Continuance. The decision-making body may grant a continuance of the public hearing.

(5) Additional Rules. The body conducting the hearing may adopt its rules of procedure to limit the number of applications for development approval to be considered per meeting and to limit the time for each presentation or speaker.

(k) Decision-Making. The decision-making body shall make decisions based on policies, standards, plans, recommendations, the applicable law, the testimony and information presented at the hearing.

(1) Authority to Condition Development Approvals. The decision-making body may impose conditions to protect the neighborhood, implement this code and other rules and regulations and ensure compliance with any applicable policy or requirement.

(2) Planning Commission as Recommending Body to City Council. If the Planning Commission is the recommending body, recommendations shall be forwarded to the City Council.

(l) Scope of Action. The review body may take any action regarding the application that is consistent with notice, including approval with conditions or denial. The reviewing body may allow the applicant to amend the application if the amendment reduces the project density, reduces the impact of the project, or the amount of land involved in the project.

(m) Post-Decision Proceedings.

(1) Rehearing. Any aggrieved person, including the Director, may request a rehearing or file an appeal of a final action (see GJMC 21.02.210).

(2) Amendments and Revisions to Approval.

(i) The Director may approve corrections and revisions deemed minor to an approved application, in writing, subject to appeal to the decision-maker. A minor revision is one necessary in light of technical considerations that does not substantively change the character of the development approval.

(ii) The Director must give five days' notice of such corrections by posting at City Clerk agenda board.

(n) Validity.

(1) Noncompliance. Upon a finding that any of the following conditions exist, all activities taken pursuant to such development application shall immediately cease, and no person shall continue construction or make use of or maintain any activity pursuant to such approval if:

(i) The applicant fails to satisfy any condition of the approval;

(ii) The applicant fails to timely complete all work and construction set forth in a development improvements agreement. If no time limit for satisfaction of conditions is specified in the original or revised approval of the development application, the time shall be presumed to be one year from the date of approval; or

(iii) The applicant fails to fulfill any promise made in writing or at any public hearing.

(2) Extension Procedures.

(i) Considerations. Development approval deadline or a development phasing schedule may be set for greater than one year, but not more than 10 years, by the decision-making body. The decision-making body may extend any deadline if the applicant demonstrates why the original effective period or development phasing schedule was not sufficient and cannot be met. The decision-making body shall consider when deciding to extend or change any deadlines if development regulations have materially changed so as to render the project inconsistent with the regulations prevailing at the time the extension would expire.

(ii) Requests. A request to extend any deadline shall be submitted in writing to the Director prior to the expiration of the original approval or deadline.

(Ord. 4419, 4-5-10)

21.02.090 Vacation of plat.

(a) Purpose. This section is intended to provide a process for the vacation of plats, maps, and subdivisions that are no longer viable and to ensure the vacation minimizes any adverse impacts on the applicant, surrounding property owners, and the City.

(b) Applicability. If a plat has not been developed, has been partially developed, or has not been developed as approved, then the owner or the City may apply for a vacation of the plat.

(c) Approval Criteria. The vacation of the plat shall conform to all of the following:

(1) The Comprehensive Plan, Grand Junction Circulation Plan, and other adopted plans and policies of the City;

(2) No parcel shall be landlocked as a result of the vacation;

(3) Access to any parcel shall not be restricted to the point that access is unreasonable, economically prohibitive, and/or reduces or devalues any property affected by the proposed vacation;

(4) There shall be no adverse impacts on the health, safety, and/or welfare of the general community, and the quality of public facilities and services provided to any parcel of land shall not be reduced (e.g., police/fire protection and utility services); and

(5) The provision of adequate public facilities and services to any property as required in Chapter 21.06 GJMC shall not be inhibited by the proposed vacation.

(d) Decision-Maker.

(1) The Director shall make recommendations to the Planning Commission.

(2) The Planning Commission shall approve, conditionally approve or deny all applications for a plat vacation, except those subject to subsection (d)(3) of this section.

(3) If the plat to be vacated includes rights-of-way or easements, the Director and Planning Commission shall make recommendations and the City Council shall approve, conditionally approve or deny all applications for a plat vacation.

(Ord. 4419, 4-5-10)

21.02.100 Vacation of public right-of-way or easement.

(a) Purpose. The purpose of this section is to permit the vacation of surplus rights-of-way and/or easements.

(b) Applicability. Applications for vacation of any street, alley, easement or other public reservation may be made by the City or by any owner of property on which the street, alley or public reservation lies or adjoins.

(c) Approval Criteria. The vacation of the right-of-way or easement shall conform to the following:

(1) The Comprehensive Plan, Grand Junction Circulation Plan and other adopted plans and policies of the City;

(2) No parcel shall be landlocked as a result of the vacation;

(3) Access to any parcel shall not be restricted to the point where access is unreasonable, economically prohibitive, or reduces or devalues any property affected by the proposed vacation;

(4) There shall be no adverse impacts on the health, safety, and/or welfare of the general community, and the quality of public facilities and services provided to any parcel of land shall not be reduced (e.g., police/fire protection and utility services);

(5) The provision of adequate public facilities and services shall not be inhibited to any property as required in Chapter 21.06 GJMC; and

(6) The proposal shall provide benefits to the City such as reduced maintenance requirements, improved traffic circulation, etc.

(d) Decision-Maker.

(1) The Director and Planning Commission shall make recommendations to the City Council.

(2) The City Council shall approve, conditionally approve or deny all applications for a vacation of a right-of-way or easement. Vacation of a right-of-way shall be accomplished by the passing of an ordinance by the City Council. Vacation of an easement shall be accomplished by resolution of the City Council.

(3) The Director has the authority to review and approve, conditionally approve or deny a request for the vacation of an easement created for a temporary purpose, granted to the City by a separate instrument and not dedicated on a plat or map.

(e) Recording. All vacations must be recorded with the Mesa County Clerk and Recorder.

(Ord. 4419, 4-5-10)

21.02.110 Conditional use permit (CUP).

(a) Purpose. The purpose of a conditional use review is to provide an opportunity to utilize property for an activity which under usual circumstances could be detrimental to other permitted uses, and which normally is not permitted within the same district. A conditional use may be permitted under circumstances particular to the proposed location and subject to conditions that provide protection to adjacent land uses. A conditional use is not a use by right; it is one that is otherwise prohibited within a given zone district without approval of a conditional use permit.

(b) Applicability. A conditional use permit shall be required prior to the establishment of any conditional use identified in Chapter 21.04 GJMC or elsewhere in this code.

(c) Approval Criteria. The application shall demonstrate that the proposed development will comply with the following:

(1) District Standards. The underlying zoning districts standards established in Chapter 21.03 GJMC, except density when the application is pursuant to GJMC 21.08.020(c);

(2) Specific Standards. The use-specific standards established in Chapter 21.04 GJMC;

(3) Availability of Complementary Uses. Other uses complementary to, and supportive of, the proposed project shall be available including, but not limited to: schools, parks, hospitals, business and commercial facilities, and transportation facilities;

(4) Compatibility with Adjoining Properties. Compatibility with and protection of neighboring properties through measures such as:

(i) Protection of Privacy. The proposed plan shall provide reasonable visual and auditory privacy for all dwelling units located within and adjacent to the site. Fences, walls, barriers and/or vegetation shall be arranged to protect and enhance the property and to enhance the privacy of on-site and neighboring occupants;

(ii) Protection of Use and Enjoyment. All elements of the proposed plan shall be designed and arranged to have a minimal negative impact on the use and enjoyment of adjoining property;

(iii) Compatible Design and Integration. All elements of a plan shall coexist in a harmonious manner with nearby existing and anticipated development. Elements to consider include: buildings, outdoor storage areas and equipment, utility structures, building and paving coverage, landscaping, lighting, glare, dust, signage, views, noise, and odors. The plan must ensure that noxious emissions and conditions not typical of land uses in the same zoning district will be effectively confined so as not to be injurious or detrimental to nearby properties.

(d) Decision-Maker.

(1) The Director shall make recommendations to the Planning Commission.

(2) The Planning Commission shall approve, conditionally approve or deny all applications for a conditional use permit.

(e) Application and Review Procedures. Application requirements and processing procedures are described in GJMC 21.02.080. Site plan review and approval (pursuant to GJMC 21.02.070(f) or (g)) can occur either before or after the approval of a conditional use permit by the Planning Commission. In either case, the applicant shall submit a site sketch showing sufficient detail to enable the Planning Commission to make findings on the conditional use permit criteria (subsection (c) of this section) and showing all site design features which are proposed or necessary to mitigate neigh-

borhood impacts and/or enhance neighborhood compatibility. The Planning Commission can request additional information from the applicant if it deems the site sketch is insufficient to enable it to make a determination on the criteria. In any subsequent site plan review, the Director shall ensure and determine that all mitigating/enhancing site features approved or made conditions of approval by the Planning Commission are depicted on the approved site plan.

(f) Site Expansion or Changes. If the applicant changes or expands a structure or other feature of a site that is subject to a conditional use permit, the Director shall determine whether the expansion/change is "major" or "minor." A major expansion/change shall be reviewed by the Planning Commission in accordance with the criteria for a conditional use permit. A minor expansion/change shall be reviewed administratively in accordance with the applicable site plan review criteria and conditions of the conditional use permit. A major expansion or change is one which:

(1) Affects, changes, removes or eliminates a site feature or condition which was approved or imposed for the purpose of mitigating neighborhood impacts or enhancing neighborhood compatibility as described in subsection (c)(4) of this section;

(2) Increases the intensity of the use, the off-site impacts such as noise, light or odor, or the hours of operation;

(3) Results in a substantial change to the features shown on the site sketch which formed the basis of the Planning Commission's approval of the conditional use permit.

All other expansion/changes shall be considered minor.

(g) Validity. A conditional use permit approval shall run with the land and remain valid until the property changes use or the use is abandoned and nonoperational for a period of 12 consecutive months.

(h) Amendment or Revocation of Conditional Use Permit.

(1) Interested Party. Any interested party may apply to the City for the amendment or revocation of a conditional use permit. For purposes of this section, "interested party" shall include the following:

(i) The original applicant or successor in interest, or the current owner or lessee of the property for which the conditional use was granted (may also be referred to as the permit holder);

(ii) The City;

(iii) Any owner or lessee of property that lies within 500 feet of the property for which the conditional use permit was granted.

(2) Fee. Any person or entity, other than the City, seeking to amend or revoke a conditional use permit shall pay a fee in the amount established for an application for a conditional use permit.

(3) Preliminary Criteria. An applicant for amendment or revocation of a conditional use permit must establish the following to the satisfaction of the decision-maker before the requested change(s) can be considered by the decision-maker:

(i) Grounds for Amendment – Permit Holder. A conditional use permit may be amended at the request of the holder of the permit (the holder of the permit being the original applicant or successor in interest or the current owner or lessee of the land subject to the conditional use permit) upon a showing that a substantial change in circumstance has occurred since the approval of the permit which would justify a change in the permit.

(ii) Grounds for Revocation or Termination – Permit Holder. A conditional use permit may be revoked or terminated at the request of the holder of the permit upon a showing that, under this title, the use is an allowed use in the zone in which it is now established.

(iii) Grounds for Amendment or Revocation – Other Interested Party. A conditional use permit may be amended or revoked at the request of any other interested party if one or more of the following is established:

(A) The conditional use permit was obtained by misrepresentation or fraud;

(B) The use, or, if more than one, all the uses, for which the permit was granted has ceased or has been suspended for six months;

(C) The holder or user of the conditional use permit has failed to comply with any one or more of the conditions placed on the issuance of the permit;

(D) The holder or user of the conditional use permit has failed to comply with any City regulation governing the conduct of that use;

(E) The holder or user of the conditional use permit has failed to construct or maintain the approved site as shown on the approved site plan;

(F) The operation of the use or the character of the site has been found to be a nuisance or a public nuisance by a court of competent jurisdiction in any civil or criminal proceeding.

(iv) Due Process. No conditional use permit shall be amended or revoked against the wishes of the holder of the permit without first giving the holder an opportunity to appear before the Planning Commission and show cause as to why the permit should not be amended or revoked. Amendment or revocation of the permit shall not limit the City's ability to initiate or complete other legal proceedings against the holder or user of the permit.

(4) Decision-Maker. All applications for amendment of a conditional use permit shall be processed in the same manner as a new request for a conditional use permit, as set forth in subsection (e) of this section.

(5) Approval Criteria. An application for amendment or revocation of a conditional use permit shall demonstrate that the development or project will comply with all of the criteria set forth in subsection (c) of this section.

(Ord. 4691, 2-17-16; Ord. 4463, 4-4-11; amended during 2010 codification; Ord. 4419, 4-5-10)

21.02.120 Special permit.

(a) Purpose. The special permit review provides an opportunity for additional flexibility when considering a land use that may be less than permanent. The special permit review is accomplished through a City Council discretionary review process. A special permit may be permitted under circumstances particular to the proposed location and subject to conditions that provide protection to adjacent land uses. A special permit is required only when more flexibility is required beyond that afforded to the Director through the administrative adjustment process (see GJMC 21.02.070(l)).

(b) Applicability.

(1) A special permit is allowed in those areas designated Neighborhood Center, Village Center, City Center (which includes Downtown) or Mixed Use Opportunity Corridors on the Future Land Use Map of the Comprehensive Plan or in the C-1 and I-O zone districts along Horizon Drive north of G Road including Crossroads Boulevard and Horizon Court. A special permit shall be required prior to:

(i) Allowing additional height beyond that permitted by a district's bulk standards; or

(ii) Allowing additional building area beyond that permitted by a district's bulk standards.

(2) A special permit is allowed in all zone districts for the following uses and shall be required prior to:

(i) *Repealed by Ord. 4890;*

(ii) An interim use located in any zone district where:

(A) The development is proposed as an interim use that is allowed in the district, or as an interim use established with a minimal investment that can be easily redeveloped at the density or intensity envisioned by the Comprehensive Plan; and

(B) The applicant demonstrates that the development design and any proposed infrastructure improvements further the future development of the property at the density or intensity envisioned by the Comprehensive Plan;

(iii) Any other special permit found elsewhere in this code.

(c) Approval Criteria. The application shall demonstrate that the proposed development will comply with the following:

(1) Comprehensive Plan. The special permit shall further the goals and policies of the Comprehensive Plan. The special permit shall serve to determine the location and character of site(s) in a Neighborhood Center, Village Center, City Center or Mixed Use Opportunity Corridors on the Future Land Use Map of the Comprehensive Plan;

(2) Site Plan Review Standards. All applicable site plan review criteria in GJMC 21.02.070(g) and Submittal Standards for Improvements and Development, Transportation Engineering Design Standards (GJMC Title 29), and Stormwater Management Manual(s) (GJMC Title 28);

(3) District Standards. The underlying zoning district standards established in Chapter 21.03 GJMC, except as expressly modified by the proposed special permit; and

(4) Specific Standards. The use-specific standards established in Chapter 21.04 GJMC.

(d) Decision-Maker.

(1) The Director shall make recommendation(s) to the Planning Commission.

(2) The Planning Commission shall make recommendation(s) to the City Council.

(3) The City Council shall approve, conditionally approve or deny all applications for a special permit.

(e) Application and Review Procedures. Application requirements and processing procedures are described in GJMC 21.02.080.

(f) Validity. A special permit approval shall run with the land. City Council shall have authority to limit the scope and duration of a special permit for an interim use.

(Ord. 4890, 11-20-19; Ord. 4428, 6-14-10; Ord. 4419, 4-5-10)

21.02.130 Comprehensive Plan amendment (CPA).

(a) Purpose. In order to maintain internal consistency within the Comprehensive Plan, administrative changes and proposed amendments to the Comprehensive Plan must be consistent with the vision (intent), goals and policies included in the Plan.

(b) Applicability. All proposed amendments to the text of the Comprehensive Plan shall comply with the provisions of this section. Any proposed development that is inconsistent with any goals or policies of the Comprehensive Plan shall first receive approval of a Comprehensive Plan amendment. The Comprehensive Plan shall include all neighborhood plans, corridor plans, area plans, the Grand Junction Circulation Plan, and all other elements adopted as a part of the Comprehensive Plan.

(1) Jurisdiction Approvals. Changes to various areas of the Grand Junction Comprehensive Plan require different land use approvals:

(i) Land use changes located within the City limits may be approved by the City and do not require County approval.

(ii) Changes to land use designations inside the Persigo 201 Boundary (outside the City limits) require annexation and City approval and do not require County approval.

(iii) Changes to land use designations outside of the Persigo 201 Boundary require County approval and do not require City approval.

(iv) Changes to the Persigo 201 Service Area require approval by the Persigo Board, which is comprised of the County Commissioners and the City Council.

(v) Each entity will have an opportunity to comment on proposed changes to the Comprehensive Plan prior to adoption of the amendment.

(c) Criteria for Plan Amendments.

(1) The City may amend the Comprehensive Plan, neighborhood plans, corridor plans and area plans if the proposed change is consistent with the vision (intent), goals and policies of the Comprehensive Plan and:

(i) Subsequent events have invalidated the original premises and findings; and/or

(ii) The character and/or conditions of the area has changed such that the amendment is consistent with the Plan; and/or

(iii) Public and community facilities are adequate to serve the type and scope of land use proposed; and/or

(iv) An inadequate supply of suitably designated land is available in the community, as defined by the presiding body, to accommodate the proposed land use; and/or

(v) The community or area, as defined by the presiding body, will derive benefits from the proposed amendment.

(2) The City and County shall amend the Grand Junction Circulation Plan if:

(i) There was an error such that then-existing facts, projects, or trends that were reasonably foreseeable were not accounted for; or

(ii) Subsequent events have invalidated the original premises and findings;

(iii) The character and/or condition of the area have changed enough that the amendment is acceptable;

(iv) The community or area, as defined by the presiding body, will derive benefits from the proposed amendment;

(v) The change will facilitate safe and efficient access for all modes of transportation; and

(vi) The change furthers the goals for circulation and interconnectivity.

(d) Decision Maker: Administrative Changes.

(1) Where the City of Grand Junction has sole jurisdiction, the Director has the authority to:

(i) Make minor additions or clarifications to the policy section;

(ii) Correct errors or grammar;

(iii) Make land use designation changes for property that has multiple land use designations and is consistent with project approvals;

(iv) Approve flexibility in the location of the Village and Neighborhood Center by granting a one-half-mile leeway; and

(v) Allow the processing of a rezone application or request without a plan amendment when the proposed zoning is inconsistent with the Comprehensive Plan and the property is adjacent to the land use designation that would support the requested zone district.

(e) Decision-Maker: Plan Amendments.

(1) Inside of Persigo 201 Boundary. Concerning property within the Persigo 201 Boundary, which will be annexed if not already within the City limits, the Director and Planning Commission shall recommend and the City Council's action is the City's final action. City Council shall hold a public hearing prior to any decision regarding a Comprehensive Plan amendment within the Persigo 201 Boundary.

(2) Failure of Amendment. If an amendment request fails, any pending development application must be changed to be consistent with the plan.

(f) Application and Review Procedure.

(1) Procedure. See GJMC 21.02.080.

(2) Deadlines.

(i) Plan amendments shall be processed when they are received.

(3) Application Requirements.

(i) Minimum Requirements. In making a request for a Plan amendment the applicant shall address each of the criteria provided in this section.

(ii) Optional Materials. In addition to the required written descriptions, justifications and responses, the City Council, Planning Commission or staff may request additional documents, reports, studies, plans and drawings as deemed necessary to fully evaluate the request. The applicant may submit additional relevant materials.

(Ord. 4419, 4-5-10)

21.02.140 Code amendment and rezoning.

(a) Approval Criteria. In order to maintain internal consistency between this code and the zoning maps, map amendments must only occur if:

(1) Subsequent events have invalidated the original premises and findings; and/or

(2) The character and/or condition of the area has changed such that the amendment is consistent with the Plan; and/or

(3) Public and community facilities are adequate to serve the type and scope of land use proposed; and/or

(4) An inadequate supply of suitably designated land is available in the community, as defined by the presiding body, to accommodate the proposed land use; and/or

(5) The community or area, as defined by the presiding body, will derive benefits from the proposed amendment.

(b) Decision-Maker.

(1) The Director and Planning Commission shall make recommendations to the City Council.

(2) City Council shall make the final decision. Either the Planning Commission or the City Council may add additional property to be considered for a zoning change if such additional property is identified in the notice, in accordance with GJMC 21.02.080(g).

(c) Application and Review Procedures.

(1) Procedure. See GJMC 21.02.080.

(2) Mixed Use Opportunity Corridors. Residentially zoned property within a Mixed Use Opportunity Corridor designated on the Future Land Use Map in the Comprehensive Plan that are currently zoned for residential purposes may be rezoned to the Mixed Use Opportunity Corridor form district (MXOC) if the property is not also within a Village or Neighborhood Center, or to one of the other form districts of GJMC 21.03.090 if the property is also within a Village or Neighborhood Center, so long as the depth of the lot measured perpendicular to the corridor is at least 150 feet. When considering a rezone to a form district, the City Council shall consider the following:

(i) The extent to which the rezoning furthers the goals and policies of the Comprehensive Plan; and

(ii) The extent to which the proposed rezoning would enhance the surrounding neighborhood by providing walkable commercial, entertainment and employment opportunities, as well as alternative housing choices.

(3) Text Amendment. An application for an amendment to the text of this code shall address in writing the reasons for the proposed amendment.

(Ord. 4646, 11-19-14; Ord. 4419, 4-5-10)

21.02.150 Planned development (PD).

(a) Purpose. The planned development (PD) district is intended to apply to mixed use or unique single use projects to provide design flexibility not available through strict application and interpretation of the standards established in Chapter 21.05 GJMC. The PD zone district imposes any and all provisions applicable to the land as stated in the PD zoning ordinance. The purpose of the PD zone is to provide design flexibility as described in GJMC 21.05.010. Planned development rezoning should be used when long-term community benefits will be derived, and the vision, goals and policies of the Comprehensive Plan can be achieved. Long-term community benefits include:

(1) More efficient infrastructure;

(2) Reduced traffic demands;

(3) More usable public and/or private open space;

(4) Recreational amenities; and/or

(5) Needed housing choices.

(b) Outline Development Plan (ODP).

(1) Applicability. An outline development plan is required. The purpose of an ODP is to demonstrate conformance with the Comprehensive Plan, and coordination of improvements within and among individually platted parcels, sections or phases of a development prior to the approval of a final plat. At ODP, zoning for the entire property or for each "pod" designated for development on the plan is established. This step is recommended for larger, more diverse projects that are expected to be developed over a long period of time. Through this process, the general pattern of development is established with a range of densities assigned to individual "pods" that will be the subject of future, more detailed planning.

(2) Approval Criteria. An ODP application shall demonstrate conformance with all of the following:

(i) The Comprehensive Plan, Grand Junction Circulation Plan and other adopted plans and policies;

(ii) The rezoning criteria provided in GJMC 21.02.140;

(iii) The planned development requirements of Chapter 21.05 GJMC;

(iv) The applicable corridor guidelines and other overlay districts in GJMC Titles 23, 24 and 25;

(v) Adequate public services and facilities shall be provided concurrent with the projected impacts of the development;

(vi) Adequate circulation and access shall be provided to serve all development pods/areas to be developed;

(vii) Appropriate screening and buffering of adjacent property and uses shall be provided;

(viii) An appropriate range of density for the entire property or for each development pod/area to be developed;

(ix) An appropriate set of "default" or minimum standards for the entire property or for each development pod/area to be developed;

(x) An appropriate phasing or development schedule for the entire property or for each development pod/area to be developed; and

(3) Decision-Maker.

(i) The Director and Planning Commission shall make recommendations to City Council.

(ii) City Council shall approve, conditionally approve or deny all applications for an ODP and accompanying planned development rezoning.

(4) Additional Application and Review Procedures.

(i) Simultaneous Review of Other Plans. An applicant may file an ODP with a final development plan for all or a portion of the property, as determined by the Director at the pre-application conference.

(ii) Density/Intensity. Density/intensity may be transferred between development pods/areas to be developed unless explicitly prohibited by the ODP approval.

(iii) Validity. The effective period of the ODP/phasing schedule shall be determined concurrent with ODP approval.

(iv) Required Subsequent Approvals. Following approval of an ODP, a subsequent final development plan approval shall be required before any development activity occurs.

(c) Final Development Plan (FDP).

(1) Applicability. The plan and the plat ensure consistency with the approved ODP and specific development and construction requirements of various adopted codes.

(2) Approval Criteria. A final development plan application shall demonstrate conformance with all of the following:

(i) The approved ODP, if applicable;

(ii) The approved PD rezoning ordinance, if applicable;

(iii) The Submittal Standards for Improvements and Development, Transportation Engineering Design Standards (GJMC Title 29), and Stormwater Management Manual (GJMC Title 28) manuals and all other applicable development and construction codes, ordinances and policies;

(iv) The applicable site plan review criteria in GJMC 21.02.070(g); and

(v) The applicable final plat criteria in GJMC 21.02.070(s).

(3) Decision-Maker. The Director shall approve, conditionally approve, or deny all applications for a final development plan.

(4) Additional Application and Review Procedures.

(i) Concurrent Review of Subdivision. Unless specified otherwise at the time of ODP approval, if the form of ODP approval was a subdivision plan, a final plat may be approved and recorded prior to final plan approval for individual lots.

(ii) Review of Covenants. The City Attorney shall review and approve all covenants and restrictions prior to final development plan approval.

(iii) Notice. Notice of a final development plan is not required unless the Planning Commission elects to take final action. In such instances, notice shall be provided in the same manner and form as is required with an ODP.

(iv) Form of Final Action. The form of final approval by the Director shall be in the form of a decision letter.

(5) Recording. Upon final approval, the plat shall be recorded, if applicable, in accordance with GJMC 21.02.070(u). The final plat shall, at a minimum, contain all of the following information that is pertinent to the PD: the bulk standards; a list of approved and/or specifically excluded uses; and any pertinent conditions or stipulations that were previously made or imposed.

(d) Guarantees for Public Improvements.

(1) Except as provided herein, before the plan and plat are recorded by the Director, all applicants shall be required to complete, to the satisfaction of the Director, all street, sanitary, and other public improvements, as well as lot improvements on the individual lots of the subdivision as required by this code. The required improvements shall be those specified in the approved construction plans as per GJMC 21.02.070(t); or

(2) As a condition of final plan and plat approval, the City shall require the applicant to enter into a development improvements agreement and post a guarantee for the completion of all required improvements as per GJMC 21.02.070(m).

(e) Amendments to Approved Plans.

(1) Planned Development Rezoning Ordinance. The use, density, bulk performance and default standards contained in an approved PD rezoning ordinance may be amended only as follows, unless specified otherwise in the rezoning ordinance:

(i) No use may be established that is not permitted in the PD without amending the rezoning ordinance through the rezoning process. Uses may be transferred between development pods/areas to be developed through an amendment to the ODP provided the overall density for the entire PD is not exceeded;

(ii) The maximum and minimum density for the entire PD shall not be exceeded without amending the rezoning ordinance through the rezoning process; and

(iii) The bulk, performance and default standards may not be amended for the PD or a development pod/area to be developed without amending the PD rezoning ordinance through the rezoning process.

(2) Outline Development Plan. The approved outline development plan may be amended only by the same process by which it was approved, except for minor amendments. Unless the adopted PD rezoning ordinance provides otherwise, the approved outline development plan may be amended as follows:

(i) Minor Amendments. The Director may approve the following amendments for individual lots within the area covered by an outline development plan provided all standards in the adopted PD rezoning ordinance are met:

(A) Decreases in density so long as the character of the site is maintained;

(B) Changes in bulk standards of up to 10 percent so long as the character of the site is maintained;

(C) Changes in the location and type of landscaping and/or screening so long as the character and intent of the original design are maintained;

(D) Changes in the orientation or location of parking areas and vehicular and pedestrian circulation areas so long as the effectiveness and character of the overall site circulation, parking and parking lot screening are maintained; and

(E) The reorientation, but not complete relocation, of major structures so long as the character of the site is maintained.

(F) Simple subdivision.

(ii) Minor Amendment Review Process. Such amendments shall be reviewed by the Director using the following review criteria:

(A) The amendment shall not represent a significant change in any of the agreed upon deviations from the default standards.

(iii) Major Amendments. All other amendments to the outline development plan shall be reviewed by the Director and Planning Commission using the same process and criteria used for ODP review and approval. Final decision shall be made by City Council.

(3) Final Development Plan. Amendments to the final development plan may be approved by the Director using the same process and criteria used for outline development plan review and approval. Final development plans must be consistent with the approved outline development plan and rezoning ordinance.

(f) Lapse of Plan and Rezone. If a planned development, or any portion thereof, has not been completed in accordance with the approved development schedule, a "lapse" shall have occurred and the terms of all approved plans for incomplete portions of the PD shall be null and void. If lapse occurs, the property shall be governed by the zoning district applied to the property immediately before the rezoning to PD, or an applicant may request hearing before the Planning Commission at which time a revocation of all prior approvals shall be considered. If the Planning Commission determines that a lapse has occurred, the Director shall record an appropriate legal notice. The Director may initiate, without owner consent, a zoning change on a lapsed PD to another zone district.

(g) General Provisions.

(1) Contractual Agreement. Approval of a PD allows the development and use of a parcel of land under certain, specific conditions. Conditions of approval shall be filed with the Director in the review process. No use of the parcel, nor construction, modification, or alteration of any use or structures within a PD project shall be permitted unless such construction, modification or use complies with the terms and conditions of an approved final development plan. Each subsequent owner and entity created by the developer, such as property owners' associations or an architectural review committee, shall comply with the terms and conditions of approval. The developer shall set forth the conditions of approval within covenants. Such covenants shall be recorded with the final approved plan and plat.

(2) Transfer of Ownership. No person shall sell, convey, or transfer ownership of any property or any portion thereof within a PD zone until such person has informed the buyer of the property's status with respect to the PD process and conditions of approval. The City shall bear no liability for misrepresentation of terms and conditions of an existing approval.

(3) Planned Development Zone Designation. The Director shall designate each approved PD on the Official Zoning Map.

(Ord. 4419, 4-5-10)

21.02.160 Annexation.

(a) Purpose. In accordance with State statutes, land may be annexed or de-annexed from the City as deemed appropriate by the City Council.

(b) Applicability. Any lands to be added to or deleted from the corporate limits of the City shall comply with this section.

(c) Approval Criteria. The application shall meet all applicable statutory and City administrative requirements. A complete copy of these requirements is available from the Public Works and Planning Department.

(d) Decision-Maker.

(1) The Director shall make recommendations to City Council.

(2) City Council shall approve, conditionally approve or disapprove all applications for annexation or contraction of the municipal limits.

(e) Application and Review Procedures. Application requirements and processing procedures shall comply with those described in applicable State statutes. A summary of these procedures is available from the Public Works and Planning Department.

(f) Zoning of Annexed Properties. Land annexed to the City shall be zoned in accordance with GJMC 21.02.140 to a district that is consistent with the adopted Comprehensive Plan and the criteria set forth. Generally, future development should be at a density equal to or greater than the allowed density of the applicable County zoning district.

(Ord. 4419, 4-5-10)

21.02.170 Vested property rights.

(a) Purpose. The purpose of this section is to provide the procedures necessary to implement the provisions of § 24-68-101 C.R.S., et seq. and § 29-20-101 C.R.S. et seq.

(b) Definitions. The following definitions are for the purposes of administration of this section only and do not apply to any other sections of this code.

(1) "Site-specific development plan" (SSDP) means, for all developments requiring a public hearing, the final step, irrespective of its title, which occurs prior to building permit application; provided, however, that if the landowner wishes said approval to have the effect of creating vested rights, pursuant to § 24-68-101 C.R.S., et seq., the landowner must so request, in writing, at the time of application for said approval. Failure to so request renders the approval not a "site-specific development plan," and no vested rights shall be deemed to have been created.

(2) "Vested property right" means the right to undertake and complete the development and use of property under the terms and conditions of a site-specific development plan.

(c) Applicability. An applicant may request, in writing, to have property rights vest with a site-specific development plan. The site-specific development plan shall be applicable only to:

(1) Property zoned planned development with the approved final development plan constituting the site-specific development plan; or

(2) Any other application (i.e., outline development plan, site plan, conditional use, subdivision plat, final development plan or development improvements agreement); provided, that:

(i) The applicant requests in writing that the Planning Commission hold a public hearing and approve a specific document/application as a site-specific development plan; and/or

(ii) State law requires that a vested property right be granted, in which case the Planning Commission shall determine, at its discretion, which, if any, document/application shall constitute a site-specific development plan.

(d) Approval Criteria. The application shall demonstrate compliance with all of the following:

(1) The provisions stated in § 24-68-101 C.R.S. et seq.; and

(2) The final development plan review criteria of GJMC 21.02.150(c)(2).

(e) Decision-Maker.

(1) The Director and Planning Commission shall make recommendations to City Council.

(2) City Council shall approve, conditionally approve or deny all applications for vested property rights.

(f) Application and Review Procedures. Application requirements and processing procedures are described in GJMC 21.02.150(c), with the following modifications:

(1) Waiver Prior to Annexation. Any landowner requesting annexation shall waive in writing any preexisting vested property rights in the petition for annexation, when such rights are consistent with ordinances or regulations which are general in nature and are applicable to property subject to land use regulation. An owner may consent in writing to waive any prior vested property rights.

(2) Concurrent Review. An application for approval of a site-specific development plan shall be submitted and reviewed concurrently with an application for a final development plan or any other document that the Planning Commission shall determine, at its discretion, constitutes a site-specific development plan.

(3) Payment of Costs. In addition to any and all other fees and charges imposed by this code, the applicant shall pay all costs incurred by the City as a result of the site-specific development plan review, including publication of notices, public hearing and review costs.

(4) Notice of Approval. It is the applicant's responsibility to ensure that each final plan, map, plat or site plan, or other document constituting a site-specific development plan contains the following language: "Approval of this plan may create a vested property right pursuant to § 24-68-101 C.R.S., et seq." Omission of this statement shall invalidate the creation of the vested property right. In addition, the applicant shall, within 14 calendar days after the approval of the site-specific development plan, satisfy the notice requirements of § 24-68-103(1) C.R.S. by publishing at his/her expense a notice, in a newspaper of general circulation within the City, advising the public of the site-specific development plan approval and creation of vested property rights pursuant to law, together with a legal description of the property at issue in the site-specific development plan.

(5) Notice to City. Within 14 calendar days after the approval of a site-specific development plan, the applicant shall acknowledge by written instrument that he confirms his/her obligation to satisfy all other requirements under the City codes, rules and regulations including, but not limited to, all studies that may be required. Such studies may concern traffic, drainage, erosion control and utilities.

(6) Other Provisions Unaffected. Approval of a site-specific development plan shall not constitute an exemption from, or waiver of, any other provisions of this code pertaining to the development or use of property.

(7) The duration of any vesting shall be no longer than required by State law, unless a different duration is provided by written agreement between the owner and the City. Failure to comply

with any condition of approval of a SSDP shall result in forfeiture of vested rights and the site-specific development plan shall be declared void and lapsed and shall be reverted in accordance with GJMC 21.02.150.

(8) Approval, Effective Date, Amendments. A site-specific development plan shall be deemed approved upon the last action by the City Council relating thereto. No amendment of a site-specific development plan shall extend or change the effective date of vesting of a property right unless specifically provided by written agreement. In the event amendments to a site-specific development plan are proposed and approved, the effective date of such amendments, for purposes of duration of vested property right, shall be the initial date of the approval of the site-specific development plan.

(9) Waiver of Vesting. Any waiver, be it in part or in full, of a vested property right shall be accomplished by written agreement between the owner and the City and shall be recorded in the Mesa County land records.

(10) Limitations. Nothing in this section is intended to create any vested property right, but only to implement the provisions of § 24-68-101 C.R.S., et seq. and § 29-20-101 C.R.S., et seq. In the event of the repeal of said article or a judicial determination that said article is invalid or unconstitutional, this section shall be deemed to be repealed, and the provisions hereof no longer effective.

(Ord. 4419, 4-5-10)

21.02.180 Revocable permit.

(a) Purpose. A revocable permit is needed to ensure that any private development on public land is safely conducted in a manner that does not pose potential burdens on the public.

(b) Applicability. No structure, fence, sign or other permanent object shall be constructed, maintained, or erected, or a public right-of-way used, without a revocable permit. A revocable permit for irrigation and landscaping in the rights-of-way shall be reviewed and may be approved by the Director.

(c) Approval Criteria. Applications for a revocable permit shall demonstrate compliance with all of the following:

(1) There will be benefits derived by the community or area by granting the proposed revocable permit;

(2) There is a community need for the private development use proposed for the City property;

(3) The City property is suitable for the proposed uses and no other uses or conflicting uses are anticipated for the property;

(4) The proposed use shall not negatively impact access, traffic circulation, neighborhood stability or character, sensitive areas such as floodplains or natural hazard areas;

(5) The proposed use is in conformance with and in furtherance of the implementation of the goals, objectives and policies of the Comprehensive Plan, other adopted plans and the policies, intents and requirements of this code and other City policies; and

(6) The application complies with the submittal requirements as set forth in Section 127 of the City Charter, this chapter and the Submittal Standards for Improvements and Development manual.

(d) Decision-Maker.

(1) The Director shall make recommendations to City Council when applicable.

(2) City Council shall approve, conditionally approve, or deny all applications for a revocable permit, except:

(i) The Director shall approve, conditionally approve, or deny all applications for a revocable permit for landscaping and/or irrigation in a public right-of-way.

(Ord. 4419, 4-5-10)

21.02.190 Institutional and civic facility master plans.

(a) Purpose. The purpose of a master plan review process is to provide an opportunity for the early review of major institutional and civic facilities that provide a needed service to the community, but might impact the surrounding community. The master plan review allows the City, through a public process, to assess any impacts early in the review process and direct the applicant on how best to address the impacts.

(b) Applicability. A master plan shall be required for any institutional and/or civic use, as that term is defined in Chapter 21.04 GJMC, when such project: consists of multiple phases of construction and when constructed will include 100,000 square feet in one or more buildings; will result in significant modification of the existing transportation circulation patterns; and/or when the Director deems the project and/or the City would benefit from such a review.

(c) Approval Criteria. In reviewing a master plan, the decision-making body shall consider the following:

(1) Conformance with the Comprehensive Plan and other area, corridor or neighborhood plans;

(2) Conformance with the Grand Junction Circulation Plan and general transportation planning requirements;

(3) Adequate parking, adequate stormwater and drainage improvements, minimization of water, air or noise pollution, limited nighttime lighting and adequate screening and buffering potential;

(4) Adequacy of public facilities and services; and

(5) Community benefits from the proposal.

(d) Decision-Maker.

(1) The Director and Planning Commission shall make recommendations to City Council.

(2) City Council shall approve, conditionally approve or deny a master plan.

(e) Application and Review Procedures. The application and processing procedures shall be as follows:

(1) The review of a master plan shall precede, or be concurrent with, any other required review process.

(2) The content of the master plan document shall be sufficient to generally assess the following:

(i) Site access, traffic flow, pedestrian circulation/safety;

(ii) Adequate parking;

(iii) Location of open space and trails;

(iv) Drainage and stormwater management;

(v) General building location and size; and

(vi) Adequate screening and buffering.

(3) A general meeting shall be required.

(4) A neighborhood meeting is mandatory.

(5) Required notice shall include public notice in the newspaper, mailed notice and sign posting notice.

(f) Validity. The master plan shall be valid for a minimum of five years unless otherwise established by the decision-maker. All phases of projects being developed shall be in conformance with the approved plan. Amendments to the master plan may be proposed at any time through the regular master plan review process. An amended master plan is required if significant changes are proposed. Generally, significant changes are anything not deemed to be minor amendments as defined in GJMC 21.02.150(e)(2)(i).

(Ord. 4419, 4-5-10)

21.02.200 Variance.

(a) Purpose. The purpose of this section is to provide a process for consideration of variances from certain standards of the code.

(b) Applicability.

(1) A variance may be requested for a departure from bulk standards, performance or use-specific standards of Chapter 21.04 GJMC, all overlay district regulations of Chapter 21.07 GJMC, excluding corridor overlay districts, and the sign regulations of Chapter 21.06 GJMC.

(2) Variances shall not be requested for:

(i) The establishment or expansion of a use in a district in which such use is not permitted by this code;

(ii) Residential development which would result in an increase in density greater than that permitted in the applicable zoning district; and

(iii) Changes or modifications to any definition contained in this code.

(c) Approval Criteria. A variance may be granted only if the applicant establishes that all of the following criteria have been met:

(1) There are exceptional conditions creating an undue hardship, applicable only to the property involved or the intended use thereof, which do not apply generally to the other land areas or uses within the same zoning district, and such exceptional conditions or undue hardship was not created by the action or inaction of the applicant or owner of the property;

(2) The variance shall not confer on the applicant any special privilege that is denied to other lands or structures in the same zoning district;

(3) The literal interpretation of the provisions of the regulations would deprive the applicant of rights commonly enjoyed by other properties in the same zoning district and would cause unnecessary and undue hardship on the applicant;

(4) The applicant and the owner of the property cannot derive a reasonable use of the property without the requested variance;

(5) The variance is the minimum necessary to make possible the reasonable use of land or structures;

(6) The granting of a variance shall not conflict with the purposes and intents expressed or implied in this code; and

(7) The granting of a variance shall not conflict with the goals, policies and guiding principles of the City's Comprehensive Plan.

(d) Decision-Making.

(1) A variance from bulk standards, performance or use-specific standards of Chapter 21.04 GJMC, all overlay district regulations of Chapter 21.07 GJMC, excluding corridor overlay districts, and the sign regulations of Chapter 21.06 GJMC shall be heard and decided by the Zoning Board of Appeals.

(2) Variances to all other standards, unless otherwise specified, shall be heard and decided by the Planning Commission.

(Ord. 4890, 11-20-19; Ord. 4778, 1-3-18; Ord. 4419, 4-5-10)

21.02.210 Rehearing and appeal.

(a) Purpose. The purpose of this section is to provide for a rehearing and appeal process for decisions and actions by the Director, Zoning Board of Appeals, Planning Commission and City Council. Each procedure has a separate decision maker (see GJMC 21.01.130(g)).

(b) Appeal of Director's Interpretations. Any person, including any officer or agent of the City, aggrieved or claimed to be aggrieved by an interpretation of this code rendered by the Director may request an appeal of the interpretation in accordance with this section. An aggrieved party may appeal the Director's decision by submitting a written appeal within 10 working days of the date of the Director's decision.

(1) Approval Criteria. In granting an appeal of a Director's interpretation, the Zoning Board of Appeals shall determine whether the interpretation by the Director was in accordance with the intent and requirements of this code.

(2) Decision-Maker. The Zoning Board of Appeals shall affirm, reverse or remand the decision. In reversing or remanding the interpretation back to the Director, the Board shall state the rationale for its decision.

(3) Additional Application and Review Procedures.

(i) Application Materials. The appellant shall provide a written statement citing the specific provision of this code that the appellant believes the Director has incorrectly interpreted and the appellant's interpretation of the provision.

(ii) Notice. Notice of the hearing is not required to anyone other than the appellant.

(iii) Director's Report. The Director shall prepare a report detailing the specific provision of this code that is in question, interpretation of the provision, and the general basis of the interpretation.

(c) Appeal of Final Action on Administrative Development Permits. Any person, including any officer or agent of the City, aggrieved or claimed to be aggrieved by a final action of the Director on an administrative development permit, may request an appeal of the action in accordance with GJMC 21.01.130(g) and this subsection (c).

(1) Appeal Criteria. In hearing an appeal of an administrative development permit, the appellate body shall consider, based on the information in the record before the Director, whether the Director:

(i) Acted in a manner inconsistent with the provisions of this code or other applicable local, State of federal law; or

(ii) Made erroneous findings of fact based on the evidence and testimony on the record; or

(iii) Failed to fully consider mitigating measures or revisions offered by the applicant that would have brought the proposed project into compliance; or

(iv) Acted arbitrarily, or capriciously.

(2) Decision-Maker. The appellate body for a particular administrative development permit shall be as specified in GJMC 21.01.130(g). The appellate body shall affirm, reverse or remand the decision. In reversing or remanding a decision, the appellate body shall state the rationale for its decision. An affirmative vote of four members of the appellate body shall be required to reverse the Director's action.

(3) Application and Review Procedures. Requests for an appeal shall be submitted to the Director in accordance with the following:

(i) Application Materials. The appellant shall provide a written request that explains the rationale of the appeal based on the criteria provided in subsection (c)(1) of this section.

(ii) Notice to Applicant. If the appellant is not the applicant, the Director, within five working days of receipt of the request for appeal, shall notify the applicant of the request and the applicant shall have 10 working days to provide a written response.

(iii) Preparation of the Record. The Director shall compile all material made a part of the record of the Director's action. As may be requested by the appellate body, the Director also may provide a written report.

(iv) Notice. No notice of the appeal is required.

(v) Conduct of Hearing. The appellate body shall hold a hearing on the record to determine whether the Director acted as set forth in the criteria provided in subsection (c)(1) of this section. The appellate body shall consider only that evidence that was before the Director at the time of the Director's final action.

(d) Appeal of Action on Nonadministrative Development Permits. Any person, including any officer or agent of the City, aggrieved by or claimed to be aggrieved by a final decision of the Planning Commission may appeal the action in accordance with this subsection (d).

(1) Approval Criteria.

(i) Findings. In granting an appeal to action on a nonadministrative development permit, the appellate body shall find:

(A) The decision maker may have acted in a manner inconsistent with the provisions of this code or other applicable local, State or federal law; or

(B) The decision maker may have made erroneous findings of fact based on the evidence and testimony on the record; or

(C) The decision maker may have failed to fully consider mitigating measures or revisions offered by the applicant that would have brought the proposed project into compliance; or

(D) The decision-maker may have acted arbitrarily, acted capriciously, and/or abused its discretion; or

(E) In addition to one or more of the above findings, the appellate body shall find the appellant was present at the hearing during which the original decision was made or was otherwise on the official record concerning the development application.

(2) Facts on Record. In considering a request for appeal, the appellate body shall consider only those facts, evidence, testimony and witnesses that were part of the official record of the decision-maker's action. No new evidence or testimony may be considered, except City staff may be asked to interpret materials contained in the record. If the appellate body finds that pertinent facts were not considered or made a part of the record, they shall remand the item back to the decision-maker for a rehearing and direct that such facts be included on the record.

(3) Decision-Maker. The appellate body for a particular development permit shall be as specified in GJMC 21.01.130(g). The appellate body shall affirm, reverse or remand the decision. In reversing or remanding the decision back to the decision-maker, the appellate body shall state the rationale for its decision. An affirmative vote of four members of the appellate body shall be required to reverse the decision-maker's action.

(4) Application and Review Procedures. Requests for an appeal shall be submitted to the Director in accordance with the following:

(i) Application Materials. The appellant shall provide a written request that explains the rationale of the appeal based on the criteria provided in subsection (c) of this section. The appellant also shall submit evidence of his/her attendance at the original hearing or other testimony or correspondence from him/her that was in the official record at the time of the original hearing.

(ii) Application Fees. The appropriate fee, as may be approved by the City Council, shall be submitted with the request.

(iii) Application Deadline. A request for an appeal shall be submitted within 10 calendar days of the action taken by the decision-maker.

(iv) Notice to Applicant. If the appellant is not the applicant, the Director, within five working days of receipt of the request for appeal, shall notify the applicant of the request and the applicant shall have 10 working days to review the request and provide a written response.

(v) Preparation of the Record. The Director shall compile all material made a part of the official record of the decision-maker's action. As may be requested by the appellate body, the Director also may provide a summary report of the record.

(vi) Notice. Notice of the appeal hearing shall be provided in the same manner as was required with the original action.

(vii) Hearing. The Director shall schedule the appeal before the appellate body within 45 calendar days of receipt of the appeal. The appellate body shall hold a hearing and render a decision within 30 calendar days of the close of that hearing.

(viii) Conduct of Hearing. At the hearing, the appellate body shall review the record of the decision-maker's action. No new evidence or testimony may be presented, except that City staff may be asked to interpret materials contained in the record.

(e) Planning Commission Recommendation to City Council. All recommendations, including recommendations of denial, which the Planning Commission makes to the City Council (i.e., the Planning Commission is not the final decision-maker) shall be heard by the City Council without necessity of appeal. The applicant may withdraw in writing an application that has been heard by the Planning Commission and recommended for denial. Such hearings shall be de novo before the Council. An affirmative vote of five members of the City Council shall be required to approve rezones and Comprehensive Plan amendments recommended for denial by the Planning Commission. Procedural requirements provided elsewhere in this code shall be applicable.

(Ord. 4890, 11-20-19; Ord. 4419, 4-5-10)

Chapter 21.03

ZONING DISTRICTS

Sections:
21.03.010 Purpose.
21.03.020 Zoning Map.
21.03.030 Measurements.
21.03.040 Residential districts.
21.03.050 Residential design standards.
21.03.060 Cluster developments.
21.03.070 Mixed use districts.
21.03.080 Industrial districts.
21.03.090 Form districts.

21.03.010 Purpose.

The City is zoned into areas referred to as zones or districts. The purpose of establishing zones is to:

(a) Implement the Comprehensive Plan;

(b) Encourage the most appropriate use of land throughout the City and to ensure logical and orderly growth and development of the physical elements of the City;

(c) Prevent scattered, haphazard growth and guide orderly transition of urban areas;

(d) Conserve and enhance economic, social and aesthetic values;

(e) Protect and maintain the integrity and character of established neighborhoods;

(f) Facilitate provision of adequate public facilities and services, such as transportation, water, sewerage, schools and parks;

(g) Promote the development of convenient and beneficial clusters of uses, including business and shopping facilities where satisfactory proof is made that the same are reasonably necessary and desirable for the public convenience and welfare;

(h) Provide for adequate light and clean air;

(i) Aid in preventing traffic congestion in the streets and public ways of the City;

(j) Prevent unduly noisome and/or injurious substances, conditions and operations;

(k) Secure safety from fire, panic and other dangers; and

(l) Promote the public health, safety and welfare.

(Ord. 4419, 4-5-10)

21.03.020 Zoning Map.

(a) Establishment. The boundaries of zones established by this code shall be shown on a map entitled Zoning Map of the City of Grand Junction. Such maps are, by this reference, made a part of this code.

(b) Boundaries.

(1) Zone Boundaries. Usually zone boundaries shall be on municipal corporate lines, section lines, parcel lines, natural boundary lines or on the center lines of highways, streets, alleys, railroad rights-of-way or these lines extended. In cases where these lines are not used, the zone district lines shall be as determined by using the scale of the official Zoning District Map.

(2) Zoning Standards. If a parcel of land is divided by a zoning district boundary line at the time of enactment of this code or by subsequent amendments thereto, the appropriate standards and uses for each zone shall apply on the portion of the parcel covered by that zone.

(3) Location and Maintenance. The official zoning map shall be located in, and maintained by, the Public Works and Planning Department. All amendments to the zoning map made in accordance with the requirements of this code shall be shown on the maps.

(4) District Boundary Disputes. Disputes concerning the exact location of any zone district boundary line shall be decided in accordance with Chapter 21.02 GJMC.

(c) Districts.

Residential Districts	
R-R	Residential – Rural
R-E	Residential – Estate
R-1	Residential – 1
R-2	Residential – 2
R-4	Residential – 4
R-5	Residential – 5
R-8	Residential – 8
R-12	Residential – 12
R-16	Residential – 16
R-24	Residential – 24
Mixed Use Districts	
R-O	Residential – Office
B-1	Neighborhood Business
B-2	Downtown Business
C-1	Light Commercial
C-2	General Commercial
CSR	Community Services and Recreation
M-U	Mixed Use
BP	Business Park Mixed Use
Industrial Districts	
I-O	Industrial/Office Park
I-1	Light Industrial
I-2	General Industrial
Form Districts	
MXR-	Mixed Use Residential
MXG-	Mixed Use General
MXS-	Mixed Use Shopfront
MXOC	Mixed Use Opportunity Corridor

(d) Districts to Implement the Comprehensive Plan. The following table shows which zoning district(s) appropriately implement(s) a given future land use designation of the Comprehensive Plan. A dot indicates that the zone district implements the corresponding future land use designation and is therefore an appropriate option for zoning or rezoning of land within that designated area on the future land use map of the Comprehensive Plan; the absence of a dot indicates that the zone district

is not an appropriate option for zoning or rezoning of land within the corresponding future land use designation.

Zoning District	Comprehensive Plan Land Use Designation																	
	RESIDENTIAL								NONRESIDENTIAL									
	Low				Medium		High											
	Rural	Estate	RL	RML	RM	RMH	RH-MU	UR RH-MU	Commercial	NC-MU	VC-MU	DT-MU	Mixed Use Opportunity Corridor*	Industrial	C/I	BP-MU	P & OS	Conservation/ Mineral Extraction
RR	•	•	•	•														•
R-E	•	•	•	•														
R-1	•	•	•	•														
R-2	•	•	•	•														
R-4	•	•	•	•	•	•												
R-5	•	•	•	•	•	•												
R-8					•	•				•	•					•		
R-12					•	•				•	•					•		
R-16						•	•	•		•	•	•				•		
R-24+							•	•			•	•				•		
R-O					•	•	•	•	•	•	•	•				•		
B-1								•	•	•	•					•		
B-2												•						
C-1									•	•	•	•						
C-2									•						•			
CSR	•															•	•	•
M-U									•		•			•	•			
BP															•	•		
I-O														•	•	•		
I-1														•	•			
I-2														•				
MXR-3 MXG-3 MXS-3										•	•	•						
MXR-5 MXG-5 MXS-5											•	•						

Zoning District	Comprehensive Plan Land Use Designation																	
	RESIDENTIAL								NONRESIDENTIAL									
	Low				Medium		High											
	Rural	Estate	RL	RML	RM	RMH	RH-MU	UR RH-MU	Commercial	NC-MU	VC-MU	DT-MU	Mixed Use Opportunity Corridor*	Industrial	C/I	BP-MU	P & OS	Conservation/ Mineral Extraction
MXR-8 MXG-8 MXS-8												•						
MXOC													•*					

*The Mixed Use Opportunity Corridor future land use designation of the Comprehensive Plan "overlays" other future land use designations, according to and as shown on the Comprehensive Plan Future Land Use Map. Therefore, in addition to the MXOC form district, other zone districts which implement the underlying future land use designation may also be appropriate in a given area of the Mixed Use Opportunity Corridor. Also, implementation of the Mixed Use Opportunity Corridor future land use designation is limited by GJMC 21.02.140(c)(2).

(Ord. 4646, 11-19-14; Ord. 4572, 3-20-13; Ord. 4419, 4-5-10)

21.03.030 Measurements.

(a) Lot Area Measurement.

(1) "Lot area" means the amount of net land area contained within the property lines of a lot or parcel, not including street right-of-way. Lots that were legally created prior to adoption of this code that are smaller than required may be developed if they meet the other provisions of this code.

(2) Essential unoccupied public utility installations, such as substations, shall be permitted in an area smaller than the minimum lot area prescribed by this code. While coverage requirements shall not apply, all landscaping, screening and other requirements shall apply.

(3) If the following conditions are met, minimum lot size may be reduced by the Director on lots abutting "tracts" (as defined below) to the extent the abutting tract provides for a portion of the minimum lot size:

(i) The abutting "tract" includes one or more of the following:

(A) A trail for the use of the general public;

(B) Public water or public sewer lines;

(C) A landscape buffer required pursuant to this code;

(D) A drainage facility required by this code; or

(E) Open space (whether required by this code or otherwise established), which is land within a development designed for and perpetually limited to the common use or enjoyment of the residents or occupants of the development and/or the public, but not including areas used for streets, alleys, driveways or off-street parking or loading areas;

(ii) Only that portion of the proposed lot line that is contiguous with the abutting tract may be used for purposes of determining the reduction in minimum lot size;

(iii) The reduction in minimum lot size is less than or equal to the open area provided by the tract;

(iv) The tract shall contain no structure in perpetuity in the portion of the tract that is to provide for a portion of the minimum lot size;

(v) Maintenance of the tract is provided for in covenants, conditions and restrictions or other binding agreement as approved by the City;

(vi) The tract will not provide any part of or be used in any part to establish a setback pursuant to subsection (d)(5) of this section;

(vii) The tract is part of the subdivision or development that is the subject of the application.

(b) Lot Width.

(1) Lot width is measured between side lot lines along a line that is parallel to the front lot line located at the minimum front setback distance from the front lot line.

(2) Minimum lot width may be varied by the Director on irregularly shaped lots.

(3) If the following conditions are met, minimum lot width may be varied by the Director on lots abutting "tracts" (as defined below) to the extent the abutting tract provides for a portion of the minimum lot width:

(i) The abutting "tract" includes one or more of the following:

(A) A trail for the use of the general public;

(B) Public water or public sewer lines;

(C) A landscape buffer required pursuant to this code;

(D) A drainage facility required by this code; or

(E) Open space (whether required by this code or otherwise established) which is land within a development designed for and perpetually limited to the common use or enjoyment of the residents or occupants of the development and/or public, but not including areas used for streets, alleys, driveways or off-street parking or loading areas;

(ii) Only that portion of the proposed lot line that is contiguous with the abutting tract may be used for purposes of determining the reduction in minimum lot width;

(iii) The reduction in minimum lot width is less than or equal to the open area provided by the tract;

(iv) The tract shall contain no structure in perpetuity in the portion of the tract that is to provide for a portion of the minimum lot width;

(v) Maintenance of the tract is provided for in covenants, conditions and restrictions or other binding agreement as approved by the City;

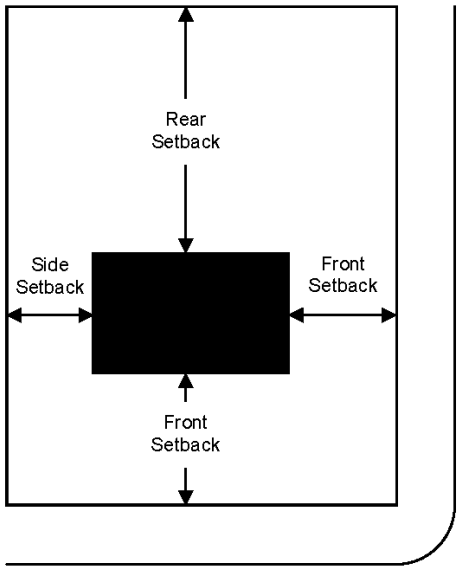
(vi) The tract will not also provide any part of or be used in any part to establish a setback pursuant to subsection (d)(5) of this section;

(vii) The tract is part of the subdivision or development that is the subject of the application.

(c) Street Frontage. Street frontage is measured between side lot lines along the front lot line.

(d) Setbacks.

(1) Measurement. Setbacks are measured as the unobstructed unoccupied open area between the furthermost projection of a structure and the property line of the lot on which the structure is located, except as modified by the standards of this section. Setbacks shall be unobstructed from the ground to the sky except as specified in this section. Structures shall meet the front yard setback from all abutting streets unless otherwise provided in this code.



(2) Exceptions and Permitted Encroachments. The following features may encroach into required setbacks:

(i) Landscaping;

(ii) Bay windows, not to exceed three feet;

(iii) Chimneys, not to exceed two feet;

(iv) Clothesline posts;

(v) Driveways, curbs and sidewalks;

(vi) Flagpoles;

(vii) Heating and cooling units, not to exceed three feet;

(viii) Mailboxes;

(ix) Overhanging roof, eave, gutter, cornice, or other architectural feature and awnings, not to exceed three feet;

(x) Underground utilities;

(xi) Signs;

(xii) Open steps, stairs or fire escapes (nonenclosed), not to exceed six feet;

(xiii) Uncovered, unenclosed terraces, patios or porches, not to exceed six feet into the setback, but in no case closer than three feet to any property line;

(xiv) Fences or walls, if otherwise allowed by this code;

(xv) Yard and service lighting fixtures and poles;

(xvi) Required parking where not specifically prohibited;

(xvii) Open carports, up to one-half of the required side or rear yard setback for principal structures, but not closer than three feet to the lot line;

(xviii) In-ground swimming pools;

(xix) Solar arrays or panels; and

(xx) Pergolas with no encroachment into easement(s).

(3) Setback Averaging. Regardless of the minimum front setback required by the zoning district, a front setback may be reduced to the mean of the setbacks of the immediately adjoining lots that are on both sides of the subject lot. The following rules apply in calculating the mean setback:

(i) Only the setbacks on the lots that abut a side of the subject lot at the street and are on the same side of the street may be used. Setbacks across the street or along a different street may not be used; and

(ii) When one abutting lot is vacant, or if the subject lot is a corner lot, then the average is calculated using the setback of the not vacant lot and the zoning district minimum setback.

(iii) Approval of setback averaging shall be in the form of a letter from the Director.

(4) The following special setbacks shall apply where noted:

(i) On corner lots, in areas where an existing parkway strip exceeds 10 feet in width between a sidewalk and the curb, the front yard setback on a side street may be varied by the Director under the conditions and restrictions listed below. A side street shall be considered that street corresponding to the side yard of the majority of the structures on a block. In unusual or conflicting circumstances, the Director shall designate which street is the side street.

(A) No variance shall be approved to less than five feet from property line.

(B) A variance may be approved only for a single-family residential use.

(C) Any variance approved shall meet all other provisions of this code, including sight distance requirements. No variance shall be granted unless the City Engineer finds, in writing, that the proposal will not create a danger to pedestrians or vehicle circulation.

(D) No vehicular access shall be allowed from a side street to any structure approved for a variance under the provisions of this section.

(E) A variance shall only be effective if it is issued by the Director, contains the legal description and any terms and conditions, and is recorded by the applicant prior to issuance of a building permit.

(ii) More than one contiguous parcel of land in the same ownership may be used for a principal use and to satisfy setback requirements for structures if such owner records an instrument, approved by the City Attorney, which limits the uses and rights to convey (including for loans) the contiguous parcel.

(5) If the following conditions are met, setbacks may be reduced by the Director on lots abutting "tracts" (as defined below) to the extent the abutting tract provides for a portion of the setback:

(i) The abutting "tract" includes one or more of the following:

(A) A trail for the use of the general public;

(B) Public water or public sewer lines;

(C) A landscape buffer required pursuant to this code;

(D) A drainage facility required by this code; or

(E) Open space (whether required by this code or otherwise established) which is land within a development designed for and perpetually limited to the common use or enjoyment of the residents or occupants of the development and/or the public, but not including areas used for streets, alleys, driveways or off-street parking or loading areas;

(ii) The abutting "tract" runs the full length of the applicable lot line for which a reduction in setback requirement is sought;

(iii) The reduction in setback is less than or equal to the open area provided by the tract;

(iv) The tract shall contain no structure in perpetuity in the portion of the tract that is required to provide for the necessary area for the setback;

(v) Maintenance of the tract is provided for in covenants, conditions and restrictions or other binding agreement as approved by the City;

(vi) The tract will not also provide any part of, or be used in any part to establish the minimum lot size pursuant to subsection (a)(3) of this section or the minimum lot width pursuant to subsection (b)(3) of this section;

(vii) The tract is part of the subdivision or development that is the subject of the application.

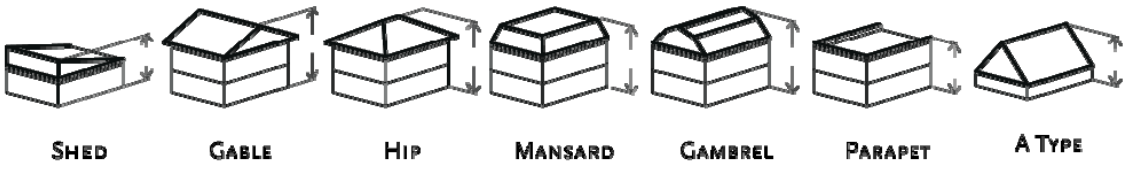
(6) Garage. Minimum front yard setback for garage, carport or other vehicle storage space (principal and accessory) shall be 20 feet, measured from the storage entrance to the property line.

(7) Multiple Frontage. Any setback along a street shall be considered a front setback. Accessory structures may be allowed in a front setback through an administrative adjustment (see GJMC 21.02.070(l).

(e) Lot Coverage. Lot coverage is measured as the percentage of the total lot area covered by buildings. It is calculated by dividing the square footage of impervious surface by the square footage of the lot.

(f) Height.

(1) "Building height" means the vertical distance between the mean finished grade between the lowest and highest grades along the foundation and the highest point of the roof or facade (see graphic).



(2) Exceptions. Zoning district height limits do not apply to belfries, cupolas, spires, domes, monuments, airway beacons, radio/communication towers, windmills, flagpoles, chimneys, radio/television receiving antennas and chimney flues (see subsection (d)(2) of this section). Height limits do not apply to any bulkhead, elevator, water tank, or to any similar structure or mechanical appurtenance or similar structure if total area of such structure is less than 20 percent of the total area of the roof.

(3) Any hazard or obstruction to aircraft as regulated by the FAA is prohibited. Buildings, belfries, towers, trees and flagpoles are examples of such hazards depending on location and height. The construction, maintenance, or establishment of any building, tree, smokestack, chimney, flagpole, wire, tower or other structure or appurtenances thereto, which may consti-

tute a hazard or obstruction to safe air navigation, landing, or takeoff of aircraft near an airport, is prohibited. Regulations adopted by the Federal Aviation Administration (FAA) shall be minimum standards. No request shall be approved if it violates FAA standards.

(g) Story Height.

(1) An attic story is considered a half-story and counts toward the calculation of maximum number of stories.

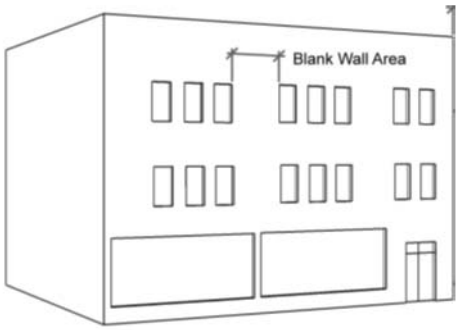
(2) Basements are not considered a story.

(3) If a ground story is more than five feet above original grade, the space below counts as an additional story.

(4) Ground floor elevation is measured from natural or improved grade (whichever is more restrictive) to the finished floor level of the ground floor. Grade is measured continuously across a lot.

(5) Story height is measured from the top of finished floor to the top of the finished floor above.

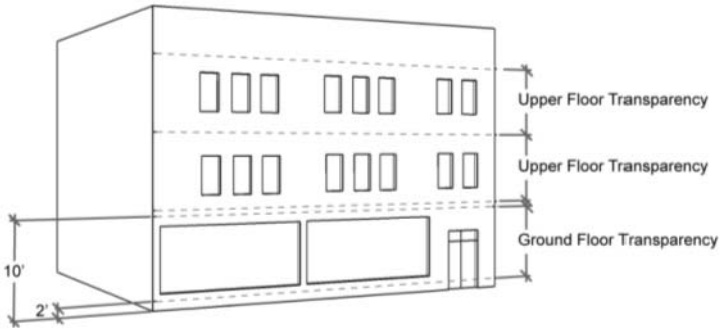
(h) Blank Wall Area.



(1) A portion of the exterior facade of the building which does not include a substantial material change (paint color is not considered a substantial change); windows or doors; or columns, pilasters or other articulation greater than 12 inches in depth.

(2) Blank wall area applies to both ground and upper story street-facing facades.

(i) Transparency.



(1) Ground floor transparency (windows and doors) is measured between two and 12 feet above the adjacent sidewalk.

(2) For form district building type shopfront only (see GJMC 21.03.090(f)), a minimum of 60 percent of the street-fronting, street-level window pane surface area must allow views into the

ground story use for a depth of at least six feet. Windows must be clear, unpainted, or made of similarly treated glass; spandrel glass or backpainted glass does not comply with this provision.

(j) Density/Intensity.

(1) Definitions. The following definitions shall apply to all maximum and minimum density calculations for zoning and land use classifications, unless otherwise indicated.

(2) Maximum Residential Density. "Maximum residential density" means the number calculated by dividing the total number of dwelling units or residential lots, by the gross acreage expressed in square feet or acres of the development property. Gross land area includes the entire parcel or property at the time a development application is filed. The "gross residential density" is calculated the same as maximum residential density.

(3) Minimum Residential Density. This calculation shall apply to the term "net minimum residential density" as used in this code. "Minimum residential density" means the number calculated by dividing the total number of dwelling units or residential lots by the net developable land area of the development parcel. "Net developable land area" means all portions of the parcel at the time a development application is filed, minus the following if they are to be left as open space:

(i) Floodways and floodplains;

(ii) As defined by the Clean Water Act: wetlands, surface waters, stream and river channels, banks and corridors;

(iii) Slopes of greater than 30 percent or other areas of unstable soils that are not suitable for development;

(iv) Clear zones and critical zones;

(v) Open space or recreation areas to be dedicated to a public agency or to a private entity approved by the Director to perpetually maintain the open space;

(vi) Ridgeline setback areas in excess of any required setbacks;

(vii) Areas of geologic hazards; and

(viii) Other areas that, in the opinion of the body reviewing the development, are similarly unsuitable for development.

(4) Transitional Densities. Larger lots or other screening and buffering areas that are provided as a transition for adjoining established neighborhoods may be excluded from the density calculations for purposes of determining minimum density on those parcels that are not large enough to accommodate the transition and meet minimum density.

(5) Other Residential Density. Density of group living facilities shall be calculated as four beds equal one dwelling unit. Group living facilities are meant to fit into a neighborhood with the same characteristics and requirements.

(6) Application of Density/Intensity Definitions. The maximum and minimum residential density or nonresidential intensity requirements apply to all development except:

(i) Minimum density requirements shall not apply to a simple subdivision if one or more lots can reasonably be resubdivided or developed in a manner that complies with the minimum density and other requirements of this code;

(ii) There shall be no minimum density requirement applicable to a major subdivision if all but two of the resulting lots comply with the minimum density requirements and at least one of the two lots that do not comply can reasonably be resubdivided or developed in a

manner that complies with the minimum density and other requirements of this code and no other development is allowed; and

(iii) A mix of residential and nonresidential uses.

(7) Mixed Use Density/Intensity. The density of a lot with a mix of residential and nonresidential uses ("mixed use").

(i) Mixed Use Lot. The density of a mixed use lot shall be calculated by dividing the total number of dwellings on the lot by the gross land area of the lot. The gross residential density of the lot shall be the maximum density permitted in the underlying zoning district. There is no minimum density requirement for a mixed use lot, if at least 10 percent of the gross floor area is used for nonresidential purposes.

(ii) Mixed Use Subdivision. In a mixed use subdivision, the density shall be calculated for each lot, unless provided otherwise at the time of subdivision approval.

(Ord. 4778, 1-3-18; Ord. 4601, 9-4-13; Ord. 4419, 4-5-10)

21.03.040 Residential districts.

(a) R-R: Residential – Rural.

(1) Purpose. To provide areas for low intensity agricultural operations and very low density single-family uses in a rural setting. This district is appropriate where low density development is desired or where terrain and/or lack of public facilities and services require low intensity development or a sense of openness is desired.

(2) Sewer and Roads. Only the City Council may waive the requirements that each structure be served by the Persigo sewer system. Rural road standards may apply.

(b) R-E: Residential – Estate.

(1) Purpose. To provide areas for low density, estate-type single-family residential development on lots of at least one acre in size.

(2) Sewer and Roads. Only the City Council may waive the requirements that each structure be sewered by the Persigo sewer system. Rural road standards may apply.

(c) R-1: Residential – 1.

(1) Purpose. To provide areas for low density residential uses in less intensely developed areas. R-1 tracts should abut or be in close proximity to existing large-lot single-family development, making R-1 an appropriate transition district between rural and higher density areas.

(d) R-2: Residential – 2.

(1) Purpose. To provide areas for medium-low density, single-family and two-family residential uses where adequate public facilities and services exist.

(2) Performance Standards. Development shall conform to the standards established in this code. The creation of a two-family dwelling via the construction of a second dwelling unit attached to an existing single-family dwelling shall require that the construction materials and roof pitch of the addition match the construction materials and roof pitch of the existing dwelling and be architecturally compatible with the existing dwelling.

(e) R-4: Residential – 4.

(1) Purpose. To provide for medium-low density single-family and two-family residential uses where adequate public facilities and services are available.

(2) Performance Standards. Development shall conform to the standards established in this code.

(i) The creation of a two-family dwelling via the construction of a second dwelling unit attached to an existing single-family dwelling shall require that the construction materials and roof pitch of the addition match the construction materials and roof pitch of the existing dwelling and be architecturally compatible with the existing dwelling. The attaching of two manufactured homes shall not constitute a two-family dwelling.

(ii) For the purpose of calculating density on parcels smaller than five acres, one-half of the land area of all adjoining rights-of-way may be included in the gross lot area. The area of the right-of-way shall not be included to determine compliance with the minimum lot area requirements.

(f) R-5: Residential – 5.

(1) Purpose. To provide for medium density detached and attached dwellings and multifamily in areas where large-lot development is discouraged and adequate public facilities and services are available. R-5 supports the Comprehensive Plan's principles of concentrating urban growth and reinforcing community centers. A mix of dwelling types is allowed in this district.

(2) Performance Standards.

(i) The creation of a two-family dwelling via the construction of a second dwelling unit attached to an existing single-family dwelling shall require that the construction materials and roof pitch of the addition match the construction materials and roof pitch of the existing dwelling and be architecturally compatible with the existing dwelling. The attaching of two manufactured homes shall not constitute a two-family dwelling.

(ii) For the purpose of calculating density on parcels smaller than five acres, one-half of the land area of all adjoining rights-of-way may be included in the gross lot area. The area of the right-of-way shall not be included to determine compliance with the minimum lot area requirements.

(g) R-8: Residential – 8.

(1) Purpose. To provide for medium-high density attached and detached dwellings, two-family dwelling and multifamily. R-8 is a transitional district between lower density single-family districts and higher density multifamily or business development. A mix of dwelling types is allowed in this district.

(2) Performance Standards.

(i) For the purpose of calculating density on parcels smaller than five acres, one-half of the land area of all adjoining rights-of-way may be included in the gross lot area. The area of the right-of-way shall not be included to determine compliance with the minimum lot area requirements.

(ii) The creation of a two-family dwelling via the construction of a second dwelling unit attached to an existing single-family dwelling shall require that the construction materials and roof pitch of the addition match the construction materials and roof pitch of the existing dwelling and be architecturally compatible with the existing dwelling.

(iii) *Repealed by Ord. 4890.*

(iv) The front yard setback shall be a minimum of 20 feet for the garage portion of a principal structure and 15 feet for the remainder of the principal structure.

(h) R-12: Residential – 12.

(1) Purpose. To provide for high density development allowing several types of residential units within specified densities. R-12 may serve as a transitional district between single-family and trade districts. This district is intended to allow a mix of residential unit types and densities to

provide a balance of housing opportunities in a neighborhood. This zone may be appropriate as a part of a mixed use center.

(2) Performance Standards.

(i) For purpose of calculating density on any parcel, one-half of the land area of all adjoining rights-of-way may be included in the gross lot area.

(ii) The creation of a two-family dwelling via the construction of a second dwelling unit attached to an existing single-family dwelling shall require that the construction materials and roof pitch of the addition match the construction materials and roof pitch of the existing dwelling and be architecturally compatible with the existing dwelling.

(iii) *Repealed by Ord. 4890.*

(iv) The front yard setback shall be a minimum of 20 feet for the garage portion of a principal structure and 15 feet for the remainder of the principal structure.

(i) R-16: Residential – 16.

(1) Purpose. To provide for high density residential use. This district allows multifamily development within specified densities. R-16 may serve as a transitional district between single-family and trade zones. This district is intended to allow high density residential unit types and densities to provide a balance of housing opportunities in the community. It is appropriate in the Village and Neighborhood Centers.

(2) Performance Standards.

(i) For purpose of calculating density on any parcel, one-half of the land area of all adjoining rights-of-way may be included in the gross lot area.

(ii) The front yard setback shall be a minimum of 20 feet for the garage portion of a principal structure with 15 feet for the remainder of the principal structure.

(j) R-24: Residential – 24.

(1) Purpose. To provide for high density residential use. This district allows multifamily development within specified densities. R-24 may serve as a transitional district between single-family and trade zones. This district is intended to allow high density residential unit types and densities to provide a balance of housing opportunities in the community. It is appropriate in the Village and Neighborhood Centers.

(2) Performance Standards.

(i) For purpose of calculating density on any parcel, one-half of the land area of all adjoining rights-of-way may be included in the gross lot area.

(ii) The front yard setback shall be a minimum of 20 feet for the garage portion of a principal structure and 15 feet for the remainder of the principal structure.

Residential District Summary Table

	RR	R-E	R-1	R-2	R-4	R-5	R-8	R-12	R-16	R-24
Lot										
Area (min. ft. unless otherwise specified)	5 acres	1 acre	30,000	15,000	7,000	4,000	3,000	n/a	n/a	n/a
Width (min. ft.)	150	100	100	100	70	40	40	30	30	30
Frontage (min. ft.)	50	50	50	50	20	20	20	20	20	20
Frontage on cul-de-sac (min. ft.)	30	30	30	30	n/a	n/a	n/a	n/a	n/a	n/a
Setback										
Principal structure										
Front (min. ft.)	20	20	20	20	20	20	20*	20*	20*	20*
Side (min. ft.)	50	15	15	15	7	5	5	5	5	5
Rear (min. ft.)	50	30	30	30	25	15	10	10	10	10
Accessory structure										
Front (min. ft.)	25	25	25	25	25	25	25	25	25	25
Side (min. ft.)	50	5	3	3	3	3	3	3	3	3
Rear (min. ft.)	50	10	10	5	5	5	5	5	5	5
Bulk										
Lot coverage (max.)	5%	15%	20%	30%	50%	60%	70%	75%	75%	80%
Height (max. ft.)	35	35	35	35	40	40	40	60	60	72
Density (min. units per acre)	n/a	n/a	n/a	n/a	2	3	5.5	8	12	16
Density (max. units per acre)	1 unit / 5 acres	1	1	2	4	5.5	8	12	16	n/a
Cluster allowed	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No
Notes										

Note: Minimum lot area, lot width and lot frontage do not apply to two-family dwellings or multifamily.

*20 feet for the garage portion of a principal structure and 15 feet for the remainder of the principal structure.

R-5: Min. lot area civic – 20,000 sf.

R-8: Min. lot area civic – 20,000 sf.

(Ord. 4890, 11-20-19; Ord. 4831, 2-6-19; Ord. 4428, 6-14-10; Ord. 4419, 4-5-10)

21.03.050 Residential design standards.

(a) Two-Family, Attached Single-Family, Multifamily Dwellings. In accordance with the provisions of this subsection, attached dwellings shall be allowed as indicated in GJMC 21.04.010.

(1) There is no side setback for attached single-family dwellings or the common wall of two-family dwellings. Covenants shall provide for the maintenance of common walls, other common structures and common spaces and facilities.

(2) The City Attorney may require changes and additions to ensure long-term maintenance of all structures and property.

(3) Attached single-family and multifamily dwellings that front onto a private drive, shared drive, parking lot, or other private access way shall be set back a minimum of 15 feet from the edge of the access way, with front loading garages set back a minimum of 20 feet from any vehicular or pedestrian access way.

(b) Zero Lot Line Development. In a zero lot line development, dwellings are shifted to one side of the lot to provide greater usable yard space on each lot.

(1) A zero lot line development is allowed in any residential zone, except in an R-R, R-E, R- l, or R-2 zone such development must be clustered.

(2) The outside boundary of the permissible building envelope for each lot must be graphically depicted on a map, to be recorded with the plat. The corresponding plat shall note the existence of the building envelope map and reference its recording information.

(3) One side setback may be reduced down to zero. The street side setback and interior side setbacks abutting a property outside the project shall not change.

(4) All zero lot line development shall comply with the following:

(i) The minimum distance between adjacent structures in the development must be equal to twice the required side setback of the zone unless changed pursuant to a cluster. The eaves, including any gutters, on the side of the dwelling with the reduced setback may encroach up to 18 inches into the abutting lot within the project. The building envelope map shall note the extent and location of the potential encroachment. Appropriate easements shall be created for maintenance/repair purposes.

(ii) A maintenance/repair easement shall be created when the eaves or side wall of a proposed house would be within four feet of the abutting property. In addition, any structure on the abutting lot is restricted to one or more feet from the common boundary so that after construction of both dwellings there remains at least five feet between the structures at all points, except when the structure is attached dwelling units.

(iii) If the side wall of a house is on or within three feet of the property line, no windows or other openings in the wall are allowed, for privacy and due to the building and fire codes.

(Ord. 4419, 4-5-10)

21.03.060 Cluster developments.

(a) The purpose of cluster developments is to encourage the preservation of environmentally sensitive areas, open space and agricultural lands, while encouraging and providing the ability to develop at a density range supported by the Comprehensive Plan and those densities that are consistent with the property's zoning designation.

(b) In any residential zone district where clustering is permitted, the Director may approve lots that are smaller and arranged differently than otherwise allowed under this code.

(c) Unless provided otherwise by the subdivision approval, cluster subdivisions must meet the following standards:

(1) Twenty percent of the gross acreage must be open space.

(2) The minimum lot size is the percentage of open space of total acres of the entire development multiplied by 1.5. The minimum lot size requirement of the underlying zoning district may then be reduced by the resulting percentage. Minimum lot size shall also be subject to other provisions, such as GJMC 21.07.020(f), Hillside Development, which might further restrict lot size. The following table provides example lot sizes based on various open space reservations.

Minimum lot size = (existing min. lot size) – (% open space x 1.5 x existing min. lot size)

(3) In no event shall any lot be less than 3,000 square feet.

(4) Bulk standard requirements for clustered lots are those of the district which has the closest lot sizes. For example, if an R-2 district is developed with 30 percent open space then the bulk requirements of the R-4 district apply.

(5) The bulk standards of the R-8 district apply to every lot of less than 4,500 square feet.

	Min. Req. Lot Size	20 Percent Open Space	30 Percent Open Space	50 Percent Open Space	66 Percent Open Space
R-R	5 acres	3.5 acres	2.75 acres	1.25 acres	3,000 sq. ft.
R-E	1 acre	30,492 sq. ft.	23,958 sq. ft.	16,890 sq. ft.	3,000 sq. ft.
R-1	30,000 sq. ft.	21,000 sq. ft.	16,500 sq. ft.	7,500 sq. ft.	3,000 sq. ft.
R-2	15,000 sq. ft.	10,500 sq. ft.	8,250 sq. ft.	3,750 sq. ft.	3,000 sq. ft.
R-4	7,000 sq. ft.	4,900 sq. ft.	3,850 sq. ft.	3,000 sq. ft.	3,000 sq. ft.
R-5	4,000 sq. ft.	3,000 sq. ft.	3,000 sq. ft.	3,000 sq. ft.	3,000 sq. ft.

(6) Where clustering is used in areas that are not otherwise limited by topography or other natural features, lots shall generally be organized where lots located near adjacent developments are designed with similarly sized lots or should be planned where open space, buffering and/or other tools such as building envelopes and setbacks can help minimize impacts on existing adjacent development.

(d) At least 20 percent of a cluster development shall be open space. Unless the Director approves otherwise, public open space shall abut or provide easy access to or protect other public land, especially federal land. The applicant for cluster development shall:

(1) Offer the open space to dedicate to a local government or other entity approved by the Director. Open space in a cluster shall be offered as a dedication to the City or, at the election of the City, to a nonprofit trust or conservancy approved by the City;

(2) Convey open space to an entity to hold it in perpetuity for the owners of lots and/or the public; or

(3) Establish a conservation easement for agricultural land to be preserved in the form approved by the City Attorney.

(e) All open space shall be conveyed to, owned and maintained by an entity approved by the City. The covenants and restrictions regarding perpetual preservation and maintenance of the open space shall include provisions addressing:

(1) Maintenance duties of the grantee;

(2) A mechanism so that each lot owner may be assessed by the grantee; and

(3) The power but not any duty of the City to enforce any covenant or restriction.

(f) Open space shall be provided for each phase of a development or all may be provided at the first phase. If common open space will not be provided proportionally by phase, the developer shall on the first plat identify all areas of all phases which are intended to be open space and deliver to the City Clerk a warranty deed to all such areas which will be recorded if the development is not completed.

(g) Unless the Director approves otherwise, public open space shall abut or provide easy access to or protect other public land, especially federal land. Open space design and developer constructed improvements shall:

(1) Be linked to existing and planned public open spaces, constructed areas and trails as the Director deems possible;

(2) Maximize access and use by residents of the cluster development; and

(3) Provide trails, paths and walkways to recreation areas, schools, commercial areas and other public facilities.

(h) The Director may require:

(1) Paved pedestrian paths, located in rights-of-way or easements;

(2) Paved bicycle ways; and

(3) Equestrian trails surfaced with softer materials such as wood chips or gravel.

(i) Buffering.

(1) A perimeter enclosure in accordance with GJMC 21.06.040 may be required to create a visual barrier between the cluster development and adjoining development.

(2) The perimeter of a cluster development that abuts a right-of-way shall provide a buffer. The type of buffer shall take in to account the future road classification, right-of-way width, and type of current and future development on adjacent properties.

(3) The project landscaping and buffer design shall be established as part of any preliminary subdivision plan approval.

(j) A cluster development project may be developed in phases. The Director may require the applicant to divide the project into phases in order to meet requirements and standards contained in these regulations. Each phase must be self-sufficient with adequate facilities and services and contain a mix of residential uses and densities and open space, while meeting the requirements, standards and conditions applicable to the project as a whole.

(Ord. 4804, 6-6-18; Ord. 4778, 1-3-18; Ord. 4428, 6-14-10; Ord. 4419, 4-5-10)

21.03.070 Mixed use districts.

(a) R-O: Residential Office.

(1) Purpose. To provide low intensity, nonretail, neighborhood service and office uses that are compatible with adjacent residential neighborhoods. Development regulations and performance standards are intended to make buildings compatible and complementary in scale and appearance to a residential environment.

(2) Performance Standards. New construction, including additions and rehabilitations, in the R-O district shall be designed with residential architectural elements and shall be consistent with existing buildings along the street. “Consistent” means the operational, site design and layout, and architectural considerations described in the next subsections.

(3) Site Design, Layout and Operational Considerations.

(i) Parking. Business uses in the R-O district shall be designed and operated not to increase on-street parking in front of dwellings in the neighborhood. On-site parking shall be provided pursuant to the parking rules. On-site parking spaces shall only be located in the side and rear yards; and screened from adjacent dwellings by a solid wall, fence or vegetation having a height of not less than four feet or more than six feet (vegetation may exceed six feet in height). Fences must comply with GJMC 21.04.040(i), any design guidelines and other conditions of approval.

(ii) Service Entrances. Service entrances, loading areas and dumpster areas shall be located only in the rear or side yard. Each loading area shall be screened from each adjacent residential use or zone.

(iii) Use of Front Yard. Front yards shall be reserved for landscaping, sidewalks, driveway access to parking areas and signage.

(iv) Hours of Business. No uses in this district shall open earlier than 7:30 a.m. and shall close no later than 8:00 p.m.

(v) Outdoor Storage and Display. Outdoor storage and display areas associated with nonresidential uses are prohibited.

(4) Architectural Considerations.

(i) Building Alignment along Streets. Every new building and addition shall be located so that it aligns with existing neighborhood buildings in both elevation (e.g., horizontal lines of peaks of roofs, cornices, window sills) and plan (e.g., setbacks from the street and rear property lines and spacing between structures/setbacks from side property lines).

(ii) Building Orientation/Style. Main entrances shall open onto a street and shall align with those of adjacent residential buildings. For example, in many R-O areas, raised foundations and steps that define the main entrance are prevailing residential characteristics. Door styles shall be similar to those found on residential dwellings.

(iii) Building Mass/Scale Proportion. Each new building, its mass in relation to open spaces and its windows, doors, and openings shall be visually compatible. "Visually compatible" means compatible with adjacent and neighboring buildings including mass, shape, window, doors, openings, roof shape, roof pitch and orientation. For example, a large building shall be compatible with surrounding smaller dwellings by dividing its mass into smaller components to create a building elevation that is more like the size and proportion of the nearby dwellings.

(iv) Height. New buildings shall have the same number of stories and a height which is compatible with those of nearby dwellings. Three stories shall be the maximum subject to maximum height of 40 feet.

(v) Roof Shape. The roofs of new buildings shall be visually compatible with nearby dwellings. Roof pitch shall be at least 4:12.

(vi) Fenestration. Windows and doors shall be visually compatible with surrounding residential structures. Visually compatible includes the relationship of width to height, and the spacing of windows and doors. For example, tall evenly spaced rectangular windows are typical of certain residential styles in R-O district areas.

(vii) Materials. The exterior of all new buildings, additions and alterations shall be similar in size and appearance to nearby dwellings. Sign materials should be visually compatible with materials used on the building facade.

(viii) Signage. See GJMC 21.06.070(h)(2) for sign standards in the R-O district.

(b) B-1: Neighborhood Business.

(1) Purpose. To provide small areas for office and professional services combined with limited retail uses, designed in scale with surrounding residential uses; a balance of residential and nonresidential uses.

(2) Performance Standards.

(i) Parking. Business uses shall be designed and operated so as not to increase on-street parking in front of neighborhood dwellings. On-site parking shall be provided.

(ii) Service Entrances. Business service entrances, service yards and loading areas shall be located only in the rear or side yard.

(iii) Outdoor Storage and Display. Outdoor storage is prohibited. Outdoor display of retail merchandise is permitted subject to GJMC 21.04.040(h).

(c) B-2: Downtown Business.

(1) Purpose. To provide concentrated downtown retail, service, office and mixed uses not including major/regional shopping centers or large outdoor sales areas. The B-2 district promotes the vitality of the downtown area as provided by the Comprehensive Plan. Pedestrian circulation is encouraged as are common parking areas.

(2) Street Design. Effective and efficient street design and access shall be considerations in the determination of project/district intensity.

(3) Performance Standards.

(i) Landscaping. Landscaping is required for surface parking and for the park strip in the right-of-way.

(ii) Service Entrances. Service entrances, service yards and loading areas shall be located only in the rear or side yard.

(iii) Outdoor Storage and Display. Outdoor storage and permanent displays are prohibited. Portable display of retail merchandise may be permitted subject to this code.

(4) Open Space.

(i) Public Parks and Open Space Fee. The owner of any residential or mixed use project in a B-2 zone district shall be subject to the required parks impact fee.

(ii) Open Space Requirement. Multifamily or mixed use developments in a B-2 zone district shall be required to pay 10 percent of the value of the raw land of the property as determined in GJMC 21.06.020(a).

(d) C-1: Light Commercial.

(1) Purpose. To provide indoor retail, service and office uses requiring direct or indirect arterial street access, and business and commercial development along arterials. The C-1 district should accommodate well-designed development on sites that provide excellent transportation access, make the most efficient use of existing infrastructure and provide for orderly transitions and buffers between uses.

(2) Street Design. Effective and efficient street design and access shall be considerations in the determination of project/district intensity.

(3) Performance Standards.

(i) Service Entrances. Building entrances to service yard and loading areas shall be located only in the rear and side yard.

(ii) Outdoor Storage and Display. Outdoor storage is not allowed within the front yard. Outdoor display of retail merchandise is permitted subject to GJMC 21.04.040(h).

(4) Height. Maximum height for structures in the C-1 and I-O zone districts which are north of G Road and east of 27 Road along Horizon Drive (including Crossroad Boulevard and Horizon Court) shall be 65 feet, except by special permit for additional height.

(e) C-2: General Commercial.

(1) Purpose. To provide for commercial activities such as repair shops, wholesale businesses, warehousing and retail sales with limited outdoor display of goods and even more limited outdoor operations.

(2) Street Design. Effective and efficient street design and access shall be considerations in the determination of project/district intensity.

(3) Performance Standards. Outdoor storage and display areas are not allowed within the front yard setback. Permanent and portable display of retail merchandise is permitted.

(f) CSR: Community Services and Recreation.

(1) Purpose. To provide public and private recreational facilities, schools, fire stations, libraries, fairgrounds, and other public/institutional uses and facilities. The district would include open space areas, to prevent environmental damage to sensitive areas, and to limit development in areas where police or fire protection, protection against flooding by stormwater, or other services or utilities are not readily available. The CSR district would include outdoor recreational facilities, educational facilities, open space corridors, recreational, nonvehicular transportation and environmental areas and would be interconnected with other parks, trails and other recreational facilities. The district may also be used for public property, environmentally sensitive lands, and extractive uses (gravel pits) regardless of the land use designation.

(2) Performance Standards. Development shall conform to the standards established in this code. Outdoor storage areas shall comply with the standards in GJMC 21.04.040(h), except those associated with extractive uses, in which case no screening shall be required for an extractive use unless required by Chapter 21.04 or 21.06 GJMC in order to buffer from neighborhood uses or zones.

(g) M-U: Mixed Use.

(1) Purpose. To provide for a mix of light manufacturing and office park employment centers, retail, service and multifamily residential uses with appropriate screening, buffering and open space and enhancement of natural features and other amenities such as trails, shared drainage facilities, and common landscape and streetscape character.

(2) Performance Standards. Development shall conform to the standards established in this code.

(i) Refer to any applicable overlay zone district and/or corridor design standards and guidelines.

(ii) Loading/Service Areas. Loading docks and trash or other service areas shall be located only in the side or rear yards.

(iii) Vibration, Smoke, Odor, Noise, Glare, Wastes, Fire Hazards and Hazardous Materials. No person shall occupy, maintain or allow any use in an M-U district without continuously meeting the following minimum standards regarding vibration, smoke, odor, noise, glare, wastes, fire hazards and hazardous materials. Conditional use permits for uses in this district may establish higher standards and conditions.

(A) Vibration. Except during construction or as authorized by the City, an activity or operation which causes any perceptible vibration of the earth to an ordinary person on any other lot or parcel shall not be permitted.

(B) Noise. The owner and occupant shall regulate uses and activities on the property so that sound never exceeds 65 decibels at any point on the property line.

(C) Glare. Lights, spotlights, high temperature processes or otherwise, whether direct or reflected, shall not be visible from any lot, parcel or right-of-way.

(D) Solid and Liquid Waste. All solid waste, debris and garbage shall be contained within a closed and screened dumpster, refuse bin and/or trash compactor. Incineration of trash or garbage is prohibited. No sewage or liquid wastes shall be discharged or spilled on the property.

(E) Hazardous Materials. Information and materials to be used or located on the site whether on a full-time or part-time basis that are required by the SARA Title III Community Right to Know shall be provided at the time of any City review, including the site plan. Information regarding the activity or at the time of any change of use or expansion, even for existing uses, shall be provided to the Director.

(iv) Outdoor Storage and Display. Outdoor storage shall only be located in the rear half of the lot. Permanent display areas may be located beside or behind the principal structure. For lots with double or triple frontage the side and rear yards that are to be used for permanent display areas shall be established with site plan approval. Portable display of retail merchandise may be permitted as provided in Chapter 21.04 GJMC.

(h) BP: Business Park Mixed Use.

(1) Purpose. To provide for a mix of light manufacturing and employment centers, limited commercial services, and multifamily residential uses in a business park setting with proper screening and buffering, all compatible with adjoining uses.

(2) Street Design. Effective and efficient street design and access shall be considerations in the determination of project/district intensity.

(3) Performance Standards.

(i) Loading Docks. Loading docks shall be located only in the side or rear yards.

(ii) Vibration, Smoke, Odor, Noise, Glare, Wastes, Fire Hazards and Hazardous Materials. No person shall occupy, maintain or allow any use in a BP district without continuously meeting the following minimum standards regarding vibration, smoke, odor, noise, glare, wastes, fire hazards and hazardous materials. Conditional use permits for uses in this district may establish higher standards and conditions.

(A) Vibration. Except during construction or as authorized by the City, an activity or operation which causes any perceptible vibration of the earth to an ordinary person on any other lot or parcel shall not be permitted.

(B) Noise. The owner and occupant shall regulate uses and activities on the property so that sound never exceeds 65 decibels at any point on the property line.

(C) Glare. Lights, spotlights, high temperature processes or otherwise, whether direct or reflected, shall not be visible from any lot, parcel or right-of-way.

(D) Solid and Liquid Waste. All solid waste, debris and garbage shall be contained within a closed and screened dumpster, refuse bin and/or trash compactor. Incineration of trash or garbage is prohibited. No sewage or liquid wastes shall be discharged or spilled on the property.

(E) Hazardous Materials. Information and materials to be used or located on the site, whether on a full-time or part-time basis, that are required by the SARA Title III Community Right to Know shall be provided at the time of any City review, including site plan. Information regarding the activity or at the time of any change of use or expansion, even for existing uses, shall be provided to the Director.

(iii) Outdoor Storage and Display. Outdoor storage shall only be located in the rear half of the lot. Permanent display areas may be located beside or behind the principal structure. For lots with double or triple frontage the side and rear yards that are to be used for permanent display areas shall be established with site plan approval. Portable display of retail merchandise may be permitted as provided in GJMC 21.04.040(h).

(Ord. 4890, 11-20-19; Ord. 4831, 2-6-19; Ord. 4672, 7-15-15; Ord. 4655, 2-18-15; Ord. 4623, 2-19-14; Ord. 4419, 4-5-10)

21.03.080 Industrial districts.

(a) I-O: Industrial/Office Park.

(1) Purpose. To provide for a mix of light manufacturing uses, office park, limited retail and service uses in a business park setting with proper screening and buffering, all compatible with adjoining uses.

(2) Street Design. Effective and efficient street design and access shall be considerations in the determination of project/district intensity.

(3) Performance Standards.

(i) Retail Sale Area. Areas devoted to retail sales shall not exceed 10 percent of the gross floor area of the principal structure, and 5,000 square feet on any lot or parcel.

(ii) Vibration, Smoke, Odor, Noise, Glare, Wastes, Fire Hazards and Hazardous Materials. No person shall occupy, maintain or allow any use in an I-O district without continuously meeting the following minimum standards regarding vibration, smoke, odor, noise, glare, wastes, fire hazards and hazardous materials. Conditional use permits for uses in this district may establish higher standards and conditions.

(A) Vibration. Except during construction or as authorized by the City, an activity or operation which causes any perceptible vibration of the earth to an ordinary person on any other lot or parcel shall not be permitted.

(B) Noise. The owner and occupant shall regulate uses and activities on the property so that sound never exceeds 65 decibels at any point on the property line.

(C) Glare. Lights, spotlights, high temperature processes or otherwise, whether direct or reflected, shall not be visible from any lot, parcel or right-of-way.

(D) Solid and Liquid Waste. All solid waste, debris and garbage shall be contained within a closed and screened dumpster, refuse bin and/or trash compactor. Incineration of trash or garbage is prohibited. No sewage or liquid wastes shall be discharged or spilled on the property.

(E) Hazardous Materials. Information and materials to be used or located on the site, whether on a full-time or part-time basis, that are required by the SARA Title III Community Right to Know shall be provided at the time of any City review, including site plan. Information regarding the activity or at the time of any change of use or expansion, even for existing uses, shall be provided to the Director.

(iii) Outdoor Storage and Display. Outdoor storage and permanent display areas may be located beside or behind the principal structure. For lots with double or triple frontage the side and rear yards that are to be used for permanent display areas shall be established with site plan approval. Portable display of retail merchandise may be permitted as provided in GJMC 21.04.040(h).

(b) I-1: Light Industrial.

(1) Purpose. To provide for areas of light fabrication, manufacturing and industrial uses which are compatible with existing adjacent land uses, access to transportation and the availability of public services and facilities. I-1 zones with conflicts between other uses can be minimized with orderly transitions of zones and buffers between uses.

(2) Street Design. Effective and efficient street design and access shall be considerations in the determination of project/district intensity.

(3) Performance Standards.

(i) Retail Sale Area. Areas devoted to retail sales shall not exceed 10 percent of the gross floor area of the principal structure, and 5,000 square feet on any lot or parcel.

(ii) Vibration, Smoke, Odor, Noise, Glare, Wastes, Fire Hazards and Hazardous Materials. No person shall occupy, maintain or allow any use in an I-1 district without continuously meeting the following minimum standards regarding vibration, smoke, odor, noise, glare, wastes, fire hazards and hazardous materials. Conditional use permits for uses in this district may establish higher standards and conditions.

(A) Vibration. Except during construction or as authorized by the City, an activity or operation which causes any perceptible vibration of the earth to an ordinary person on any other lot or parcel shall not be permitted.

(B) Noise. The owner and occupant shall regulate uses and activities on the property so that sound never exceeds 65 decibels at any point on the property line.

(C) Glare. Lights, spotlights, high temperature processes or otherwise, whether direct or reflected, shall not be visible from any lot, parcel or right-of-way.

(D) Solid and Liquid Waste. All solid waste, debris and garbage shall be contained within a closed and screened dumpster, refuse bin and/or trash compactor. Incineration of trash or garbage is prohibited. No sewage or liquid wastes shall be discharged or spilled on the property.

(E) Hazardous Materials. Information and materials to be used or located on the site, whether on a full-time or part-time basis, that are required by the SARA Title III Community Right to Know shall be provided at the time of any City review, including site plan. Information regarding the activity or at the time of any change of use or expansion, even for existing uses, shall be provided to the Director.

(iii) Outdoor Storage and Display. Portable display of retail merchandise may be permitted as provided in GJMC 21.04.040(h).

(A) Outdoor storage and displays shall not be allowed in the front yard setback;

(B) Screening shall be maintained in the frontage adjacent to arterial and collector streets and along that portion of the frontage on local streets which adjoin any zone except I-1 or I-2;

(C) Unless required to buffer from an adjoining district, screening along all other property lines is not required; and

(D) Screening of dumpsters is not required.

(c) I-2: General Industrial.

(1) Purpose. To provide areas of heavy and concentrated fabrication, manufacturing and industrial uses which are compatible with adjacent uses, easy semi-tractor trailer access to the State highway system and/or railroads and the availability of public services and facilities. Conflicts between the I-2 district must be minimized with other uses by orderly transitions and buffers between uses.

(2) Street Design. Effective and efficient street design and access shall be considerations in the determination of project/district intensity.

(3) Performance Standards.

(i) Retail Sale Area. Areas devoted to retail sales shall not exceed 10 percent of the gross floor area of the principal structure, and 5,000 square feet on any lot or parcel.

(ii) Vibration, Smoke, Odor, Noise, Glare, Wastes, Fire Hazards and Hazardous Materials. No person shall occupy, maintain or allow any use in an I-2 district without continuously meeting the following minimum standards regarding vibration, smoke, odor, noise, glare, wastes, fire hazards and hazardous materials. Conditional use permits for uses in this district may establish higher standards and conditions.

(A) Vibration. Except during construction or as authorized by the City, an activity or operation which causes any perceptible vibration of the earth to an ordinary person on any other lot or parcel shall not be permitted.

(B) Noise. The owner and occupant shall regulate uses and activities on the property so that sound never exceeds 65 decibels at any point on the property line.

(C) Glare. Lights, spotlights, high temperature processes or otherwise, whether direct or reflected, shall not be visible from any lot, parcel or right-of-way.

(D) Solid and Liquid Waste. All solid waste, debris and garbage shall be contained within a closed and screened dumpster, refuse bin and/or trash compactor. Incineration of trash or garbage is prohibited. No sewage or liquid wastes shall be discharged or spilled on the property.

(E) Hazardous Materials. Information and materials to be used or located on the site, whether on a full-time or part-time basis, that are required by the SARA Title III Community Right to Know shall be provided at the time of any City review, including site plan. Information regarding the activity or at the time of any change of use or expansion, even for existing uses, shall be provided to the Director.

(iii) Outdoor Storage and Display. Portable display of retail merchandise may be permitted as provided in GJMC 21.04.040(h).

(A) Outdoor storage and displays shall not be allowed in the front yard setback;

(B) Screening shall be maintained in the frontage adjacent to arterial and collector streets and along that portion of the frontage on local streets which adjoin any zone except I-1 or I-2;

(C) Unless required to buffer from an adjoining district, screening along all other property lines is not required; and

(D) Screening of dumpsters is not required.

Mixed Use and Industrial Bulk Standards Summary Table

	R-O	B-1	B-2	C-1	C-2	CSR	M-U	BP	I-O	I-1	I-2
Lot											
Area (min. ft. unless otherwise specified)	5,000	10,000	n/a	20,000	20,000	1 ac	1 ac	1 ac	1 ac	1 ac	1 ac
Width	50	50	n/a	50	50	100	100	100	100	100	100
Frontage	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Setback											
Principal structure											
Front (min. ft.)	20	20	0	15	15	15	15	15	15	15	15
Side (min. ft.)	5	0	0	0	0	0	0	0	0	0	0
Side – abutting residential (min. ft.)	n/a	10	n/a	10	10	10	10	10	10	10	n/a
Rear (min. ft.)	10	15	0	10	10	10	10	10	10	10	10
Accessory structure											
Front (min. ft.)	25	25	25	25	25	25	25	25	25	25	25
Side (min. ft.)	3	0	0	0	0	0	0	0	0	0	0
Side – abutting residential (min. ft.)	n/a	5	n/a	5	5	5	5	5	5	5	n/a
Rear (min. ft.)	5	15	0	10	10	10	10	10	10	10	10
Other Dimensional Requirements											
Lot coverage (max.)	70%	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Height (max. ft.)	40	40	80	40	40	65	65	65	65	50	50
Density (min. units per acre)	4	8	8	12	n/a	n/a	8	8	n/a	n/a	n/a
Density (max. units per acre)	n/a	16	n/a	24	n/a	n/a	24	24	n/a	n/a	n/a
Building size (max. sf)	10,000	15,000	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Notes											

B-1: Max. building size varies by use; retail – 15,000 sf (unless a CUP is approved), office 30,000

B-2: Parking front setback for parking as a principal use – 30 ft., as an accessory use – 6 ft.

C-1: Min. rear setback – 0 if an alley is present

CSR: Maximum building height abutting residential – 40 ft.

(Ord. 4890, 11-20-19; Ord. 4831, 2-6-19; Ord. 4672, 7-15-15; Ord. 4665, 6-3-15; Ord. 4623, 2-19-14; Ord. 4419, 4-5-10)

21.03.090 Form districts.

(a) Intent. The form districts are intended to implement the Neighborhood Center, Village Center, Downtown Mixed Use future land use designations and Mixed Use Opportunity Corridors of the Comprehensive Plan. The form districts are intended to create pedestrian-friendly urban areas where higher density mixed uses and mixed building types promote less dependence on the auto-mobile. The form districts are intended to be used in combination to create mixed use centers. The centers are intended to transition in scale to existing neighborhoods. The Comprehensive Plan Neighborhood Center designation is implemented with the three-story districts, the Village Center designation is implemented with the three- and five-story districts, and the Downtown Mixed Use

designation is implemented with the three-, five- and eight-story districts. The Mixed Use Opportunity Corridor designation is implemented with the MXOC, a three-story form district as limited by GJMC 21.02.140(c)(2); in addition, because the Mixed Use Opportunity Corridor overlays other future land use designations as shown on the Comprehensive Plan Future Land Use Map, other zone districts which implement the underlying future land use designation would also be appropriate zoning options in a given area of the Mixed Use Opportunity Corridor.

(b) Mixed Use Residential (MXR-3, -5, -8). The mixed use residential (MXR) districts are:

(1) Intended to create residential neighborhoods with a mix of housing options in a pedestrian-friendly environment.

(2) Divided into three intensities: low (MXR-3), medium (MXR-5), and high (MXR-8).

(3) Intended as a transition from a mixed use center or corridor to the surrounding neighborhoods.

(4) Comprised of the apartment, townhouse and civic building types.

(c) Mixed Use General (MXG-3, -5, -8). The mixed use general (MXG) districts are:

(1) Intended to create a mix of compatible uses in close proximity to one another in a pedestrian-friendly environment.

(2) Divided into three intensities: low (MXG-3), medium (MXG-5), and high (MXG-8).

(3) Comprised of the general, apartment, townhouse and civic building types.

(d) Mixed Use Shopfront (MXS-3, -5, -8). The mixed use shopfront (MXS) districts are:

(1) Intended to create the commercial core of a mixed use pedestrian-friendly area.

(2) Divided into three intensities: low (MXS-3), medium (MXS-5), and high (MXS-8).

(3) Comprised of the shopfront building type.

(e) Mixed Use Opportunity Corridors (MXOC) district is intended to:

(1) Create mixed use development(s) along the corridor in a pedestrian-friendly environment while accommodating the more automobile-centric nature of the areas due to the fact that these corridors are primarily along arterial streets;

(2) Provide a transition from nonresidential to existing neighborhood residential uses, and respect the limitations set forth in GJMC 21.02.140(c)(2);

(3) Combine access between two or more sites whenever possible to restrict the number of access points along the arterial street; and

(4) Establish standards for access, parking, delivery and pick-up areas, trash service, signage, building entry, and architecture that reflect the somewhat more automobile-centric nature compared to the other form districts.

(f) District Standards.

(1) Building Type by District.

District	Building Type				
	Shopfront	**General**	**Apartment**	**Townhouse**	**Civic**
Mixed Use Residential (MXR-)			•	•	•
Mixed Use General (MXG-)		•	•	•	•
Mixed Use Shopfront (MXS-)	•				
Mixed Use Opportunity Corridor (MXOC)	•	•	•	•	•

(2) Height.

Intensity	District	Height Stories (min.)	Height Stories (max.)	Height Feet (max.)
Low	MXR-3, MXG-3, MXS-3, MXOC	1	3	50
Medium	MXR-5, MXG-5, MXS-5	2	5	65
High	MXR-8, MXG-8, MXS-8	2	8	100

(3) Building Entrances. The following building entrance requirements apply to shopfront, general and apartment building types:

(i) An entrance providing both ingress and egress, operable during normal business hours, is required to meet the street-facing entrance requirements. Additional entrances off another street, pedestrian area or internal parking area are permitted.

(ii) The entrance separation requirements provided for the building type must be met for each building, but are not applicable to adjacent buildings.

(iii) An angled entrance may be provided at either corner of a building along the street to meet the street entrance requirements, provided any applicable entrance spacing requirements can still be met.

(iv) A minimum of 50 percent of a required entrance must be transparent.

(v) A required fire exit door with no transparency may front on a primary, side, or service street.

(vi) A street-facing entrance is not required in the MXOC.

(4) Parking.

(i) On-site surface parking must be located behind the parking setback line.

(ii) Structured parking must contain active uses on the ground story along any primary street for the first 30 feet of the building measured from the street-facing facade.

(iii) The required street frontage may be interrupted to allow for a maximum 30-foot-wide vehicular entrance to a parking structure or area.

(5) Service Entrances. Business service entrances, service yards and loading areas shall be located only in the rear or side yard, behind the parking setback line.

(6) Open Space.

(i) Public Parks and Open Space Fee. The owner of any multifamily or mixed use project in a form district shall be subject to the required parks impact fee.

(ii) Open Space Requirement. Multifamily or mixed use developments in a form district shall be required to pay 10 percent of the value of the raw land of the property as determined in GJMC 21.06.020(a).

(7) Outdoor Storage and Display. Outdoor storage and permanent displays are prohibited. Portable display of retail merchandise may be permitted as provided in GJMC 21.04.040(h).

(8) Awning Standards. Awnings and other facade enhancements are encouraged. One or more awnings extending from the building may be erected. Awnings shall be at least eight feet above the sidewalk and shall be at least four feet wide, along the building frontage, and shall not overhang into the right-of-way more than six feet. Awnings shall otherwise meet with the requirements of the Grand Junction Municipal Code and Colorado Department of Transportation (CDOT) regulations.

(9) Landscaping and Buffering.

(i) No landscaping/screening buffer is required between adjacent properties zoned Mixed Use.

(ii) No street frontage landscaping is required when the setback for a building is 10 feet or less.

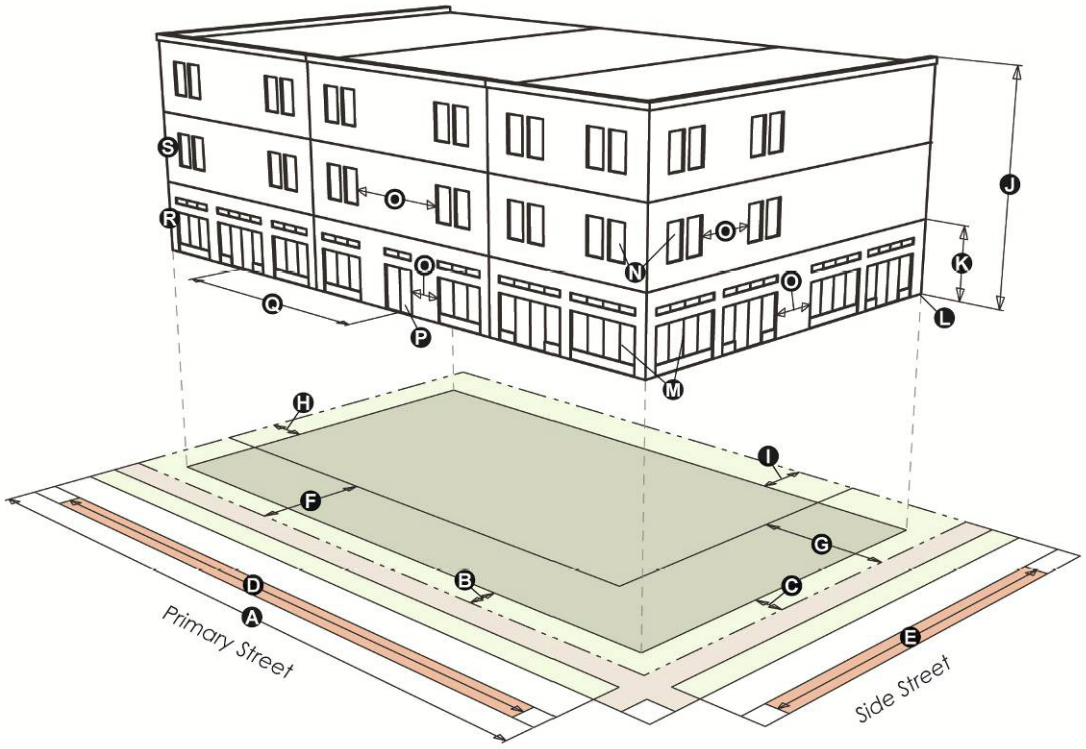
(iii) Street trees are required at a rate of one tree per 80 feet. Street trees may be planted in the right-of-way with City approval.

(iv) All other landscaping regulations of the Grand Junction Municipal Code shall apply.

(10) Mechanical Equipment. Screening of mechanical equipment either located on the roof or on the ground is required.

(g) Building Types. See the building types on the following pages.

(1) Shopfront. A building form intended for ground floor retail sales and service uses with upper-story residential or office uses. Lodging and indoor recreation and entertainment uses would also be allowed. High transparency (in the form of windows and doors) is required on the ground floor to encourage interaction between the pedestrian and the ground story space. Primary entrances are prominent and street facing except that street-facing entrances are optional in MXOC.

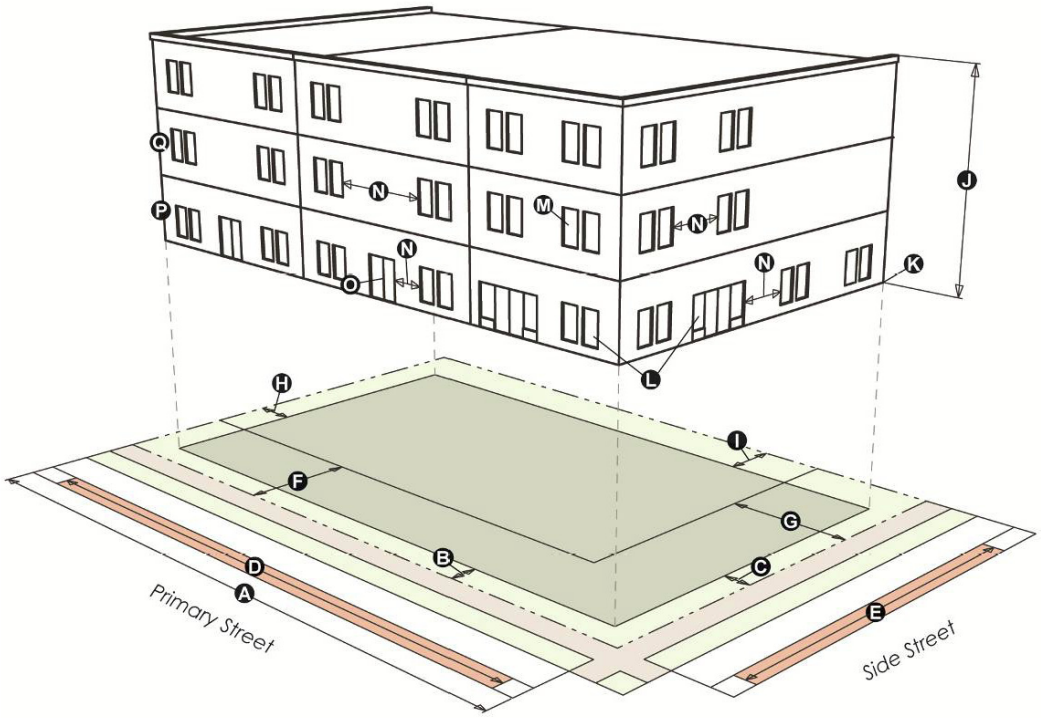


	MXS-3 MXOC	MXS-5	MXS-8
LOT			
Area (min. ft.^{2})	4,000	5,000	n/a
Ⓐ Width (min. ft.)	40	50	n/a
Lot coverage (max.)	75%	75%	n/a
FRONT SETBACK AREA			
Ⓑ Primary street (min./max. ft.)*	0/10	0/10	0/10
Ⓒ Side street (min./max. ft.)	0/10	0/10	0/10
REQUIRED STREET FACADE**			
Ⓓ Primary street (min.)	85%	85%	85%
Ⓔ Side street (min.)	40%	40%	40%
PARKING SETBACK			
Ⓕ Primary street (min. ft.)	30	30	30
Ⓖ Side street (min. ft.)	10	10	10
SIDE/REAR SETBACKS			
Ⓗ Side, interior (min. ft.)	5	5	5
Ⓘ Rear (min. ft.)	15	10	0

	MXS-3 MXOC	MXS-5	MXS-8
HEIGHT			
Ⓙ Stories (max.)	3	5	8
Ⓙ Feet (max.)	50	65	100
Ⓚ Ground story height (min. ft.)	15	15	15
Ⓛ Ground story elevation (min. ft.)	0	0	0
BUILDING FACADE			
Ⓜ Ground story transparency (min.)***	60%	60%	60%
Ⓝ Upper story transparency (min.)	20%	20%	20%
Ⓞ Blank wall area (max. ft.)	30	30	30
Ⓟ Street-facing entrance required***	yes	yes	yes
Ⓠ Street entrance spacing	n/a	n/a	50
ALLOWED USE			
Ⓡ Ground story	Commercial, Institutional and Civic		
Ⓢ Upper story	Commercial, Institutional and Civic, Residential		

* No maximum front setback in MXOC
** Excludes drainage facilities, waterways, and pedestrian areas
*** Not required in MXOC

(2) General. A building form intended for ground floor office and personal services uses (but does not include sales, repair or entertainment oriented uses) with upper-story residential or office. Transparency (in the form of windows and doors) is required on the ground floor to encourage interaction between the pedestrian and the ground story space; however, required transparency is lower than that for a shopfront building form. Primary entrances are prominent and street facing except that street-facing entrances are optional in MXOC.

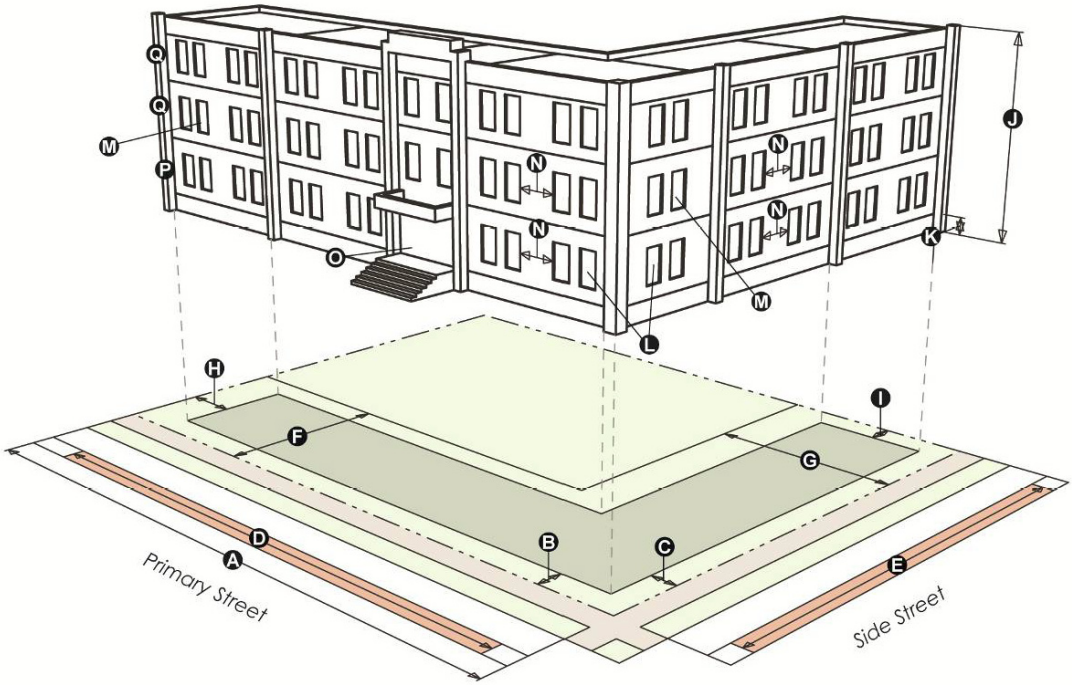


	MXG-3 MXOC	MXG-5	MXG-8
LOT			
Area (min. ft.^{2})	4,000	5,000	n/a
Ⓐ Width (min. ft.)	40	50	n/a
Lot coverage (max.)	75%	75%	n/a
FRONT SETBACK AREA			
Ⓑ Primary street (min./max. ft.)*	0/10	0/10	0/10
Ⓒ Side street (min./max. ft.)	0/10	0/10	0/10
REQUIRED STREET FACADE**			
Ⓓ Primary street (min.)	80%	80%	80%
Ⓔ Side street (min.)	40%	40%	40%
PARKING SETBACK			
Ⓕ Primary street (min. ft.)	30	30	30
Ⓖ Side street (min. ft.)	10	10	10
SIDE/REAR SETBACKS			
Ⓗ Side, interior (min. ft.)	5	5	5
Ⓘ Rear (min. ft.)	15	10	5

	MXG-3 MXOC	MXG-5	MXG-8
HEIGHT			
Ⓙ Stories (max.)	3	5	8
Ⓙ Feet (max.)	50	65	100
Ⓚ Ground story elevation (min. ft.)	0	0	0
BUILDING FACADE			
Ⓛ Ground story transparency (min.)***	40%	40%	40%
Ⓜ Upper story transparency (min.)	20%	20%	20%
Ⓝ Blank wall area (max. ft.)	30	30	30
Ⓞ Street-facing entrance required***	yes	yes	yes
ALLOWED USE			
Ⓟ Ground story	Commercial, Institutional and Civic		
Ⓠ Upper story	Commercial, Institutional and Civic, Residential		

* No maximum front setback in MXOC
** Excludes drainage facilities, waterways, and pedestrian areas
*** Not required in MXOC

(3) Apartment. A building form containing three or more dwelling units consolidated into a single structure. An apartment contains internal common walls. Dwelling units within a building may be situated either wholly or partially over or under other dwelling units. The building often shares a common entrance. Primary building entrance is generally through a street-facing lobby.

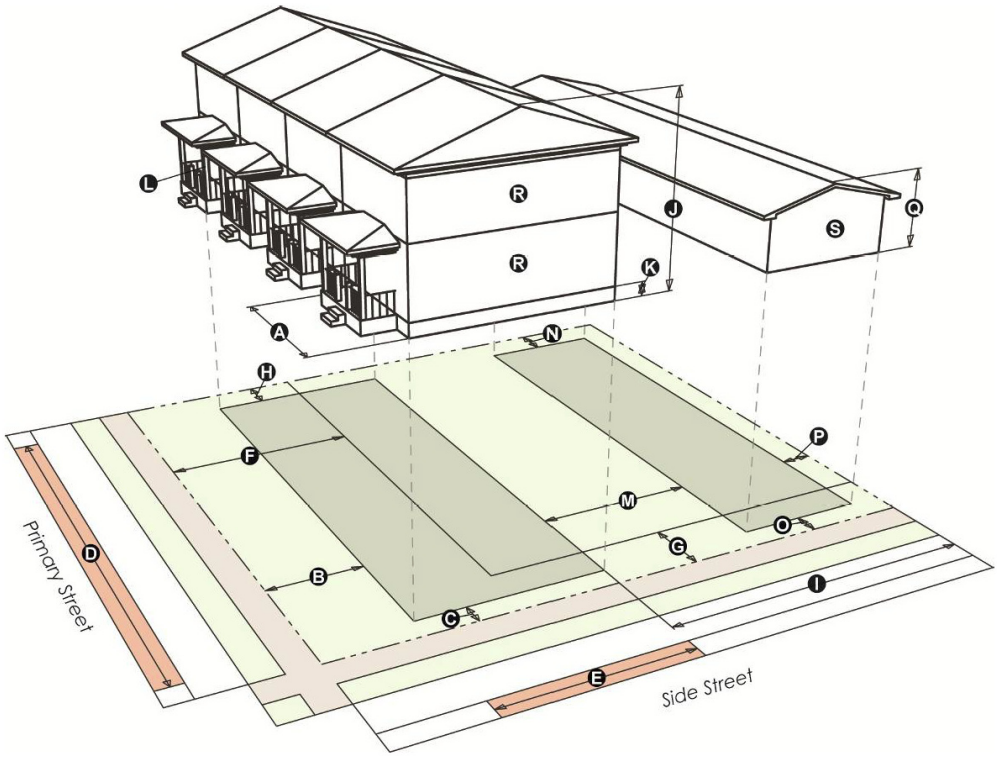


	MXG-3 MXR-3 MXOC	MXG-5 MXR-5	MXG-8 MXR-8
LOT			
Area (min. ft.^{2})	6,000	6,000	6,000
Ⓐ Width (min. ft.)	60	60	60
Lot coverage (max.)	75%	75%	75%
FRONT SETBACK AREA			
Ⓑ Primary street (min./max. ft.)*	0/15	0/15	0/15
Ⓒ Side street (min./max. ft.)	0/15	0/15	0/15
REQUIRED STREET FACADE**			
Ⓓ Primary street (min.)	75%	75%	75%
Ⓔ Side street (min.)	35%	35%	35%
PARKING SETBACK			
Ⓕ Primary street (min. ft.)	30	30	30
Ⓖ Side street (min. ft.)	10	10	10
SIDE/REAR SETBACKS			
Ⓗ Side, interior (min. ft.)	5	5	5
Ⓘ Rear (min. ft.)	15	10	5

	MXG-3 MXR-3 MXOC	MXG-5 MXR-5	MXG-8 MXR-8
HEIGHT			
Ⓙ Stories (max.)	3	5	8
Ⓙ Feet (max.)	50	65	100
Ⓚ Ground story elevation (min. ft.)	0	0	0
BUILDING FACADE			
Ⓛ Ground story transparency (min.)***	20%	20%	20%
Ⓜ Upper story transparency (min.)	20%	20%	20%
Ⓝ Blank wall area (max. ft.)	30	30	30
Ⓞ Street-facing entrance required***	yes	yes	yes
ALLOWED USE			
Ⓟ Ground story	Residential		
Ⓠ Upper story	Residential		

* No maximum front setback in MXOC
** Excludes drainage facilities, waterways, and pedestrian areas
*** Not required in MXOC

(4) Townhouse. A building form with multiple dwelling units located side-by-side on a single zone lot and consolidated into a single structure that relates to the scale of surrounding houses. Each unit is separated by a common side wall. Units are not vertically mixed. Each unit has its own external entrance.

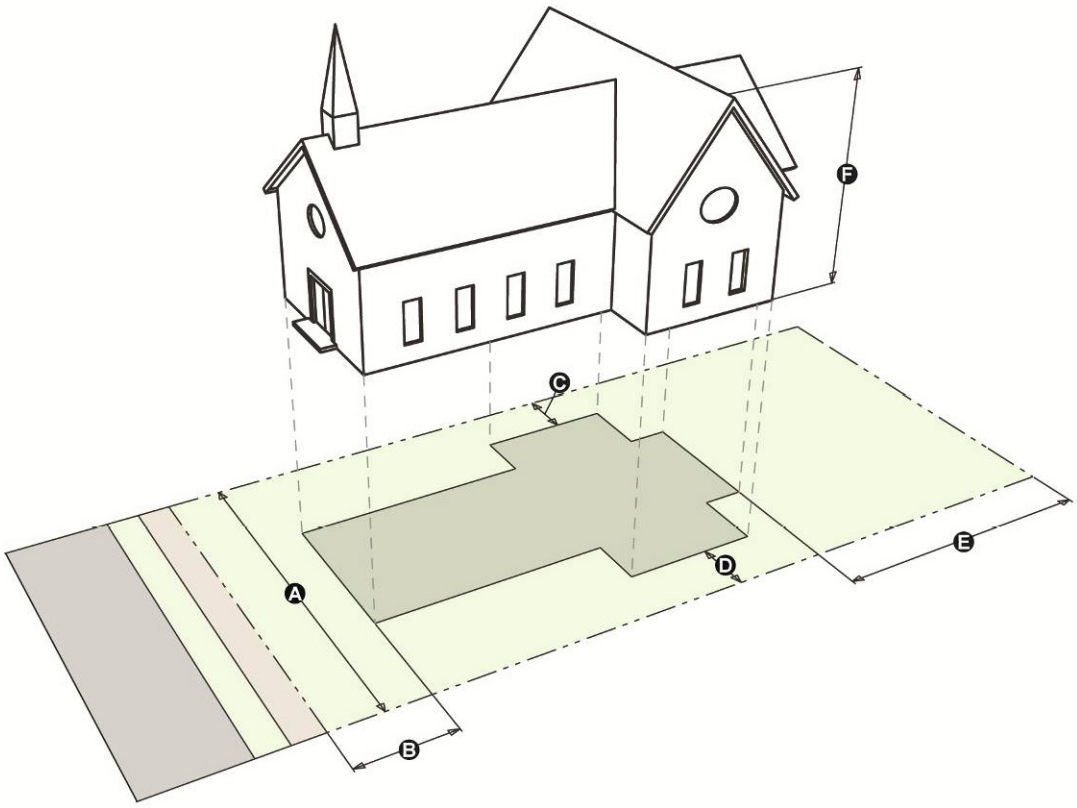


	MXG-3, MXR-3, MXOC
LOT	
Area (min. ft.^{2})	1,200
Ⓐ Unit width (min. ft.)	16
Lot coverage (max.)	75%
FRONT SETBACK AREA	
Ⓑ Primary street (min./max. ft.)*	0/15
Ⓒ Side street (min./max. ft.)	0/15
REQUIRED STREET FACADE**	
Ⓓ Primary street (min.)	75%
Ⓔ Side street (min.)	35%
PARKING SETBACK	
Ⓕ Primary street (min. ft.)	30
Ⓖ Side street (min. ft.)	10
SIDE/REAR SETBACKS	
Ⓗ Side, interior (min. ft.)	5
Ⓘ Rear (min. ft.)	10

	MXG-3, MXR-3, MXOC
HEIGHT	
Ⓙ Stories (max.)	3
Ⓙ Feet (max.)	50
Ⓚ Ground story elevation (min. ft.)	1.5
BUILDING FACADE	
Ⓛ Street-facing entrance required***	yes
ACCESSORY STRUCTURE SETBACKS	
Ⓜ Separation from primary structure (min. ft.)	10
Ⓝ Side, interior (min. ft.)	5
Ⓞ Side, street (min. ft.)	10
Ⓟ Rear (min. ft.)	5
ACCESSORY STRUCTURE HEIGHT	
Ⓠ Stories (max.)	2
Ⓠ Feet (max.)	30
ALLOWED USE	
Ⓡ All stories	Residential
Ⓢ Accessory structure	Accessory uses, accessory dwellings

* No maximum front setback in MXOC
** Excludes drainage facilities, waterways, and pedestrian areas
*** Not required in MXOC

(5) Civic. A building form containing civic, religious, institutional or public uses. In order to provide a visual landmark, the civic building form is permitted to be set back further than other building forms. Civic buildings are commonly placed on prominent sites.



	MXG-3 MXR-3 MXOC	MXG-5 MXR-5	MXG-8 MXR-8
LOT			
Area (min. ft.^{2})	10,000	10,000	10,000
Ⓐ Width (min. ft.)	100	100	100
Lot coverage (max.)	80%	80%	80%
SETBACKS			
Ⓑ Front (min. ft.)	15	15	15
Ⓒ Side, interior (min. ft.)	5	5	5
Ⓓ Side, street (min. ft.)	10	10	10
Ⓔ Rear (min. ft.)	15	15	15
HEIGHT			
Ⓕ Stories (max.)	3	5	8
Ⓕ Feet (max.)	50	65	100
ALLOWED USE			
All stories	Institutional and Civic		

(h) Mixed Use Opportunity Corridors. See GJMC 21.02.140(c)(2). In addition to the standards established in subsections (f) and (g) of this section, except as specifically modified therein for the MXOC zone district, standards for the MXOC shall be as follows:

(1) Access. When the site is adjacent to a local or collector street, the primary access shall be on the lower order street. Additional access points may be allowed based on traffic safety, as determined by the City's Development Engineer. Whenever possible, access between two or more sites shall be combined and access points restricted on arterial streets.

(2) Parking, Delivery/Pick-Up Areas, Trash Service. Parking, delivery and pick-up, and trash service areas are not permitted between the building and the primary street (corridor).

(3) Architectural Standards.

(i) Any facade of a new building along the corridor shall have visually interesting architectural features and patterns that are designed to reduce mass and scale and reflect the desired vision of construction; buildings at a human scale with urban design features attractive to the motoring public, the surrounding neighborhood, bicyclists and pedestrians.

(ii) The building facade shall exhibit a minimum of three of the following seven architectural design elements:

(A) Variation in materials, material modules, expressed joints and details, surface relief and texture to break up building forms and wall surfaces. Such detailing may include sills, headers, belt courses, reveals, pilasters, window bays or similar features for all sides of the building.

(B) Facade articulation/variation such as recessed or projecting bays or pilaster/column projections at a minimum of every 30 feet for all sides of the building.

(C) Variation in roof lines/roof materials in order to add interest to and reduce the scale of buildings or expanses of blank wall. This can be accomplished through design elements such as overhangs, eaves, recesses, projections, raised cornice parapets over doors or bays and peaked roof forms.

(D) Facade features on the primary street (corridor) that emphasize the primary building entrance through projecting or recessed forms, detail, color and/or material.

(E) Outdoor patio in combination with or without outdoor seating located between the building and the primary street (corridor).

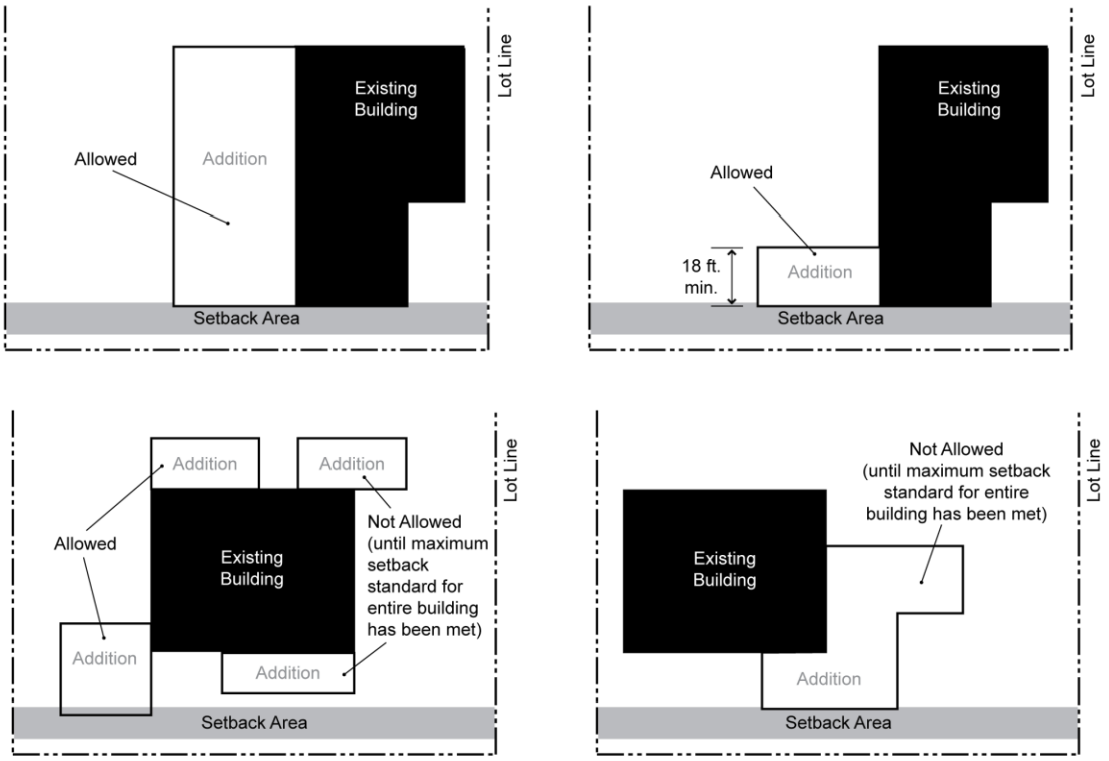
(F) Ground story transparency of at least 50 percent in the form of windows and/or door(s) for facades facing all public street frontages.

(G) Other architectural and landscaping features that achieve the goals of the overall form district vision or concept, as determined by the Director.

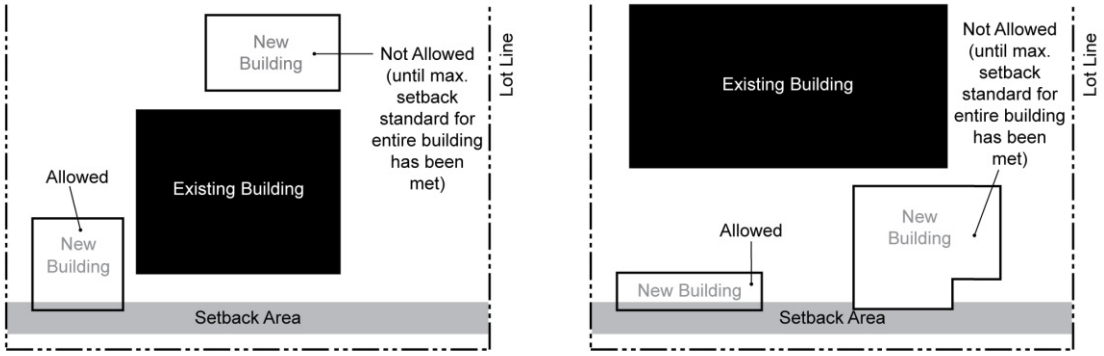
(i) Additions and New Buildings on Nonconforming Sites.

(1) Applicability. This subsection (i) apples to any development in a form district where a maximum setback applies, except in MXOC.

(2) Permitted Additions. Where an existing building is being expanded, the setback area and required building frontage standards apply to the ground level, street-facing facade of the entire addition as set forth below.



(3) Permitted New Buildings. Where a new building is being constructed on a site with a nonconforming existing building, the setback area and required building frontage standards apply to the ground level, street-facing facade of the entire new building as set forth below.



(j) Use Categories Allowed in Form Districts. For the purposes of the form districts, the following use restrictions specific to the form districts are established. The references are to the use categories included in the use table in GJMC 21.04.010.

(1) Residential. Allows household living; home occupation; and group living use categories.

(2) Institutional and Civic. Includes colleges and vocational schools; community service; cultural; day care; hospital/clinic; parks and open space; religious assembly; funeral homes/mortuaries/crematories; safety services; schools; utility, basic; utility, corridors use categories, but not detention facilities use category.

(3) Commercial. Includes entertainment event, major; lodging; office; recreation and entertainment, outdoor; recreation and entertainment, indoor; and retail sales and service (except adult entertainment) use categories. Does not include self-service storage; vehicle repair; vehicle service, limited; parking, commercial; or entertainment event, outdoor use categories.

(4) Industrial. Includes only the telecommunications facilities use category, but not manufacturing and production, industrial services, contractors and trade shops, oil and gas support operations, junk yard, impound lot, heavy equipment storage/pipe storage, warehouse and freight movement, waste-related use, wholesale sales, agricultural, aviation or surface passenger terminal, mining use categories.

(Ord. 4737, 2-1-17; Ord. 4646, 11-19-14; Ord. 4622, 2-19-14; amended during 2010 codification; Ord. 4419, 4-5-10)

Chapter 21.04

USES

Sections:
21.04.010 Use table.
21.04.020 Use categories.
21.04.030 Use-specific standards.
21.04.040 Accessory uses and structures.
21.04.050 Temporary uses and structures.

21.04.010 Use table.

(a) Use Categories and Principal Uses. The only uses allowed in any zone or district are those listed or described in the use table below. Uses are permitted subject to the requirements of the rest of the code. The use categories listed in the first column are described in GJMC 21.04.020. The second column of the use table contains a listing of principal uses associated with the use category in the first column. Each listing in the principal use column of the table may include more than one principal use. (For example, General Retail Sales, Outdoor Operations, Display or Storage contains several different retail uses, each of which may, for example, generate more traffic trips per day than another. Their inclusion in one listing means only that they are allowed in the same zone districts, but does not mean that they are treated identically with respect to other code requirements.) The last column of the use table contains cross-references to use-specific standards or other code provisions associated with the principal use(s).

(b) Allowed Uses. An "A" indicates the listed use is allowed by right within the respective zoning district. If compliance with all City, State and Federal requirements are fully met, the Director may allow development, construction and/or use. The text for each zone, the balance of this code, applicable State and other City regulations and Federal requirements supplement the use table and control if inconsistent or ambiguous. No person shall begin any use without a written approval of the Director.

(c) Conditional Uses. A "C" indicates the use is allowed within the respective zoning district only with a conditional use permit granted in accordance with the limitations, requirements and criteria of GJMC 21.02.110 and in accordance with the review procedures of GJMC 21.02.080. A conditional use is not a use by right; it is one that is prohibited within a given zone district unless a conditional use permit for the specific use has been granted. Conditional uses are subject to all other applicable standards of this code.

(d) Prohibited Uses. A blank space indicates the listed use is not allowed within the district, unless otherwise expressly allowed by another provision of this code.

Marijuana related business, whether retail, commercial, industrial or agricultural, except marijuana testing facility(ies) are prohibited in all zone districts in accordance with Chapter 5.15 GJMC. Marijuana testing facility(ies) is (are) allowed in the zone districts shown.

Marijuana testing facilities shall be categorized as/under the "industrial services, contractors and trade shops, oil and gas support operations without hazardous materials" category of the use zone matrix as "research, testing and laboratory facilities – indoors (including marijuana testing facilities)" as allowed uses in B-2, C-1, C-2, MU, BP, IO, I-1 and I-2 zone districts.

(e) Uses Not Mentioned. No building, use or development permit shall be issued for a use not specifically mentioned or described in the use table. If a question or interpretation arises regarding where, how or whether a proposed use fits into the use table, the Director shall decide if a use not specifically mentioned can reasonably be interpreted to fit into a principal use category or a general use category where similar uses are described. The Director may ask the Planning Commission at a regularly scheduled meeting to ratify his decision.

Key: A = Allowed; C = Conditional; Blank Cell = Not Permitted

USE CATEGORY	PRINCIPAL USE	R-R	R-E	R-1	R-2	R-4	R-5	R-8	R-12	R-16	R-24	R-O	B-1	B-2	C-1	C-2	CSR	M-U	BP	I-O	I-1	I-2	MX-	Std.
RESIDENTIAL																							See GJMC 21.03.090	
Household Living – residential occupancy of a dwelling unit by a "household"	Business Residence											A	A	A	A	A	A	A	A	A	A			21.04.030(i)
	Two Family Dwelling				A	A	A	A	A			A	C											
	Single-Family Detached	A	A	A	A	A	A	A				A	C	C			A							21.04.030(m)
	Multifamily						A	A	A	A	A	A	A	A	A			A	A					21.04.030(n)
	Accessory Dwelling Unit	A	A	A	A	A	A	A	A			A		A										21.04.040(f)
	Agricultural Labor Housing	A															A							
	Manufactured Housing Park						C	C	C															21.04.030(f)
	All Other Household Living						A	A	A															
Home Occupation	Home Occupation	A	A	A	A	A	A	A	A	A	A	A	A	A	A			A						21.04.040(g)
Group Living – residential occupancy of a structure by a group of people who do not meet the definition of "Household Living"	Small Group Living Facility	A	A	A	A	A	A	A	A	A	A	A	A	C	C			C	A					21.04.030(p) & 21.04.020(b)
	Large Group Living Facility						A	A	A	A	A	A	A	A	A			A	A					21.04.030(p) & 21.04.020(b)
	Unlimited Group Living Facility								A	A	A	A	A	A	A			A	A					21.04.030(p) & 21.04.020(b)
	Fraternities/ Sororities					A*	A*	A*	A*	A*	A*													21.04.030(p)(1) * location restricted; see 21.04.020(p)(1)(ii)
	Rooming/Boarding House							A	A	A	A	A	A	A	A									21.04.030(p)(3)
	Other Group Living (e.g., dormitory style living)						C	C	A	A	A	A	A	A			A	A						21.04.020(b) 21.04.030(p)(4)

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USE CATEGORY	**PRINCIPAL USE**	**R-R**	**R-E**	**R-1**	**R-2**	**R-4**	**R-5**	**R-8**	**R-12**	**R-16**	**R-24**	**R-O**	**B-1**	**B-2**	**C-1**	**C-2**	**CSR**	**M-U**	**BP**	**I-O**	**I-1**	**I-2**	**MX-**	**Std.**
INSTITUTIONAL AND CIVIC																								
Colleges and Vocational Schools – colleges and institutions of higher learning	Colleges and Universities													A	A	A	A	A	A	A	A	A	See GJMC 21.03.090	21.04.020(d)
	Vocational, Technical and Trade Schools												A	A	A	A	A	A	A	A	A	A		
Community Service – uses providing a local service to the community	Community Activity Building	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A				21.04.020(e)
	All Other Community Service	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A		21.04.020(e)
Cultural – establishments that document the social and religious structures and intellectual and artistic manifestations that characterize a society	Museums, Art Galleries, Opera Houses, Libraries								A	A	A	A	A	A	A	A	A	A		A	A	A		
Day Care – care, protection and supervision for children or adults on a regular basis away from their primary residence for less than 24 hours per day	Home-Based Day Care (1 – 12)	A	A	A	A	A	A	A	A	A	A	A	A	A	A			A						21.04.020(f)
	General Day Care	C	C	C	C	C	C	A	A	A	A	A	A	A	A	A		A	A	A				21.04.020(f)
Detention Facilities – facilities for the detention or incarceration of people	Jails, Honor Camps, Reformatories													C		C	C				C	C		21.04.020(cc)
	Community Corrections Facility												C	C	C	C	C							21.04.020(cc)
	Law Enforcement Rehabilitation Centers												C	C	C	C	C				C	C		21.04.020(cc)

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USE CATEGORY	PRINCIPAL USE	R-R	R-E	R-1	R-2	R-4	R-5	R-8	R-12	R-16	R-24	R-O	B-1	B-2	C-1	C-2	CSR	M-U	BP	I-O	I-1	I-2	MX-	Std.
Hospital/Clinic – uses providing medical treatment or surgical care to patients	Medical and Dental Clinics									C	C	A	A	A	A	A		A	A	A	A			21.04.020(g)
	Counseling Centers (Nonresident)											A	A	A	A	A		A	A	A				21.04.020(g)
	Hospital/Mental Hospital											C	C	C	C	C	C	C	A	C				21.04.020(g)
	Physical and Mental Rehabilitation (Resident)											C	C	C	C	C	C	C	C	C				21.04.020(g)
	All Other													C	C	C		C	C	C				21.04.020(g)
Parks and Open Space – natural areas consisting mostly of vegetative landscaping or outdoor recreation, community gardens, etc.	Cemetery	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A						21.04.020(h)
	Golf Course	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A		A	A	A		21.04.020(h)
	Golf Driving Ranges	A	A	A	A	C	C	C	C	C	C	C	A	A	A	A	A	A		A	A	A		21.04.020(h)
	Parks, Lakes, Reservoirs, Other Open Space	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A		A	A	A		21.04.020(h)
Religious Assembly – meeting area for religious activities	All	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A		A			21.04.030(o)& 21.04.020(i)
Funeral Home/ Mortuary	All											A	A	A	A	A		A	A	A				
Crematory	All															A				A	A	A		
Safety Services – public safety and emergency response services	All	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A		21.04.020(j)
Schools – schools at the primary, elementary, middle, junior high or high school level	Boarding Schools								A	A	A	A	A	C	C	C	A	A	A					21.04.020(k)
	Elementary Schools	A	A	A	A	A	A	A	A	A	A	A	A	A	A		A	A	A					21.04.020(k)
	Secondary Schools	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A					21.04.020(k)

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USE CATEGORY	**PRINCIPAL USE**	**R-R**	**R-E**	**R-1**	**R-2**	**R-4**	**R-5**	**R-8**	**R-12**	**R-16**	**R-24**	**R-O**	**B-1**	**B-2**	**C-1**	**C-2**	**CSR**	**M-U**	**BP**	**I-O**	**I-1**	**I-2**	**MX-**	**Std.**
Utility, Basic – Infrastructure services that need to be located in or near the area where the service is provided	Utility Service Facilities (Underground)	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A		21.04.020(l)
	All Other Utility, Basic	C	C	C	C	C	C	C	C	C	C	A	A	A	A	A	A	C	A	A	A	A		21.04.020(l)
Utility, Corridors – passageways for bulk transmitting or transporting of electricity, gas, oil, communication signals, or other similar services	Transmission Lines (Above Ground)	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C		C	C	C	C	C		21.04.020(m)
	Transmission Lines (Underground)	C	C	C	C	C	C	C	C	C	C	C	C	C	C	A		C	A	A	A	A		21.04.020(m)
	Utility Treatment, Production or Service Facility																	C	C	C	C	C		21.04.020(m)
	All Other	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C		C	C	C	C	C		21.04.020(m)
COMMERCIAL																								
Entertainment Event, Major – activities and structures that draw large numbers of people to specific events or shows	Indoor Facilities	A												A	A	A	A	A	A	A			See GJMC 21.03.090	21.04.020(n)
	Outdoor Facilities	C														C	C	C	C	C	C	C		21.04.020(n)
Lodging – hotels, motels, short-term rentals and similar establishments	Hotels and Motels													A	A	A		A	A	A				
	Short-Term Rentals	A	A	A	A	A	A	A	A	A	A	A	A	A	A			A	A					21.04.030(h)
Office – activities conducted in an office setting and generally focusing on business, government, professional, or financial services	General Offices											A	A	A	A	A	A	A	A	A	A			21.04.020(o)
	Office with Drive-Through												A	A	A	A	A	A	A	A	A			21.04.020(o)

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USE CATEGORY	PRINCIPAL USE	R-R	R-E	R-1	R-2	R-4	R-5	R-8	R-12	R-16	R-24	R-O	B-1	B-2	C-1	C-2	CSR	M-U	BP	I-O	I-1	I-2	MX-	Std.
Parking, Commercial – parking that is not necessary to serve a specific use and for which fees may be charged	All											C	A		A	A	A	A	A	A	A	A		21.06.050(b) & 21.04.020(p)
Recreation and Entertainment, Outdoor – large, generally commercial uses that provide continuous recreation or entertainment-oriented activities	Campgrounds	C													A	A	A							21.04.030(e)
	Resort Cabins and Lodges	C															A							21.04.020(q)
	Swimming Pools, Community	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A					21.04.020(q)
	Shooting Ranges, Outdoor																C				C	C		21.04.020(q)
	Amusement Park, Miniature Golf														A	A	C	C	C					21.04.020(q)
	Riding Academy, Roping or Equestrian Area	C	C														C							21.04.030(a) & 21.04.020(q)
	Zoo														C	C	C							21.04.030(a) & 21.04.020(q)
	All Other Outdoor Recreation	C													C	C	C	C			C	C		21.04.020(q)
	Health Club											A	A	A	A	A	A	A	A	A	A			
Recreation and Entertainment, Indoor – large, generally commercial uses that provide indoor recreation or entertainment-oriented activities including health clubs, movie theaters, skating rinks, arcades	Movie Theater, Skating Rink, Arcade												A	A	A	A	A	A		A				
	Shooting Ranges, Indoor														C	C	C				C	C		
	All Other Indoor Recreation												C	A	A	A	A	C	A	A	C			

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USE CATEGORY	**PRINCIPAL USE**	**R-R**	**R-E**	**R-1**	**R-2**	**R-4**	**R-5**	**R-8**	**R-12**	**R-16**	**R-24**	**R-O**	**B-1**	**B-2**	**C-1**	**C-2**	**CSR**	**M-U**	**BP**	**I-O**	**I-1**	**I-2**	**MX-**	**Std.**
Retail Sales and Service* – firms involved in the sale, lease or rental of new or used products to the general public. They may also provide personal services or entertainment, or provide product repair or services for consumer and business goods.	Adult Entertainment														A	A					A	A		21.04.030(b) & 21.04.020(r)
	Alcohol Sales, Retail												A	A	A	A		A	C					21.04.020(r)
	Bar/Nightclub												C	C	C	C		C	C	C	C			21.04.020(r)
	Animal Care/ Boarding/Sales, Indoor	A											A	A	A	A			A	A	A			21.04.020(r)
	Animal Care/ Boarding/Sales, Outdoor	C														A			C	C	C			21.04.030(a) & 21.04.020(r)
	Delivery and Dispatch Services (Vehicles On-Site)														A	A				A	A	A		21.04.020(r)
	Drive-Through Uses (Restaurants)													A	A	A			A		A			21.04.020(r)
	Drive-Through Uses (Retail)												A	A	A	A			A		A			21.04.020(r)
	Food Service, Catering												A	A	A	A		A	A	A	A			21.04.020(r)
	Food Service, Restaurant (Including Alcohol Sales)												A	A	A	A	A	A	A	A	A			21.04.020(r)
	Farm Implement/ Equipment Sales/ Service														A	A					A	A		21.04.030(l)& 21.04.020(r)
	Farmers' Market													A	A	A		A						21.04.020(r)
	Flea Market															A					A	A		21.04.030(c)& 21.04.020(r)
	Feed Store														A	A					A	A		21.04.020(r)
	Fuel Sales, Automotive/ Appliance												A	A	A	A					A	A		21.04.020(r)
	Fuel Sales, Heavy Vehicle															A					A	A		21.04.020(r)

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USE CATEGORY	PRINCIPAL USE	R-R	R-E	R-1	R-2	R-4	R-5	R-8	R-12	R-16	R-24	R-O	B-1	B-2	C-1	C-2	CSR	M-U	BP	I-O	I-1	I-2	MX-	Std.
	General Retail Sales, Indoor Operations, Display and Storage												A	A	A	A		A	A					21.04.030(l)& 21.04.020(r)
	General Retail Sales, Outdoor Operations, Display or Storage														A	A		A			C			21.04.040(h) & 21.04.020(r)
	Landscaping Materials Sale/ Greenhouse/ Nursery	C	C	C	C										A	A	C				A	C		21.04.020(r)
	Manufactured Building Sales and Service															A					A			21.04.020(r)
	Marijuana Related Business																							Ch. 5.15
	Produce Stands	A	A	A	A	A	A	A	A	A	A	A	A	A		A	A	A	A	A	A	A		21.04.030(u)
	Rental Service, Indoor Display/ Storage													A	A	A		A			A			21.04.020(r)
	Rental Service, Outdoor Display/ Storage														A	A					A			21.04.040(h)& 21.04.020(r)
	Repair, Small Appliance											A	A	A	A	A		A			A			21.04.020(r)
	Repair, Large Appliance													A	A	A		A			A	A		21.04.020(r)
	Personal Services											A	A	A	A	A		A	A	C				21.04.020(r)
	All Other Retail Sales and Services												A	A	A	A		C	C	C				21.04.030(l)& 21.04.020(r)
Self-Service Storage – uses providing separate storage areas for individual or business uses	Mini-Warehouse									C	C		C		A	A			A	A	A	A		21.04.030(g)& 21.04.020(s)

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USE CATEGORY	**PRINCIPAL USE**	**R-R**	**R-E**	**R-1**	**R-2**	**R-4**	**R-5**	**R-8**	**R-12**	**R-16**	**R-24**	**R-O**	**B-1**	**B-2**	**C-1**	**C-2**	**CSR**	**M-U**	**BP**	**I-O**	**I-1**	**I-2**	**MX-**	**Std.**
Vehicle Repair – repair service to passenger vehicles, light and medium trucks and other consumer motor vehicles	Auto and Light Truck Mechanical Repair														A	A			A	A	A	A		21.04.020(t)
	Body Shop														A	A			A	A	A	A		21.04.020(t)
	Truck Stop/Travel Plaza														A	A			A		A	A		21.04.030(s)& 21.04.020(t)
	Tire Recapping and Storage															A					A	A		21.04.020(t)
	All Other Vehicle Repair															C					C	A		21.04.030(s)& 21.04.020(t)
Vehicle Service, Limited – direct services to motor vehicles where the driver or passengers generally wait in the car or nearby while the service is performed	Car Wash, Gasoline Service Station, Quick Lube												A	A	A	A		A	A	A	A	A		21.04.030(s)& 21.04.020(u)
	All Other Vehicle Service, Limited														A	A					A	A		21.04.020(u)
INDUSTRIAL																								
Manufacturing and Production – firms involved in the manufacturing, processing, fabrication, packaging, or assembly of goods	***Indoor Operations and Storage***																							
	Assembly													A	A	A		A	A	A	A	A		21.04.020(w)
	Food Products													A	A	A		A	A	A	A	A		21.04.020(w)
	Manufacturing/ Processing													A	A	A		A	A	A	A	A		21.04.020(w)
	Marijuana Related Business																							Ch. 5.15
	Indoor Operations with Outdoor Storage																							
	Assembly														A	A			A	A	A	A		21.04.040(h) & 21.04.020(w)
	Food Products														A	A			A	A	A	A		21.04.040(h) & 21.04.020(w)
	Manufacturing/ Processing															A			A	A	A	A		21.04.040(h) & 21.04.020(w)
	Marijuana Related Business																							Ch. 5.15

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USE CATEGORY	PRINCIPAL USE	R-R	R-E	R-1	R-2	R-4	R-5	R-8	R-12	R-16	R-24	R-O	B-1	B-2	C-1	C-2	CSR	M-U	BP	I-O	I-1	I-2	MX-	Std.
	Outdoor Operations and Storage																							
	Assembly															C				C	A	A	See GJMC 21.03.090	21.04.040(h) & 21.04.020(w)
	Food Products															C				C	A	A		21.04.040(h) & 21.04.020(w)
	Manufacturing/ Processing															C				C	A	A		21.04.040(h) & 21.04.020(w)
	Marijuana Related Business																							Ch. 5.15
	All Other Industrial Service, Including any Hazardous Occupancy per the International Fire Code or International Building Code																			C	C	C		21.04.040(h) & 21.04.020(w)
Industrial Services, Contractors and Trade Shops, Oil and Gas Support Operations without hazardous materials	Indoor Operations and Storage													C	A	A		A		A	A	A	See GJMC 21.03.090	
	Indoor Operations and Outdoor Storage (Including Heavy Vehicles)															A			C	A	A	A		21.04.040(h)
	Outdoor Storage And Operations															A				A	A	A		21.04.040(h)
	Research, Testing and Laboratory Facilities – Indoors (Includes Marijuana Testing Facilities)													A	A	A		A	A	A	A	A		Ch. 5.15
Junk Yard	Junk Yard																				C	C		21.04.030(d)& 21.04.040(h)
Impound Lot	Impound Lot															C					C	C		21.04.030(d)& 21.04.040(h)
Heavy Equipment Storage/Pipe Storage	All																			A	A	A		21.04.040(h)

Key: A = Allowed; C = Conditional; Blank Cell = Not Permitted																								
USE CATEGORY	**PRINCIPAL USE**	**R-R**	**R-E**	**R-1**	**R-2**	**R-4**	**R-5**	**R-8**	**R-12**	**R-16**	**R-24**	**R-O**	**B-1**	**B-2**	**C-1**	**C-2**	**CSR**	**M-U**	**BP**	**I-O**	**I-1**	**I-2**	**MX-**	**Std.**
Warehouse and Freight Movement – firms involved in the storage or movement of freight	Indoor Operations, Storage and Loading															A		A		A	A	A		21.04.020(x)
	Indoor Storage with Outdoor Loading Docks															A		A		A	A	A		21.04.020(x)
	Outdoor Storage or Loading															A				A	A	A		21.04.040(h)& 21.04.020(x)
	Gas or Petroleum Storage																			C	C	C		21.04.020(x)
	Sand or Gravel Storage																				A	A		21.04.030(k)& 21.04.020(x)
	All Other																				C	C		21.04.020(x)
Waste-Related Use – uses that receive solid or liquid wastes from others, uses that collect sanitary wastes or uses that manufacture or produce goods or energy from the composting of organic material	Non-Hazardous Waste Transfer Station																C				C	C		21.04.020(y)
	Medical/Hazardous Waste Transfer Station																C				C	C		21.04.030(j)& 21.04.020(y)
	Solid Waste Disposal Sites																C				C	C		21.04.030(d)& 21.04.020(y)
	Recycling Collection Point												C	C	C	C	C			C	C	C		21.04.030(d) & 21.04.020(y)
	All Other Waste-Related																C				C	C		21.04.030(d)& 21.04.020(y)

Key: A = Allowed; C = Conditional; Blank Cell = Not Permitted

USE CATEGORY	PRINCIPAL USE	R-R	R-E	R-1	R-2	R-4	R-5	R-8	R-12	R-16	R-24	R-O	B-1	B-2	C-1	C-2	CSR	M-U	BP	I-O	I-1	I-2	MX-	Std.
Wholesale Sales – firms involved in the sale, lease or rental of products primarily intended for industrial, institutional or commercial businesses	Wholesale Business (No Highly Flammable Materials/Liquids)															A		A		A	A	A		21.04.020(z)
	Agricultural Products	C																			A	A		21.04.020(z)
	All Other Wholesale Uses																				A	A		21.04.020(z)
Agricultural	Animal Confinement																C				C	C		21.04.030(a) & 21.04.020(aa)
	Dairy	C															C				C	C		21.04.030(a)& 21.04.020(aa)
	Confined Animal Feeding Operation, Feedlot																C				C	C		21.04.030(a)& 21.04.020(aa)
	Forestry, Commercial	A																						21.04.020(aa)
	Marijuana Related Business																							Ch. 5.15
	Pasture, Commercial	A	A	A	A																A	A		21.04.020(aa)
	Winery	A															A	A			A	A		21.04.020(aa)
	All Other Agriculture	A	A	A	A																			21.04.020(aa)

Key: A = Allowed; C = Conditional; Blank Cell = Not Permitted																							
USE CATEGORY	**PRINCIPAL USE**	**R-R**	**R-E**	**R-1**	**R-2**	**R-4**	**R-5**	**R-8**	**R-12**	**R-16**	**R-24**	**R-O**	**B-1**	**B-2**	**C-1**	**C-2**	**CSR**	**M-U**	**BP**	**I-O**	**I-1**	**I-2**	**MX-**	**Std.**
Aviation or Surface Passenger Terminal – facilities for the landing and takeoff of flying vehicles or stations for ground-based vehicles, including loading and unloading areas	Airports/Heliports															C	C			C	C	C		21.04.020(bb)
	Bus/Commuter Stops	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A		21.04.020(bb)
	Bus/Railroad Depot													A	A	A	A			A	A	A		21.04.020(bb)
	Helipads													C	C	C	C	C		C	C	C		21.04.020(bb)
	All Other Aviation or Surface Passenger Terminal																C			C	C	C		21.04.020(bb)
Mining – mining or extraction of mineral or aggregate resources from the ground for off-site use	Oil or Gas Drilling	C	C														C				C	C		21.04.020(dd)
	Sand or Gravel Extraction or Processing	C	C														C			C	C	C		21.04.030(k) & 21.04.020(dd)
	All Other Mining	C	C														C					C		21.04.030(k) & 21.04.020(dd)
Telecom-munications Facilities – devices and supporting elements necessary to produce nonionizing electromagnetic radiation operating to produce a signal	Facilities on Wireless Master Plan Priority Site When Developed in Accordance with Wireless Master Plan Site-Specific Requirements	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	21.04.030(q)& 21.04.020(ee)
	Temporary PWSF (e.g., COW)	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	21.04.030(q)
	Co-Location	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	21.04.030(q)
	Tower Replacement	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	21.04.030(q)
	Dual Purpose Facility	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	21.04.030(q)

Key: A = Allowed; C = Conditional; Blank Cell = Not Permitted																								
USE CATEGORY	**PRINCIPAL USE**	**R-R**	**R-E**	**R-1**	**R-2**	**R-4**	**R-5**	**R-8**	**R-12**	**R-16**	**R-24**	**R-O**	**B-1**	**B-2**	**C-1**	**C-2**	**CSR**	**M-U**	**BP**	**I-O**	**I-1**	**I-2**	**MX-**	**Std.**
	DAS and Small Cell Facilities	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	21.04.030(q)
	Base Station with Concealed Attached Antennas	A**	A**	A**	A**	A**	A**	A**	A**	A**	A**	A**	A**	A	A	A	A	A**	A**	A	A	A	A**	21.04.030(q)
	Base Station with Non-Concealed Attached Antennas	C**	C**	C**	C**	C**	C**	C**	C**	C**	C**	C**	C**	C	A	A	A	C**	A**	A	A	A	C**	21.04.030(q)
	Tower, Concealed	C	C***	C***	C***	C***	C***	C***	C	C	C	C	C	C	A	A	C	C	C	C	A	A		21.04.030(q)
	Tower, Non-Concealed														C	C	C				C	C		21.04.030(q)
	Broadcast Tower																				C	C		21.04.030(q)

NOTES:

* Refer to Chapter 5.15 GJMC.

** Except NOT allowed on structures the principal use of which is single- or two-family residential, group living, or day care, or on multifamily structures of fewer than three stories.

*** Except NOT allowed on any site or lot where the principal use is single- or two-family residential.

(Ord. 4858, 6-5-19; Ord. 4831, 2-6-19; Ord. 4813, 8-15-18; Ord. 4744, 4-5-17; Ord. 4722, 10-21-16; Ord. 4710, 7-20-16; Ord. 4704, 6-1-16; Ord. 4599, 9-4-13; Ord. 4546, 7-18-12; Ord. 4445, 11-29-10; Ord. 4419, 4-5-10)

21.04.020 Use categories.

(a) General.

(1) Basis for Classifications. Use categories classify land uses and activities into use categories based on common functional, product, or physical characteristics. Characteristics include the type and amount of activity, the type of customers or residents, how goods or services are sold or delivered and site conditions. The use categories provide a systematic basis for assigning present and future land uses into appropriate zoning districts.

(2) Principal Use Characteristics. Principal uses are assigned to the category that most closely describes the nature of the principal use. The characteristics subsection of each use category describes the common characteristics of the associated principal uses.

(3) Considerations Used in Categorizing Uses. The following considerations shall be used to determine whether and where a use belongs in the use table and whether the activity is to be considered a principal or accessory use:

(i) The actual or projected characteristics of the activity in relationship to the stated characteristics of each use category;

(ii) The relative amount of site area or floor space and equipment devoted to the activity;

(iii) Relative amounts of sales from each activity;

(iv) The customer type for each activity;

(v) The relative number of employees in each activity;

(vi) Hours of operation;

(vii) Building and site arrangement;

(viii) Vehicles used with the activity;

(ix) The relative number of vehicle trips generated by the use;

(x) Signs;

(xi) How the use advertises itself; and

(xii) Whether the activity is likely to be found independent of the other activities on the site.

(4) Developments with Multiple Principal Uses. When all principal uses of a development fall within one use category, the entire development is assigned to that use category. A development that contains a coffee shop, bookstore and bakery, for example, would be classified in the retail sales and service category because all of the development's principal uses are in that category. When the principal uses of a development fall within different use categories, each principal use is classified in the applicable category and each use is subject to all applicable regulations for that category.

(5) Accessory Uses. Accessory uses are allowed by right in conjunction with a principal use unless otherwise stated in the regulations. Also, unless otherwise stated, accessory uses are subject to the same regulations as the principal use. Common accessory uses are listed as examples in the use category descriptions.

(6) Use of Examples. The examples subsection of each use category lists common examples of uses included in the respective use category. The names of these sample uses are generic. They are based on common meanings and not on what a specific use may call itself. For example, a use that calls itself a wholesale warehouse but that sells mostly to consumers is included in the retail sales and service category rather than the wholesale sales category. This is because the actual activity on the site matches the description of the retail sales and service category.

(b) Group Living.

(1) Characteristics. Group living is characterized by the residential occupancy of a structure by a group of people who do not meet the definition of household living. A *group living facility* is a type of group living characterized by the provision of training, treatment, supervision or other professional support or care and who receive care, training, treatment, supervision or other support from caregivers or staff on site. Tenancy is arranged on a monthly or longer basis, and the size of the group may be larger than a typical family. Uses where tenancy may be arranged for a shorter period are not considered residential; they are considered to be either a form of lodging (see retail sales and service categories) or a temporary shelter (see community service categories). Generally, group living structures have a common eating area for residents, but a common eating area by itself, without other care, treatment, supervision or other professional or health support services being provided on site, does not indicate a group living facility (a multifamily residential facility, such as apartments, may, for example, have a common eating area).

(2) Accessory Uses. Accessory uses commonly associated with group living are recreational facilities and parking of vehicles for occupants and staff.

(3) Examples. The group living category is further broken down into the following subcategories:

(i) Fraternity or sorority – a place of residence that is operated by a nationally or locally chartered membership organization and is used, occupied and maintained as living and dining quarters for its members who are enrolled in an accredited college or university or other accredited educational institution and which is recognized and subject to controls by such educational institution.

(ii) Unlimited group living facility – a group living facility with 17 or more residents.

(iii) Large group living facility – a group living facility with 10 to 16 residents.

(iv) Small group living facility – a group living facility with five to nine residents.

(v) Boarding and rooming house – a single dwelling unit where a live-in or on-site owner provides lodging to others in three or more rooms, with or without meals, for compensation in the form of rent, “room and board,” or in kind services.

(vi) Other group living. Other group living includes dwelling units in a multi-unit complex shared by unrelated persons who have access to and common use of some living and eating areas and areas and facilities for the preparation and serving of food within the dwelling unit, and may include, by way of example and not limitation, dormitory style living.

(c) Household Living.

(1) Characteristics. Household living is characterized by the residential occupancy of a dwelling unit by a household. Tenancy is arranged on a month-to-month or longer basis. Uses where tenancy may be arranged for a shorter period are not considered residential. They are considered to be a form of transient lodging (see the retail sales and service and community service categories).

(2) Accessory Uses. Accessory uses commonly associated with household living are recreational activities, raising of pets, gardens, personal storage buildings, hobbies and parking of the occupants’ vehicles. Home occupations and accessory dwelling units are accessory uses that are subject to additional regulations. (See GJMC 21.04.040.)

(3) Examples. Uses include living in houses, duplexes, triplexes, fourplexes and other multidwelling structures, retirement center apartments, manufactured housing and other structures with self-contained dwelling units.

(4) Exceptions. Lodging in a dwelling unit or where less than two-thirds of the units are rented on a monthly or longer basis is considered a hotel or motel use and is classified in the retail sales and service category.

(d) Colleges.

(1) Characteristics. This category includes colleges and other institutions of higher learning that offer courses of general or specialized study leading to a degree. Colleges tend to be in campus-like settings usually on multiple blocks.

(2) Accessory Uses. Accessory uses include offices, housing for students, food service, laboratories, health and sports facilities, theaters, meeting areas, parking, maintenance facilities and support commercial.

(3) Examples. Examples include universities, liberal arts colleges, community colleges, nursing and medical schools not accessory to a hospital and seminaries.

(4) Exceptions. Business and trade schools are classified as retail sales and service.

(e) Community Services.

(1) Characteristics. Community services are uses of a public, nonprofit, or charitable nature generally providing a local service to people of the community. Generally, they provide the service on site or have employees at the site on a regular basis. The service is ongoing, not just for special events. Community centers or facilities that have membership provisions are open to the general public to join at any time (for instance, any senior citizen could join a senior center). The use may provide special counseling, education, or training of a public, nonprofit or charitable nature.

(2) Accessory Uses. Accessory uses may include offices; meeting areas; food preparation areas; parking, health and therapy areas; and athletic facilities.

(3) Examples. Examples include libraries, museums, senior centers, community centers, publicly owned swimming pools, youth club facilities, hospices, social service facilities, temporary shelters, vocational training for persons with physical or mental disabilities, crematoriums, columbariums and mausoleums.

(4) Exceptions.

(i) Private lodges, clubs and private or commercial athletic or health clubs are classified as retail sales and service. Commercial museums are classified as retail sales and service.

(ii) Parks are classified as parks and open areas.

(iii) Uses where tenancy is arranged on a month-to-month basis, or for a longer period, are residential and are classified as household or group living.

(f) Day Care.

(1) Characteristics. Day care uses provide care, protection and supervision for children or adults on a regular basis away from their primary residence for less than 24 hours per day. There are two types of day care:

(i) Home-Based Day Care. A home-based day care provides care, protection and supervision for up to 12 individuals, not including children of the day care provider, or as allowed by State licensing.

(ii) General Day Care. A general day care provides care, protection and supervision for 12 or more individuals, or as licensed by the State.

(2) Accessory Uses. Accessory uses include offices, recreation areas and parking.

(3) Examples. Examples include preschools, nursery schools, latch key programs and adult day care programs. Childcare centers, as defined in § 26-6-102(1.5), C.R.S., are classified as day care uses under this code.

(4) Exceptions. Day care does not include public or private schools or facilities operated in connection with an employment use, shopping center or other principal use, where children are cared for while parents or guardians are occupied on the premises or in the immediate vicinity.

(g) Hospitals.

(1) Characteristics. Hospitals include uses providing medical or surgical care to patients and offering overnight care.

(2) Accessory Uses. Accessory uses include outpatient clinics, offices, laboratories, teaching facilities, meeting areas, cafeterias, parking, maintenance facilities and housing facilities for staff or trainees.

(3) Examples. Examples include medical centers and hospitals.

(4) Exceptions.

(i) Uses that provide exclusive care and planned treatment or training for psychiatric, alcohol, or drug problems, where patients are residents of the program, are classified as group living facilities.

(ii) Medical clinics or centers that provide care where patients are generally not kept overnight are classified as office.

(iii) Emergency medical clinics are classified as retail sales and service.

(h) Parks and Open Areas.

(1) Characteristics. Parks and open areas are uses of land focusing on natural areas, large areas consisting mostly of vegetative landscaping or outdoor recreation, community gardens, or public squares. Lands tend to have few structures.

(2) Accessory Uses. Accessory uses may include clubhouses, maintenance facilities, concessions, caretaker’s quarters and parking.

(3) Examples. Examples include parks, golf courses, cemeteries, public squares, plazas, playgrounds, ballfields, recreation areas, recreational trails, botanical gardens, nature preserves and land used for grazing that is not part of a farm or ranch.

(i) Religious Institutions.

(1) Characteristics. Religious institutions primarily provide meeting areas for religious activities.

(2) Accessory Uses. Accessory uses include Sunday school facilities, parking, caretaker dwellings and group living facilities such as convents.

(3) Examples. Examples include churches, temples, synagogues and mosques.

(j) Safety Services.

(1) Characteristics. Safety services are uses that provide public safety and emergency response services. They often need to be located in or near the area where the service is provided. Employees are regularly present on site.

(2) Accessory Uses. Accessory uses include offices and parking.

(3) Examples. Examples include fire stations, police stations and emergency medical and ambulance stations.

(k) Schools.

(1) Characteristics. This category includes public and private schools at the primary, elementary, middle, junior high, or high school level that provide elective or State-mandated education.

(2) Accessory Uses. Accessory uses include play areas, cafeterias, recreational and sport facilities, auditoriums and before- or after-school day care.

(3) Examples. Examples include public and private daytime schools, boarding schools and military academies.

(4) Exceptions.

(i) Preschools are classified as day care uses.

(ii) Business and trade schools are classified as retail sales and service.

(l) Utilities, Basic.

(1) Characteristics. Basic utilities are infrastructure services that need to be located in or near the area where the service is provided. Basic utility uses generally do not regularly have employees at the site. Services may be publicly or privately provided.

(2) Accessory Uses. Accessory uses may include parking and control, monitoring, data or transmission equipment.

(3) Examples. Examples include water and sewage pump stations; electrical substations; water towers and reservoirs; stormwater retention and detention facilities; telephone exchanges; recycling drop-off stations; and park-and-ride facilities for mass transit.

(4) Exceptions.

(i) Services where people are generally present are classified as community services, offices, or safety services.

(ii) Utility offices where employees or customers are generally present are classified as offices.

(iii) Bus barns are classified as warehouse and freight movement.

(m) Utility Corridors.

(1) Characteristics. This category includes public or private passageways, including easements, for the express purpose of transmitting or transporting electricity, gas, oil, water, sewage, communication signals, or other similar services on a regional level.

(2) Examples. Examples include major utility transmission lines and pipelines, including 115kV or larger electrical transmission lines.

(3) Exceptions. Utility corridors located within public rights-of-way are not included.

(n) Entertainment Event, Major.

(1) Characteristics. Major entertainment event uses are characterized by activities and structures that draw large numbers of people to specific events or shows. Activities are generally of a spectator nature.

(2) Accessory Uses. Accessory uses may include restaurants, bars, concessions, parking and maintenance facilities.

(3) Examples. Examples include stadiums, sports arenas, coliseums, auditoriums, exhibition and meeting areas and fairgrounds.

(4) Exceptions.

(i) Exhibition and meeting areas with less than 20,000 square feet of total event area are classified as retail sales and service.

(ii) Banquet halls that are part of hotels or restaurants are accessory to those uses, and are included in the retail sales and service category.

(iii) Theaters, including drive-in theaters, are classified as retail sales and service.

(iv) Recreation or entertainment uses conducted on a continuous basis are classified as outdoor recreation and entertainment or retail sales and service uses.

(o) Office.

(1) Characteristics. Office uses are characterized by activities conducted in an office setting and generally focusing on business, government, professional, medical, or financial services.

(2) Accessory Uses. Accessory uses may include cafeterias, health facilities, parking, or other amenities primarily for the use of employees in the firm or building.

(3) Examples. Examples include professional services such as lawyers, accountants, engineers, or architects; financial businesses such as lenders, brokerage houses, bank headquarters, or real estate agents; data processing; sales offices; government offices and public utility offices; TV and radio studios; medical and dental clinics, medical and dental labs; and blood-collection facilities.

(4) Exceptions.

(i) Offices that are part of and located with a principal use in another category are considered accessory. Headquarters offices, when in conjunction with or adjacent to a principal use in another category, are considered part of the other category.

(ii) Contractors and others who perform services off site are included in the office category if equipment and materials are not stored on the site and fabrication, services, or similar work is not carried on at the site.

(p) Parking, Commercial.

(1) Characteristics. Commercial parking facilities provide parking that is not accessory to a specific use. A fee may or may not be charged. A facility that provides both accessory parking for a specific use and regular fee parking for people not connected to the use is also classified as a commercial parking facility.

(2) Accessory Uses. In a parking structure only, accessory uses may include gasoline sales, car washing and vehicle repair activities if these uses provide service only to vehicles parked in the garage.

(3) Examples. Examples include short- and long-term fee parking facilities and mixed parking lots (partially accessory to a specific use, partly for rent to others).

(4) Exceptions.

(i) Parking facilities that are accessory to a use, but that charge the public to park for occasional events nearby, are not considered commercial parking facilities.

(ii) Parking facilities that are accessory to a principal use are not considered commercial parking uses, even if the operator leases the facility to the principal use or charges a fee to the individuals who park in the facility.

(iii) Public transit park-and-ride facilities are classified as basic utilities.

(q) Recreation and Entertainment, Outdoor.

(1) Characteristics. Outdoor recreation and entertainment uses are large, generally commercial uses that provide continuous recreation or entertainment-oriented activities. They primarily take place outdoors. They may take place in a number of structures that are arranged together in an outdoor setting.

(2) Accessory Uses. Accessory uses may include concessions, restaurants, parking, caretaker's quarters and maintenance facilities.

(3) Examples. Examples include riding academies, roping arenas, equestrian arenas, amusement parks, theme parks, golf driving ranges, miniature golf facilities and zoos.

(4) Exceptions.

(i) Golf courses are classified as parks and open space.

(ii) Uses that draw large numbers of people to periodic events, rather than on a continuous basis, are classified as major entertainment events.

(r) Retail Sales and Service.

(1) Characteristics. Retail sales and service firms are involved in the sale, lease or rent of new or used products to the general public. They may also provide personal services or entertainment, or provide product repair or services for consumer and business goods.

(2) Accessory Uses. Accessory uses may include offices, storage of goods, manufacture or repackaging of goods for on-site sale and parking.

(3) Examples. Examples include uses from the four following groups:

(i) Sales-Oriented. Stores selling, leasing, or renting consumer, home and business goods including art, art supplies, bicycles, clothing, dry goods, electronic equipment, fabric, furniture, garden supplies, gifts, groceries, hardware, home improvements, household products, jewelry, pets, pet food, pharmaceuticals, plants, printed material, stationery and videos; food sales and sales or leasing of consumer vehicles including passenger vehicles, motorcycles, light and medium trucks and other recreational vehicles, wineries, and fruit and vegetable stands.

(ii) Personal Service-Oriented. Branch banks; emergency medical care; laundromats; photographic studios; photocopy and blueprint services; hair, tanning and personal care services; business, martial arts and other trade schools; dance or music classes; taxidermists; mortuaries; veterinarians; and animal grooming.

(iii) Entertainment-Oriented. Restaurants, cafes, delicatessens, bars and taverns; indoor continuous entertainment activities such as bowling alleys, ice rinks and game arcades; pool halls; dance halls; indoor firing ranges; theaters, health clubs, gyms, membership clubs and lodges; hotels, motels, recreational vehicle parks and other temporary lodging with an average length of stay of less than 30 days.

(iv) Repair-Oriented. Repair of TVs, bicycles, clocks, watches, shoes, guns, appliances and office equipment; photo or laundry drop-off; tailor; locksmith; and upholsterer.

(4) Exceptions.

(i) Lumberyards and other building material sales that sell primarily to contractors and do not have a retail orientation are classified as wholesale sales.

(ii) Repair and service of consumer motor vehicles, motorcycles and light and medium trucks are classified as vehicle repair. Repair and service of industrial vehicles and equipment and heavy trucks are classified as industrial service.

(iii) Sales, rental, or leasing of heavy trucks and equipment or manufactured housing units are classified as wholesale sales.

(iv) Hotels, restaurants and other services that are part of a truck stop are considered accessory to the truck stop, which is classified as industrial service.

(v) In certain situations, hotels and motels may be classified as a community service use, such as short-term housing or mass shelter. See Community Services.

(s) Self-Service Storage.

(1) Characteristics. Self-service storage uses provide separate storage areas for individual or business uses. The storage areas are designed to allow private access by the tenant for storing or removing personal property.

(2) Accessory Uses. Accessory uses may include living quarters for a resident manager or security and leasing offices. Use of the storage areas for sales, service and repair operations, or manufacturing is not considered accessory to the self-service storage use. The rental of trucks or equipment is also not considered accessory to a self-service storage use.

(3) Examples. Examples include facilities that provide individual storage areas for rent. These uses are also called mini-warehouses.

(4) Exceptions. A transfer and storage business where there are no individual storage areas or where employees are the primary movers of the goods to be stored or transferred is in the warehouse and freight movement category.

(t) Vehicle Repair.

(1) Characteristics. Vehicle repair includes servicing passenger vehicles, light and medium trucks and other consumer motor vehicles such as motorcycles, boats and recreational vehicles. The customer may wait at the site while the service or repair is being performed, but generally not.

(2) Accessory Uses. Accessory uses may include offices, sales of parts and vehicle storage.

(3) Examples. Examples include vehicle repair, transmission or muffler shop, auto body shop, alignment shop, auto upholstery shop, auto detailing and tire sales and mounting.

(4) Exceptions. Repair and service of industrial vehicles and equipment and of heavy trucks; towing and vehicle storage; and vehicle wrecking and salvage are classified as industrial service.

(u) Vehicle Service, Limited.

(1) Characteristics. Limited vehicle service uses provide direct services to motor vehicles where the driver or passengers generally wait in the car or nearby while the service is performed.

(2) Accessory Uses. Accessory uses may include auto repair and tire sales.

(3) Examples. Examples include full-service, mini-service and self-service gas stations; car washes; and quick lubrication services.

(4) Exceptions.

(i) Truck stops are classified as industrial service.

(ii) Refueling facilities for vehicles that belong to a specific use (fleet vehicles) are considered accessory uses if they are located on the site of the principal use.

(v) Industrial Service, Contractors and Trade Shops, Oil and Gas Support Operations.

(1) Characteristics. Industrial service firms are engaged in the repair or servicing of industrial, business or consumer machinery, equipment, products or by-products. Firms that service consumer goods do so by mainly providing centralized services for separate retail outlets. Con-

tractors and building maintenance services and similar uses perform services off site. Few customers, especially the general public, come to the site.

(2) Accessory Uses. Accessory activities may include offices, parking and storage.

(3) Examples. Examples include oil and gas and/or support operations; welding shops; machine shops; tool repair; electric motor repair; repair of scientific or professional instruments; sales, repair, storage, salvage or wrecking of heavy machinery, metal and building materials; towing and vehicle storage; auto and truck salvage and wrecking; heavy truck servicing and repair; tire retreading or recapping; truck stops; building, heating, plumbing or electrical contractors; printing, publishing and lithography; exterminators; janitorial and building maintenance services; fuel oil distributors; solid fuel yards; research and development laboratories; laundry, dry-cleaning and carpet cleaning plants; and photofinishing laboratories.

(4) Exceptions.

(i) Contractors and others who perform services off site are included in the office category, if major equipment and materials are not stored at the site and fabrication, or similar work, is not carried on at the site.

(ii) Hotels, restaurants and other services that are part of a truck stop are considered accessory to the truck stop.

(iii) Operations which include storage of hazardous materials require a CUP.

(w) Manufacturing and Production.

(1) Characteristics. Manufacturing and production uses are involved in the manufacturing, processing, fabrication, packaging, or assembly of goods. Natural, manmade, raw, secondary, or partially completed materials may be used. Products may be finished or semifinished and are generally made for the wholesale market, for transfer to other plants, or to order for firms or consumers. Goods are generally not displayed or sold on site, but if so, they are a subordinate part of sales. Relatively few customers come to the manufacturing site.

(2) Accessory Uses. Accessory activities may include offices, cafeterias, parking, employee recreational facilities, warehouses, storage yards, repair facilities, truck fleets and caretaker's quarters.

(3) Examples. Examples include processing of food and related products; catering establishments; slaughter houses and meat packing; weaving or production of textiles or apparel; lumber mills, pulp and paper mills and other wood products manufacturing; woodworking, including cabinet makers; production of chemical, rubber, leather, clay, bone, plastic, stone, or glass materials or products; movie production facilities; concrete batching and asphalt mixing; production or fabrication of metals or metal products including enameling and galvanizing; manufacture or assembly of machinery, equipment, instruments, including musical instruments, vehicles, appliances, precision items and other electrical items; production of artwork and toys; sign making; and production of prefabricated structures, including mobile homes.

(4) Exceptions.

(i) Manufacturing of goods to be sold primarily on site and to the general public are classified as retail sales and service.

(ii) Manufacture and production of goods from composting organic material is classified as waste-related uses.

(x) Warehouse and Freight Movement.

(1) Characteristics. Warehouse and freight movement uses are involved in the storage or movement of goods for themselves or other firms. Goods are generally delivered to other firms or

the final consumer, except for some will-call pickups. There is little on-site sales activity with the customer present.

(2) Accessory Uses. Accessory uses may include offices, truck fleet parking and maintenance areas.

(3) Examples. Examples include separate warehouses used by retail stores such as furniture and appliance stores; household moving and general freight storage; cold storage plants, including frozen food lockers; storage of weapons and ammunition; major wholesale distribution centers; truck, or air freight terminals; bus barns; parcel services; major post offices; and grain terminals.

(4) Exceptions.

(i) Uses that involve the transfer or storage of solid or liquid wastes are classified as waste-related uses.

(ii) Mini-warehouses are classified as self-service storage uses.

(y) Waste-Related.

(1) Characteristics. Waste-related uses are characterized by uses that receive solid or liquid wastes from others for disposal on the site or for transfer to another location, uses that collect sanitary wastes, or uses that manufacture or produce goods or energy from the composting of organic material. Waste-related uses also include uses that receive hazardous wastes from others.

(2) Accessory Uses. Accessory uses may include recycling of materials, offices and repackaging and transshipment of by-products.

(3) Examples. Examples include sanitary landfills, tire disposal or recycling, waste composting, recycling processing facilities, incinerators, energy recovery plants, sewage plants, brine disposal/storage and hazardous-waste-collection sites.

(4) Exceptions. Disposal of dirt, concrete, asphalt and similar nondecomposable materials is considered fill. Recycling drop-off stations (no on-site processing) are basic utility uses.

(z) Wholesale Sales.

(1) Characteristics. Wholesale sales uses are involved in the sale, lease, or rental of products primarily intended for industrial, institutional, or commercial businesses. The uses emphasize on-site sales or order taking and often include display areas. Businesses may or may not be open to the general public, but sales to the general public are limited. Products may be picked up on site or delivered to the customer.

(2) Accessory Uses. Accessory uses may include offices, product repair, warehouses, parking, minor fabrication services and repackaging of goods.

(3) Examples. Examples include sale or rental of machinery, equipment, heavy trucks, building materials, special trade tools, welding supplies, machine parts, electrical supplies, janitorial supplies, restaurant equipment and store fixtures; mail order houses; and wholesalers of food, clothing, auto parts, and building hardware.

(4) Exceptions.

(i) Firms that engage primarily in sales to the general public or on a membership basis are classified as retail sales and service.

(ii) Firms that are primarily storing goods with little on-site business activity are classified as warehouse and freight movement.

(aa) Agriculture.

(1) Characteristics. Agriculture includes activities that primarily involve raising, producing or keeping plants or animals.

(2) Accessory Uses. Accessory uses include dwellings for proprietors and employees of the use, animal training, and wholesale sales of products produced on site.

(3) Examples. Examples include breeding or raising of fowl or other animals; dairy farms; stables; riding academies; kennels or other animal boarding places; farming, orchards, vineyards, truck gardening, forestry, tree farming; and wholesale plant nurseries.

(4) Exceptions.

(i) Processing of animal or plant products are classified as manufacturing and production.

(ii) Livestock auctions are classified as wholesale sales.

(iii) Plant nurseries that are oriented to retail sales are classified as retail sales and service.

(bb) Aviation and Surface Passenger Terminals.

(1) Characteristics. Aviation and surface passenger terminals include facilities for the landing and takeoff of aircraft, including loading and unloading areas. Aviation facilities may be improved or unimproved. Aviation and surface passenger terminals also include passenger terminals for aircraft, regional bus service and regional rail service.

(2) Accessory Uses. Accessory uses include freight handling areas, concessions, offices, parking and maintenance and fueling facilities.

(3) Examples. Examples include airports, bus passenger terminals for regional bus service, railroad passenger stations for regional rail service and helicopter landing facilities.

(4) Exceptions.

(i) Bus and rail passenger stations for subregional service such as mass transit stops and park-and-ride facilities are classified as basic utilities.

(ii) Private helicopter landing facilities that are accessory to another use are considered accessory uses. However, they are subject to all the regulations and approval criteria for helicopter landing facilities.

(cc) Detention Facilities.

(1) Characteristics. Detention facilities include facilities for the judicially required detention or incarceration of people. Inmates and detainees are under 24-hour supervision by peace officers, except when on an approved leave.

(2) Accessory Uses. Accessory uses include offices, recreational and health facilities, therapy facilities, maintenance facilities and hobby and manufacturing activities.

(3) Examples. Examples include prisons, jails, and probation centers.

(4) Exceptions. Programs that provide care and training or treatment for psychiatric, alcohol, or drug problems, where patients are residents of the program, but where patients are not supervised by peace officers are classified as group living. Programs that provide transitional living experience for former offenders, such as halfway houses, where residents are not supervised by peace officers, are also classified as group living.

(dd) Mining.

(1) Characteristics. Mining includes mining or extraction of mineral or aggregate resources from the ground for off-site use.

(2) Accessory Uses. Accessory uses include storage, sorting, stockpiling, or transfer off site of the mined material.

(3) Examples. Examples include quarrying or dredging for sand, gravel or other aggregate materials; mining; and oil, gas, or geothermal drilling.

(ee) Telecommunications Facilities.

(1) Characteristics. Telecommunications facilities include all devices, mechanical and/or electronic equipment or machinery, supporting structures or supporting elements, antenna(s), conduit, cable, enclosures, equipment compound(s), and/or assemblages necessary to generate or transmit nonionizing electromagnetic radiation or light operating to produce a signal or message used for communication. Facilities may be self-supporting, guyed, or mounted on poles, other structures, light posts, power poles, or buildings, or may be installed underground. Facilities shall also include intertie and interconnection translators, access points, access vaults or cabinets, connections from over-the-air to cable, fiber optic, or other landline transmission system.

(2) Accessory Uses. Accessory use may include transmitter facility buildings.

(3) Examples. Examples include broadcast towers, communication towers, point-to-point microwave towers, distributed antenna systems, small cell facilities, fiber-optic cables, and any other facility defined, referenced or described in GJMC 21.04.030(q).

(4) Exceptions. Exempt facilities are described in GJMC 21.04.030(q).

(Ord. 4744, 4-5-17; Ord. 4704, 6-1-16; Ord. 4546, 7-18-12; Ord. 4419, 4-5-10)

21.04.030 Use-specific standards.

(a) Animal Regulations.

(1) Purpose and Scope.

(i) This subsection provides rules and regulations for the keeping of agricultural animals, household pets and other animals. Keeping of animals shall not become a nuisance, hazard and/or create a public health problem.

(ii) Animal uses such as feedlots, zoos, kennels and veterinary/animal hospitals are specifically identified in the use table and shall be administered by the provisions of this chapter.

(2) Nonconforming Use. The existing, lawful use of a premises or structure, used for the keeping of animals, which is not in conformance with the provisions of this code, may be continued, subject to the following:

(i) No use may be expanded or enlarged, except in conformance with this code;

(ii) If a nonconforming use is discontinued for 12 consecutive months, any future use shall fully conform to this code; and

(iii) Having written proof of the existence of the use shall be the responsibility of the occupant or property owner.

(3) Agricultural Animals (see Definitions).

(i) The CSR, R-R, R-E, R-1 and R-2 districts shall not have more than one large agricultural animal per one-quarter acre of land and shall be subject to the fencing requirements of this chapter. In these districts, all types of fowl (e.g., chickens, turkeys, ducks, and geese) shall be allowed, subject to the confinement provisions of this subsection.

(ii) In all other districts, a maximum of one large agricultural animal (e.g., horse, sheep, cow, mule or burro) shall be allowed per one-half acre of land.

(iii) Agricultural animals shall be subject to the following provisions:

(A) All large agricultural animals kept on a parcel shall be fenced so that they are no closer than 100 feet from any residential structure on another property. For the purposes of this section, the first in time shall be the first in right. Written permission, if the animal were not first in time, for a lesser distance may be obtained from the property owner, or if not owner occupied, from the occupant.

(B) No person shall keep, house, or shelter one or more pig in any zone district other than R-R unless such person has obtained a conditional use permit in accordance with the provisions of GJMC 21.02.110.

(C) Small animals (e.g., chickens and rabbits), which are kept outside the residence, shall be confined by a fence, cage, or pen so as to be no closer than 20 feet from a principal residential structure on an adjoining property. A maximum of six adult animals shall be allowed on parcels of one-half an acre or less. On parcels greater than one-half an acre, 15 adult animals shall be allowed per acre.

(D) In the R-R district, the number of agricultural animals and small animals allowed under this subsection may be exceeded with a conditional use permit (see GJMC 21.02.110). If the conditional use application is approved, the permit shall state the maximum number of animals allowed by type and in the aggregate.

(4) Household Pets (See GJMC 21.10.020, Terms defined).

(i) In all districts, a maximum of three adult (four months or older) household pets, e.g., dogs and cats, per species, shall be allowed. In no event shall the total number of adult household pets exceed six.

(ii) The requirements of subsection (a)(4)(i) of this section shall not apply to those small animals kept within a residence as household pets, e.g., fish, small birds (parakeets, parrots), rodents (mice, rats), and reptiles (nonpoisonous snakes, lizards).

(iii) Dogs or cats kept confined in kennels shall be kept no closer than 20 feet from the nearest principal residential structure on an adjacent property, unless written permission for a lesser distance is obtained from the adjacent occupant or property owner. Such permission may be revoked at any time. Upon revocation, the owner of the animal shall have 30 days to move the animal so that compliance is achieved.

(5) Other Animals.

(i) Other animals may be kept only after obtaining approval from the Director.

(ii) Racing Pigeons. “Racing pigeon,” by definition, is a pigeon which, through selective past breeding, has developed the distinctive physical and mental characteristics as to enable it to return to its home after having been released a considerable distance therefrom, and which is accepted as such by the American Racing Pigeon Union, Inc. or the International Federation of Racing Pigeons Fanciers. Also commonly known as Racing Homer, Homing Pigeon or Carrier Pigeon. The structure for the keeping of housing of pigeons permitted by this regulation is defined as a “loft.” The keeping of pigeons as defined above shall be permitted on the following conditions which are, in part, recommended by the Avian Assistance Council and the American Racing Pigeon Union, Inc.:

(A) The loft shall be of such sufficient size and design, and constructed of such material, that it can be maintained in a clean and sanitary condition and shall contain at least one square foot of floor space for each mature pigeon kept therein.

(B) The construction and location of the loft shall not conflict with the requirements of this code or building code. The loft shall be enclosed except for the aviary portion which cannot exceed 20 percent of the floor area of the loft.

(C) The loft shall be maintained in a sanitary condition and in compliance with all applicable health regulations of the City.

(D) All feed for said pigeons shall be stored in such containers as to protect against intrusion by rodents and other vermin.

(E) A maximum of 50 performing birds shall be allowed on parcels of one-half acre or less. On parcels greater than one-half acre, a maximum of 100 performing birds shall be allowed. Performing birds are birds that leave the loft in training and for racing.

(F) All pigeons shall be confined to the loft, except for limited periods necessary for exercise, training and competition; and at no time shall pigeons be allowed to perch or linger on the buildings or property of others. Pigeons shall be fed only in the confines of the loft.

(G) No one shall release pigeons to fly for exercise, training or competition except in compliance with the following rules:

a. The owner of the pigeons must be a member in good standing of an organized pigeon club, such as the Grand Junction Racing Pigeon Club, The American Racing Pigeon Union, Inc. or other club that has rules that will help preserve the peace and tranquility of the neighborhood.

b. Pigeons will not be released for flying which have been fed within the previous four hours.

c. Pigeons shall be banded and registered with one of the national pigeon associations/registries.

(H) A structure housing racing pigeons shall be no closer than 50 feet to any adjacent residential or commercial structure on another property.

(b) Adult Entertainment.

(1) The City Council finds that the concentration of certain adult entertainment establishments in cities tends to result in the blighting and deterioration of the areas of such concentration. Accordingly, it is necessary that these establishments be regulated in a manner as to prevent the erosion of the character of affected neighborhoods.

(2) No adult entertainment establishment as defined herein shall be permitted within the City of Grand Junction except as provided in this code.

(3) The purpose of this subsection is to establish for the zoning and location of adult entertainment establishments which:

(i) Are not a nuisance; and

(ii) Do not violate the provisions of the law regarding sexual conduct, obscene material or obscene conduct.

(4) Nothing in this code authorizes, legalizes or permits the establishment, operation or maintenance of any business, building or activity which violates any other municipal ordinance or provision of the laws regarding nuisances, sexual conduct, obscene material or obscene conduct. “Obscene material” or “obscene conduct” means that material or conduct which, taken as a whole, appeals to the prurient interest of the average person, applying a contemporary local standard and depicts or describes sexual conduct which, taken as a whole, lacks serious literary, artistic, political or scientific value. The term “contemporary local standard” means that the material or conduct at issue must be measured in terms of the contemporary community standards of the City.

(5) Definitions.

(i) Adult Entertainment Establishments. Any establishment which conducts as a principal use of the premises or as a significant or substantial adjunct to another use of the premises, the sale, rental, display or other offering of live entertainment, dancing or material which is distinguished or characterized by its emphasis on depicting, exhibiting, describing or relating to specified sexual activities or specified anatomical areas, including but not limited to:

(A) Adult bookstore: Any establishment which sells or rents adult material including but not limited to books, magazines, movies, films, slides, or other photographic or written material and/or devices;

(B) Adult hotel or motel: Any hotel or motel in which the presentation of adult material is the primary or a principal attraction; and

(C) Adult motion picture theater: Any fully enclosed theater in which the presentation of adult material is the primary or principal attraction;

(D) Adult cabaret, restaurant or place of business: a cabaret, restaurant or place of business which features topless and/or bottomless dancers, waitresses, waiters, or entertainers, or any other depiction of adult material.

(ii) Adult Material. Any material including, but not limited to, books, magazines, newspapers, movie films, slides, or other photographic or written materials, video tapes and/or devices which are distinguished by their emphasis on depicting, describing or relating to specified anatomical areas or specified sexual activities:

(A) Specified anatomical areas are any of the following which are less than completely and opaquely covered:

a. Human genitals and pubic region;

b. Buttocks;

c. The human female breast or breasts to a point immediately below the top of the areola; and

d. Human male genitals in a discernibly turgid state even if completely and opaquely covered.

(B) Specified sexual activities or sexual conduct:

a. Human genitals in a state of sexual stimulation or arousal;

b. Actual or simulated acts of sexual intercourse, masturbation, sodomy, bestiality, cunnilingus, fellatio, anilingus or any sexual acts which are prohibited by law; and

c. Touching or fondling of the human female breast, buttock, anus or genital.

(iii) Public Building. Any building owned, leased or held by the United States of America, the State of Colorado, Mesa County, or the City of Grand Junction, any school district or other agency or political subdivision, which building is used for governmental purposes.

(iv) School. Any public or private educational facility including child day care facilities, nursery schools, preschools, kindergartens, elementary schools, middle schools, junior high schools, high schools, vocational schools, special education schools, colleges, universities and trade schools. “School” includes the school grounds, buildings, structures and facilities.

(v) Church. Any structure or building for public worship.

(vi) Park. Any public property kept, used and maintained for recreational, ornamental or aesthetic purposes.

(vii) Playground. Any property, public or private, used for and equipped with facilities for recreation especially by children. A playground may be incidental to school use but is not limited to school use or school facilities as defined herein.

(6) Prohibition. No person, corporation, or business of any sort or description, shall cause or permit the location or operation of an adult entertainment establishment as defined herein within 1,000 feet of the property line of another such business or within 1,000 feet of the property line of any church, school, park, playground, public building or within 1,000 feet of any residentially zoned property as the same are established under this code. The operation of an adult entertainment establishment shall include the opening of such business as a new business, the relocation of such business or the conversion of an existing business location to any of the uses described herein.

(7) Nonconforming Uses. Uses made nonconforming shall be governed by those provisions of this code.

(c) Flea Markets.

(1) This section establishes standards for the operation of flea markets in a manner that protects adjacent property values and street function.

(2) Performance Standards. All flea markets shall meet the following standards (see Chapter 21.10 GJMC, Definitions, and GJMC 21.04.010, Use table):

(i) No booth, stall, or other display area shall be placed or maintained within any required setback area;

(ii) Off-street parking shall be provided at 1.5 spaces per booth or stall;

(iii) Parking area shall only be accessible by driveways meeting standards established in TEDS (GJMC Title 29);

(iv) Sanitary facilities as required by the Director shall be provided on site;

(v) All items for sale shall be stored indoors (or within an approved screened storage area) or removed from the site at the close of each business day. Flea markets shall not be open for business in excess of 16 hours per day;

(vi) No storage of items other than those available for retail sale may be stored on the premises unless confined within an approved screened storage area as per GJMC 21.04.040(h);

(vii) Flea markets shall not derive access from a collector or local street which serves a residential district located within 1,200 feet of the property on which the flea market is located; and

(viii) An owner or operator of an existing flea market shall comply with all City regulations on or before December 31, 2005.

(d) New Car/Auto Recycler, End Recycler (Salvage Yard), Wrecking Yards, Appliance Recycler, Impound Lots. (For existing uses see GJMC 21.04.040(h)(2)(iii).) New car/auto recycler, end recycler (salvage yard), wrecking yards, appliance recycler and impound lots shall be allowed to operate only with an approved conditional use permit and are subject to the following requirements. Salvage, dismantling, recycling or impound lot uses as accessory uses are permitted under the same status as the principal use and are subject to all requirements of the principal use in addition to the following requirements:

(1) Recycling/wrecking/salvage yards and impound lots shall provide the screening and buffering required by GJMC 21.06.040(i) and provide a six-foot-high wall along the street frontage and

along the first 50 feet of the side perimeter from the street. The wall shall be increased to eight feet if the yard will contain any stored items in excess of six feet. The required wall shall meet the required front yard setback with landscaping in the setback area.

(2) The wall shall be of solid, 100 percent opaque construction of wood, masonry, or other material approved in writing by the Director (unless the screening and buffering required by GJMC 21.06.040(i) allows for only masonry or wood).

(3) All outdoor yards or storage lots shall comply with the following:

(i) No yard or storage lot shall be placed or maintained within a required yard setback.

(ii) Stored items shall not project above the screening except for integral units as defined in Chapter 21.10, Definitions; and stacking of no more than two vehicles on top of a wheel stand. Integral units shall include shelving up to 20 feet in height for the purpose of storing recyclable materials. Integral units shall not be stored within the first 20 feet of the property from any street frontage property line.

(iii) All screening shall be installed in a professional and workmanlike manner, and maintained in good condition.

(4) All compaction, cutting and/or other material volume reducing operations shall be conducted to minimize the noise generated by the operation.

(5) Unusable items shall be disposed of and not be allowed to collect on the premises.

(6) All tires not mounted on operational vehicles shall be neatly stacked or placed in racks. If stacked, the stacks shall not be over six feet in height; if on racks, the top of any tire on any rack shall not be over 10 feet in height.

(7) No garbage or other putrescent waste, likely to attract vermin, shall be kept on the premises. Gasoline, oil, or other hazardous materials which are removed from scrapped vehicles or parts of vehicles kept on the premises shall be disposed of in accordance with applicable federal, State and local regulations. All other regulations of the City such as, but not limited to, building codes, fire codes, weed regulations and health regulations shall apply to the operation of all such uses.

(e) Campgrounds.

(1) A camping guest shall not use a campsite as a permanent residence or domicile.

(2) Campground Design and Overall Site Layout.

(i) Access and Circulation.

(A) Entries, access drives, and parking areas shall meet City dimensional and fire standards and grading, drainage and dust control requirements as applicable.

(B) The surface of entries and access drive aisles shall be paved with asphalt or concrete with a pavement section to support an 80,000-pound fire truck.

(C) Pedestrian walkways shall be surfaced with a firm and stable, ADA-accessible material and designed to provide safe pedestrian circulation within the campground.

(ii) Parking.

(A) Parking or unit pull-in spaces shall be finished with a firm and stable material.

(B) A minimum of one parking space per camping unit shall be provided at or in proximity to each campsite.

(C) A minimum of two additional parking spaces shall be provided at each common service building or campground office.

(iii) Entries, access drive aisles and walkways shall be lighted every 500 feet consistent with the overall design of the campground. Low-level, full cut-off pedestrian lighting fixtures are encouraged.

(iv) Site Design and Planning.

(A) At least one campsite with accessible/mobility features shall be provided for each 25 campsites within the campground.

(B) An overflow area for campsites may be established but shall not exceed five campsites/parking areas per 100 in the campground.

(C) Common service buildings including restroom and shower facilities shall be located no closer than 20 feet nor more than 500 feet from any campsite that may be used by a dependent camping unit.

(D) Entryways to common service buildings shall be lighted during all operational hours between dusk and dawn.

(E) Areas of campgrounds that abut residential properties shall be screened by a six-foot solid fence or year-round vegetation measuring six feet in height. Fences must comply with GJMC 21.04.040(i) and any design guidelines.

(F) Landscaping. All areas shall be covered with either the natural vegetation and/or an acceptable form of ground cover so as to facilitate drainage, reduce dust, prevent erosion and reduce fire hazards.

a. One tree per 2,500 square feet of the total net area used as campsites (e.g., exclude drive aisles, common areas or areas with common buildings) is required. Trees may be distributed throughout the campground.

b. All other landscaping shall comply with GJMC 21.06.040.

(G) Each campground with 50 campsites or more shall provide an active recreational area(s) such as a tot lot or playground, horseshoe pits or lawn game area consisting of a minimum of 100 square feet per campsite.

(v) Campsite Design.

(A) Any campsite shall be set back a minimum of 25 feet from a public right-of-way.

(B) Each campsite shall provide a minimum of 750 square feet of space per intended camping unit and have a minimum width of 25 feet.

(C) A camping unit either in full set-up mode (all extensions/pull-outs in place), placed or built on a site shall not occupy more than 75 percent of the area of the campsite. Campsite size shall be larger than the minimum if larger camping units are intended and/or allowed.

(D) If a campsite may be used for multiple units, it shall provide at least another 400 square feet per each additional camping unit.

(E) Camping units or attachments thereto (e.g., slideouts, awnings) shall be set back a minimum of three feet from individual campsite boundary lines or five feet from campground property boundary lines.

(F) Each site shall be marked and/or numbered for identification in a conspicuous location, and be legible from the campground access drives.

(G) No permanent or semi-permanent structures, such as cabins, lean-tos, accessory structures, sheds or habitable buildings, whether placed on a permanent foundation or not, shall be erected on a campsite except by the owner/operator of the property.

(vi) Water Services.

(A) The campground water supply system shall be designed, constructed and maintained in compliance with all applicable codes. At campsites that provide for full or partial hook-up, the water system shall be connected to a public water supply system.

(B) Common water faucets shall be conveniently accessible from any campsite intended for dependent camping units.

(C) Spillage, overflow, drainage or wastewater from common faucets shall be discharged to approved drains or otherwise designed to prevent impoundment of water, creation of mud holes or other nuisance conditions.

(D) A water station for filling water storage tanks shall be provided at the rate of one station for every 100 campsites or part thereof that are designed for independent camping units. The water station shall be posted with a sign indicating it is potable water.

(vii) Sanitary Sewer.

(A) At campsites that provide for full or partial hook-up, the sewer service shall be connected to a public sewer system.

(B) It is recommended that one sanitary waste station connected to a public sewer system be provided for campgrounds designed for greater than 100 independent camping units.

(C) When a sanitary waste station is provided, it shall be located on a level site with a concrete slab sloped to a center drain and be easily accessible from the access drive.

(D) When a sanitary waste station is provided, a means for flushing holding tanks and the immediate area shall be provided at each sanitary waste station. The flushing station shall consist of a properly supported water riser pipe, valved outlet and attached hose.

(E) A flushing sink or other means of disposal connected to the public sewer system shall be provided for disposal of liquid wastes from dependent camping units unless a sanitary waste station is provided and is conveniently located to these campsites.

(viii) Restroom and Shower Facilities.

(A) All common restroom and shower facilities shall be connected to public water and sewer systems. Privies are not allowed within campgrounds within the City limits.

(B) Required toilet, sink and shower facilities shall be provided in the following minimum numbers:

a. Where a campground is designed and operated for exclusive use by independent camping units, at least one toilet and one sink shall be provided for each 50 campsites.

b. Where a campground accepts or accommodates dependent camping units, at least one toilet and one sink shall be provided for every 15 campsites not provided with sewer connections and one shower shall be provided for every 15 campsites or fractional part thereof. Sinks shall be provided at each building containing toilet facilities at a rate of one sink per toilet for up to six toilets and one sink for every two toilets thereafter.

(ix) Health, Safety and Maintenance.

(A) Emergency and fire safety rules and regulations shall be conspicuously posted by campground management and shall include the following information in addition to any other information required by the Fire and/or Police Department and any other laws and regulations:

a. Information needed for summoning the Fire and Police Departments.

b. Campground location information needed to provide to responding emergency services.

c. Location of common water faucets.

d. Location of fire suppression hydrant(s).

e. Location of sanitary waste station(s).

f. Map of campground, identifying all buildings and campsites by number.

(B) All areas including the storage, collection and disposal of refuse shall be maintained to minimize health and accidents, fire, air quality and other nuisance conditions.

(C) Durable, water-tight, easily cleanable refuse containers, sufficient to contain all refuse from the campground, shall be provided. Provision of recycling containers for separation of plastic, glass, metal and aluminum containers is recommended.

(D) All trash collection areas shall be contained with a six-foot privacy fence or wall on at least three sides of the area.

(E) A six-foot fence shall be provided around hazardous areas such as swimming pools, utility areas or storage of hazardous materials.

(F) A fire ring shall be provided at any campsite that allows the use of combustible fuel. Location of the fire rings shall be shown on the site plan.

(f) Manufactured Housing Parks.

(1) Purpose. To provide for low cost housing developments that include adequate amenities and are designed to provide a stable, long-term asset for the community.

(2) Standards. Manufactured housing parks shall have a maximum density of eight manufactured homes per acre and a minimum density of four units per acre. The following standards shall also apply:

(i) All manufactured home spaces shall abut on a hard-surfaced roadway of not less than 24 feet in width which shall be adequately lighted and drained and which shall have unobstructed access to a paved public street or highway;

(ii) No manufactured home or structure shall be closer than 25 feet to any property line of the manufactured home park nor closer than 20 feet to another manufactured home or any building in the park, except where manufactured homes are parked end to end, the end clearance shall be at least 15 feet;

(iii) No additions shall be built onto any manufactured home other than a porch or entryway, which shall be not less than 15 feet from the nearest manufactured home and its additions;

(iv) All buildings and manufactured homes within the park shall be served with centralized water supply and sewage disposal systems approved by the City;

(v) Two off-street parking spaces shall be provided for each manufactured home site and one space for every 50 square feet of floor area in administration and service buildings;

(vi) All manufactured homes shall be skirted and anchored in a manner approved by the Director;

(vii) All parking and driveway areas shall be paved;

(viii) Mobile homes, recreational vehicles or travel trailers may not be used as residences within a manufactured home park;

(ix) Each space shall be numbered in a conspicuous location and a space map posted at the entrance to the park;

(x) In evaluating the proposed development, the City shall evaluate, in addition to other considerations, the following:

(A) The effect of the proposed manufactured home park on adjacent property values;

(B) The consistence and compliance of the proposed manufactured home park with the provisions of applicable County and State regulations;

(C) The suitability of the site for the proposed use with special attention to topography, subsurface conditions and the availability of necessary utility service;

(D) The relation of the population density resulting from the proposed manufactured home park to the public interest;

(E) The use of sound planning and engineering practices;

(F) The availability of access from existing highways and the nature of the altered traffic pattern resulting from the manufactured home park; and

(G) The availability of schools, police protection, fire protection and other public services;

(xi) In the event of approval, the City shall specify appropriate conditions and safeguards to protect the character of existing and future development of adjoining properties as well as the manufactured home park; and

(xii) Existing manufactured home parks shall comply with the above standards to the greatest extent possible, except that:

(A) Existing mobile homes may continue to be used and replaced in mobile home parks established prior to 1976;

(B) Existing spaces may be used; provided, that any additions made after the effective date of the code shall comply with setback requirements herein; and

(C) Paving of existing driveways only shall be required if the park is expanded or the number of spaces increased.

(g) Mini-Warehouse.

(1) Purpose. This subsection sets standards for the establishment and maintenance of safe and attractive mini-warehouse developments that will remain a long-term asset to the community. A “mini-warehouse” shall mean a structure or group of structures for the dead storage of customers’ goods and wares where individual stalls or lockers are rented out for storage and where one or more stalls or lockers has less than 500 square feet of floor area.

(2) Fencing and Screening.

(i) Screening and buffering shall be provided in accordance with GJMC 21.06.040(e) and (f).

(ii) Signs or other advertising mediums shall not be placed upon, attached to, or painted on any required walls or fences.

(3) Landscaping. All setbacks shall be landscaped in conformance with GJMC 21.06.040(b) and shall provide appropriate visual screening and/or buffering for adjacent properties.'

(4) Architectural Standards. Mini-warehouse units provided in conjunction with multifamily housing shall be similar in architectural design and materials to the multifamily structure.

(5) Commercial Activity Prohibited. Sales, other than an occasional sale, estate sale or lien foreclosure sale from or at a mini-warehouse is specifically prohibited.

(i) It shall be unlawful for any owner, operator or lessee of any mini-warehouse or portion thereof to offer for sale, or to sell any item of personal property, or to conduct any type of commercial activity of any kind whatsoever, other than leasing of the storage units, or to permit same to occur upon any area designated as a mini-warehouse; except, one estate sale or other sale of two days or less per calendar quarter shall be allowed per property.

(ii) The Director may take appropriate legal or administrative action necessary to halt or prohibit any commercial activity from any mini-warehouse other than the leasing of storage units.

(6) Storage Only.

(i) No activity other than storage and rental of storage units shall be conducted on the premises.

(ii) No outside storage shall be permitted except the storage of licensed vehicles within approved areas designated for such storage and meet outdoor storage requirements of GJMC 21.04.040.

(7) Signage. Signage shall conform to the provisions of GJMC 21.06.070. Storage units shall be clearly marked with numbers or letters identifying the individual units and a directory of the unit locations shall be posted at the entrance or office of the facility.

(8) Accessibility/Circulation. Vehicular ingress-egress shall provide for safe access by customers and emergency vehicles and shall be paved.

(9) Height. Building height shall not exceed 18 feet.

(10) Off-Street Parking and Driveways Standards.

(i) Parking shall be provided by parking/driving lanes adjacent to the buildings. These lanes shall be at least 26 feet wide when cubicles open onto one side of the lane only and at least 30 feet wide when cubicles open onto both sides of the lane.

(ii) Two parking spaces shall be provided adjacent to the manager's office.

(iii) One parking space for every 200 storage cubicles or fraction thereof shall be located adjacent to the project office. A minimum of two such spaces shall be provided.

(iv) Required parking spaces may not be rented as or used for vehicular storage; however, additional parking areas may be provided for recreational vehicle storage or trucks rented for moving storage items, provided that it is adequately screened in conformance with this code.

(h) Short-Term Rentals.

(1) Purpose. The purpose of this regulation is to allow short-term rentals in certain zone districts in the City with a permit and with regulation to assist in protecting the health, safety, and welfare of property owners, neighbors, and occupants.

(2) Applicability. These regulations apply to all uses meeting the definition of short-term rental. Private covenants running with land may restrict or prohibit short-term rentals; it is the respon-

sibility of the property owner, not the City or any employee or agent thereof, to ensure compliance with restrictive covenants.

(3) Definitions. *Short-term rental* is a type of lodging wherein a dwelling unit, either in full or in part, is rented to a temporary occupant(s) for monetary consideration for fewer than 30 consecutive days. A bed and breakfast is, for purposes of this title, a type of *short-term rental*. Likewise, a home used similar to a rooming/boarding house but where stays are fewer than 30 consecutive days is also a *short-term rental*. *Short-term rental* does not include shelters or other transient lodging as defined as a community service use.

(4) Permit Required. No person or entity shall sell lodging to a temporary occupant(s) of a dwelling unit for fewer than 30 consecutive days without first having obtained a short-term rental permit issued by the City and complying with any conditions or restrictions thereof. A short-term rental permit is valid for the life of the short-term rental use, subject to annual re-registration in a form prescribed by the City. A separate short-term rental permit is required for each short-term rental unit. A short-term rental permit may be issued only to the owner of the property used for short-term rental. A short-term rental permit may be issued by the Director upon finding that the requirements of this subsection (h) are met. A permit may contain conditions and restrictions.

(5) Occupancy.

(i) The number of occupants at any given time in a short-term rental unit shall not exceed two persons per bedroom plus two additional renters, including the operator, except where the Director determines that the size, configuration and/or structural features of the unit allow greater or lesser occupancy.

(ii) The permit shall specify the maximum occupancy of the unit.

(6) Designated Local Responsible Party.

(i) The property owner shall designate one or more local person(s) who will be permanently available and responsible for immediately responding to complaints about or violations of law or of permit terms. *Local* as used herein means having a permanent address within a 20-mile radius from the short-term rental property and a 24-hour contact phone number.

(ii) The designated local responsible party may be the owner of the property if he or she meets the *local* criteria.

(iii) The designated local responsible party must be authorized by the property owner to permit inspection of the premises by the City and/or its agent or employee to ensure compliance with applicable fire and building codes and with the requirements for and/or of the short-term rental permit.

(7) General Requirements. The owner of a dwelling used or to be used as a short-term rental shall:

(i) Obtain a tax license from the City of Grand Junction and comply with all applicable local, State, and federal taxes;

(ii) Demonstrate and certify that the unit contains the following on the premises at all times:

(A) A smoke detector in good working order;

(B) A carbon monoxide detector in good working order;

(C) Adequate and functional building egress from each sleeping room in the unit;

(D) Posted notice providing in detail the following information in a highly visible location and readily accessible form:

a. Location of building exits and fire extinguishers;

b. Twenty-four-hour emergency contact information;

c. Parking areas and parking restrictions, including a notice that parking on lawns is not allowed;

d. Noise restrictions and quiet hours;

e. Trash disposal instructions including trash pickup location and schedule;

f. Maximum occupancy restrictions;

g. City permit number;

(iii) Certify all units maintain a fire extinguisher in good working order;

(iv) Permit inspection of the premises by the City or its agent or employee during the pendency of the permit application, and thereafter upon reasonable notice;

(v) Provide with its application a sketch or drawing of the unit that depicts all rooms, doors and windows, including dimensions, and shows on-site areas available for guest parking;

(vi) If the short-term rental unit is accessed by a shared driveway, provide the City with a copy of a written instrument authorizing use of the driveway for short-term rental purposes;

(vii) Provide the name, address and phone number of the designated local responsible party to the City, and update such information with the City whenever it changes;

(viii) Register annually with the City, certifying that the permit terms and requirements are still being met and updating any material changes to the unit or property;

(ix) Where food is prepared and served to guests/lodgers on the premises, demonstrate compliance with Mesa County Health Department regulations.

(8) Revocation, Suspension, and Appeal.

(i) A short-term rental permit may be suspended or revoked for any of the following reasons:

(A) The owner or designated responsible party has failed to comply with a requirement of this subsection (h).

(B) The owner or designated responsible party has failed to comply with a condition of or restriction set forth in the short-term rental permit.

(C) The owner has failed to collect or remit lodging taxes or otherwise comply with local, State and/or federal tax requirements.

(D) Materially false or misleading information has been provided to the City by the applicant, owner or designated responsible party on an application.

(E) The City has received excessive and substantial complaints by neighbors or affected persons that were not adequately and timely addressed by the owner or designated responsible party.

(ii) Notice of revocation shall be provided to the owner, who shall then be given an opportunity to respond within 10 days. The Director will issue any decision to revoke or suspend a permit within 10 days of the response date.

(iii) Any aggrieved person may appeal the issuance, denial, suspension, or revocation of a short-term rental permit to the Zoning Board of Appeals within 10 days of the issuance of the decision.

(i) Business Residence.

(1) Residence Occupancy. A business residence is a primary residence, located within a business structure, of the owner, operator or employee of the business. This subsection is not intended to permit general residential uses in business or commercial areas.

(2) Residence as Accessory Use. The same procedures and requirements shall govern a residential accessory use as the principal use with which it is associated (see GJMC 21.04.010, Use table). The following conditions apply to all business residences:

(i) The residential unit shall comply with all appropriate building and fire codes and with all applicable portions of this code;

(ii) Only one single-family dwelling unit per business or structure is allowed and it shall be occupied only by the owner, operator, or employee of the principal use and immediate family;

(iii) The dwelling unit shall be located within a structure used primarily for business purposes;

(iv) A minimum of one off-street parking space shall be provided for the dwelling unit in addition to the required parking for the business; and

(v) Other conditions as required through the site plan approval process.

(j) Medical and Hazardous Waste Transfer Facilities.

(1) Purpose. The purpose of this subsection is to evaluate the expected impact of a proposed medical or hazardous waste transfer facility and to reasonably ensure that such a facility is reasonably safe.

(2) Application. A medical or hazardous waste transfer facility receives and temporarily stores medical or hazardous wastes; it does not include facilities for the treatment, storage or disposal of wastes. A conditional use permit, granted in accordance with GJMC 21.02.110, shall be required prior to establishment of a medical or hazardous waste transfer station. The Director may waive or reduce informational requirements for a specific proposal after making a written finding that such information is not needed to adequately review the impacts of the proposed facility or that other available studies adequately provide the requested information.

(3) Exemptions. A facility that provides temporary storage of hazardous or medical wastes generated on the site for a period not to exceed seven days or the time period allowed by the State is not subject to the provisions of this subsection.

(4) Medical or Hazardous Waste Transfer Facility Report Requirements. An application for a conditional use permit for a medical or hazardous waste transfer facility shall include the submission of a hazardous waste facility siting report by the applicant. This report shall summarize and analyze all pertinent information regarding the proposed siting of the facility, and shall:

(i) Be prepared by an independent, qualified professional. The author of the hazardous waste facility siting report shall provide written evidence of expertise required to prepare the report;

(ii) Include the following information, as well as any additional information deemed necessary by the Planning Commission or City Council for a thorough review of the proposal:

(A) Applicant Information.

a. Applicant and property owners' names, addresses and interests in the property.

b. Name, address, and telephone number and credentials of the author of supporting technical documentation.

c. Affidavit authorizing the applicant to represent the property owner.

d. Legal description and location of the proposed site.

e. Location map indicating the location of the site in relation to the City thoroughfare system.

f. Zoning map indicating the present zoning of the site (and proposed zoning if a rezoning has been requested) and the zoning of adjacent parcels.

g. A land use map indicating existing and proposed site development and land uses of property located within 2,500 feet of proposed storage and operations areas.

h. The site topography, including existing and proposed grades shown in contour intervals of two feet.

i. The site's hydrological conditions, including the location of any floodplains, wetlands and bodies of water, as well as subsurface water characteristics.

j. The site's geological conditions, including description of geological features, unstable areas or other geological anomalies which might affect facility operation and that, to the extent such features exist, they have been adequately addressed in the facility design.

k. The history of uses at the site which may have installed underground storage tanks, deposited fill on the property for disposal or grading purposes, or contaminated soils with medical or hazardous wastes.

l. The distance from the nearest park, wetland, fresh water stream or water body, wellhead, water pumpage center, sewage treatment plant, sewage trunk line, floodway area, flood fringe area, rail freight line, federal or State highway, public water supply, groundwater recharge area, or aquifer outcrop area.

m. Existing streets, driveways, loading areas and public utilities.

(B) Project Description and Impact Analysis.

a. Description of proposed use of the site, including a detailed explanation of all operations involving medical or hazardous wastes.

b. Description and drawing of proposed buildings, structures and storage facilities, including proposed height and bulk of any.

c. Description and drawing of all proposed streets, driveways, parking areas and loading areas.

d. A traffic study which takes into consideration traffic generated by the facility as well as background traffic and all traffic that will be generated by development authorized under existing regulations in the vicinity of the facility.

e. Description of efforts made by the applicant to meet with surrounding property owners to inform them of their proposal and respond to their concerns.

f. Agency findings of compliance with applicable provisions of local, State or federal law.

g. Applicant's technical findings related to hydrological, geological and topographical constraints and proposed mitigation measures.

h. Applicant's findings related to the suitability of the site for the purposes proposed, including consistency with the Comprehensive Plan, natural features and adjacent development patterns.

i. Applicant's finding that no environmentally, archaeologically, culturally or historically significant areas, threatened or endangered species, or lakes exist on or near the property, which will be negatively impacted by the facility.

j. Applicant's findings that there are no wetlands on the property which will need to be filled in order to facilitate the construction of the facility.

k. The operator shall provide details on the site's security system, including an explanation of how access to and from the site is to be controlled.

l. The operator shall submit a full description of operations including character and location of material transfer and storage, spill and emergency response plans and manifesting program.

m. Proposed screening and landscaping of the site showing existing and proposed use of plants, berms and fences.

n. The need to relocate any existing public facilities and utilities located on the site.

(5) Medical or Hazardous Waste Transfer Facility Review Requirements. The City shall review the Hazardous Waste Facility Siting Report and the supporting documentation for completeness and the validity of the assumptions stated and determine whether the proposal:

(i) Is consistent with the Comprehensive Plan;

(ii) Will substantially advance the public health, safety or general welfare;

(iii) Will impact the marketability and property values of surrounding property;

(iv) Will impact the site's environment and natural resources;

(v) Has public benefit that outweighs public or private detriment;

(vi) Is compatible with adjacent development; and

(vii) Is a suitable use for the proposed site.

(6) In granting a conditional use permit for a medical or hazardous waste transfer facility, the City may establish reasonable conditions including, but not limited to:

(i) Containment safeguards to prevent contamination of surface or groundwaters;

(ii) Buffering, screening and berming to ensure that operations or activities on site are adequately screened from off-site locations;

(iii) Noise levels at the property line shall not exceed the guidelines for community noise published in the American National Standard ANSI 53.23-1980, entitled "Sound Level Descriptions for Determination of Compatible Land Use," [§ 25-12-103 C.R.S.];

(iv) Seismic vibrations, if any blasting is to occur during either construction or operations, are not to exceed the standard established in U.S. Bureau of Mines Bulletin 656;

(v) All on-site roads, driveways, parking and loading areas shall be paved to limit fugitive dust;

(vi) Odors shall be controlled to the maximum extent practicable using the best available technology;

(vii) Access to the site shall not use residential streets;

(viii) Fiscal assurances in a specified amount, in a form mutually acceptable to the operator and the City, to guarantee the operator's performance during the operation, closure and post-closure period, and to provide financial assurance with respect to any third party claimants for personal injury or property damage by persons residing or owning property within a specified distance from the facility, which damage can be shown to be a direct consequence of facility operations;

(ix) Limitation of the hours of operation;

(x) A surface water drainage system to provide runoff and erosion control that can accommodate a 100-year, 24-hour storm and that any surface drainage which does come in contact with waste handled outside of sealed DOT approved containers is directed to an independent collection system;

(xi) Periodic monitoring of operations and stormwater runoff from the site. The facility operator shall reimburse the local government for their costs related to inspection, monitoring and other administration of facility operations;

(xii) Limitation of the types of waste which can be received at the site and standards ensuring that personnel are properly trained to handle wastes accepted at the site;

(xiii) A franchise fee calculated to pay the City for the costs to review, monitor and enforce the permit;

(xiv) To the extent that any technical environmental issues are raised, the operator, as part of the review process and prior to approval, shall reimburse the City for the cost of engaging the services of an independent expert to study and provide an opinion concerning the issues;

(xv) The operator shall allow the City and its designees to inspect the site during hours of operation without prior notice, to ensure that the facility is being operated in accordance with applicable conditions of approval;

(xvi) Reimbursement to the City for the cost of special training, equipment and labor required for response to medical, fire and other emergencies;

(xvii) A yearly performance report for the facility. This report shall be presented to the Planning Commission annually and shall include, but not be limited to, the following:

(A) Volume and chemical classification of the substances received;

(B) Volume and chemical classification of the substances shipped from the site;

(C) Accidents;

(D) Location, type and cause of the accident;

(E) Number and type of spills on and off site;

(F) Fires – type and location;

(G) List of corrective measures taken by the operator of the facility to prevent future occurrences;

(H) Site testing data;

(I) Number and type of violations found by E.P.A. or State inspectors; and

(J) Street and traffic safety improvements.

(7) The Planning Commission shall set an expiration date on the conditional use permit approval.

(k) Mineral Extraction, Washing, Crushing, Cement Batch Plants and Asphalt Plants.

(1) Purpose. The purpose of this subsection is to establish reasonable and uniform limitations, safeguards and controls to wisely utilize natural resources and to reclaim mined land.

(i) Gravel extraction and/or processing activities should occur on parcels of sufficient size so that extraction and reclamation can be undertaken while still protecting the health, safety and welfare of the citizens.

(ii) Where gravel extraction and/or processing is adjacent to zoning or land uses other than I-1 or I-2, mining, handling and batch processing activities may be restricted, buffering may be required and/or disturbance/reclamation may be accelerated to be compatible with the adjacent zone or use.

(2) Procedure.

(i) Commercial extraction of mineral deposits shall not begin or occur until an excavation and land reclamation plan have been approved in writing by the Colorado Mined Land Reclamation Board.

(ii) A plan approved as part of a CUP and/or a reclamation/development schedule being followed under previous regulations fulfills this requirement.

(iii) Asphalt, cement and/or other batch plant operations shall be subject to CUP requirements.

(iv) A plan for a use under this subsection shall contain, in addition to those relevant requirements outlined for a CUP, the following:

(A) Detailed description of the method of extraction and reclamation to be employed, including any necessary accessory uses such as, but not limited to, crushers, batch plants and asphalt plants;

(B) An extraction plan showing the areas to be mined, location of stockpile area, location of structures, general location of processing equipment, with accompanying time schedules, fencing if applicable, depth of deposit, tons in the deposit and other pertinent information;

(C) A detailed reclamation plan showing proposed reclamation with time schedules including, but not limited to, finish contours, grading, sloping, placement, and amount and type of revegetation, post-extraction land use plans and any other relevant information;

(D) Topography of the area with contour lines of sufficient detail to portray the direction and rate of slope of the land covered in the application;

(E) Type, character, and density of proposed vegetation both during excavation and as a component of rehabilitation;

(F) The operator’s estimated cost at each of the following segments of the reclamation process, including where applicable, backfilling, grading, reestablishing topsoil, planting, revegetation management, irrigation, protection of plants and soil prior to vegetation establishment and administrative cost;

(G) A drainage plan and report prepared by a Colorado registered professional engineer with consideration of natural drainage, drainage during excavation and drainage after reclamation such that the proposed reclamation and excavation will have no adverse effect in excess of natural conditions. Where applicable, the Director may require a floodplain permit (see GJMC 21.07.010, Flood damage prevention);

(H) Traffic analysis, which reviews road capacity and safety conditions/considerations for and within the neighborhood, as that term may be defined and applied by the

Director. The Director may reduce or enlarge the neighborhood to be analyzed upon a finding of a hazard or hazardous condition. The traffic analysis shall generally conform to and address TEDS standards (GJMC Title 29) and shall include but not be limited to ingress/egress, parking and loading, on-site circulation, number of trucks per day and the capacity of roads, streets, bridges, intersections, etc.;

(I) An erosion control plan for runoff and wind-blown sediments shall be provided for the mining operation and the reclamation;

(J) Additional information that is required because of unique site features or characteristics may be required by the Public Works and Planning Departments; and

(K) Upon approval, the excavation and reclamation plans shall be filed with the City and recorded with the Mesa County Clerk and Recorder. Any change in excavation or reclamation plan shall be prohibited unless amended through the conditional use permit process.

(3) Standards.

(i) Mineral extraction, washing, crushing, cement and asphalt batch planting and other mined products related uses shall be subject to an approved excavation permit, well permit, air pollution permit, reclamation plan and any and all other permits, certifications or requirements of the State or federal agencies having jurisdiction as required;

(ii) Excavation or deposit of overburden is not permitted within 30 feet of an abutting parcel, an easement, an irrigation ditch or canal or right-of-way unless by written agreement of the owner of such property, easement, irrigation ditch, canal or right-of-way;

(iii) Excavation within 125 feet of an existing residence is not permitted unless by written agreement of the owners and occupants of the residence. No rock crushing, asphalt/cement plant or other similar equipment or operations shall take place any closer than 250 feet of a residence. The Planning Commission may require a greater distance if the operation is abutting a residential zone district. Excavation, loading, handling, processing and batch operations adjacent to residentially zoned parcels shall not exceed 65 decibels at the property line of any adjacent parcel;

(iv) At a minimum, 100 feet greenbelt setback shall be provided from jurisdictional wetlands or navigable watercourses as the same are defined by the U.S. Army Corps of Engineers (USACE). The Director upon recommendation and consent of the USACE may vary this standard;

(v) Existing trees and vegetation shall, to the extent practicable, be preserved and maintained in the required setback to protect against and reduce noise, dust and erosion. The Director may require vegetative screening and/or buffering in accordance with this code in order to minimize the impact to dissimilar adjacent uses or zoning districts;

(vi) The owner or operator shall submit a traffic analysis;

(vii) The Director of Public Works may place restrictions on right-of-way use after review of the traffic analysis. Restrictions may include but are not limited to the owner or operator being be responsible for the extraordinary upgrade and maintenance of the designated haul route;

(viii) Streets, bridges and highways designated as haul route shall be maintained by the owner/operator in a reasonably clean condition. This may include, depending on local conditions, watering, oiling, or sweeping as determined by the Director;

(ix) Hours of operation shall be restricted to 6:00 a.m. to 6:00 p.m. The Director may authorize different hours; however, the Director may also restrict as part of the CUP the hours of operation near residential or urbanized areas;

(x) In no event shall a slope of steeper than 2:1 be left for dry pits. A pit with a slope of 3:1 or steeper shall not exceed a depth of 10 feet. The floor of excavation pits, whether wet or dry, shall be left in a suitable condition;

(xi) The owner/operator shall not excavate, store overburden or mined material or dike the property in such a manner as to increase any drainage or flooding on property not owned by the operator or damage public facilities and/or property;

(xii) Prior to starting operation, where the operation is adjacent to subdivided and/or developed commercial or residential property, the Director may require buffering and/or screening. Required fencing, screening and/or buffering shall not be removed until reclamation has been completed;

(xiii) After mining has been completed, the site shall not to be used to stockpile sand and/or gravel except in I-1 and I-2 with a CUP. In any event the owner/operator is to reclaim the site as rapidly as possible;

(xiv) Operations shall comply with the noise, vibration and other applicable standards and requirements of this code. If there are conflicting or competing provisions in this code, the most stringent shall apply;

(xv) All air emissions shall comply with standards established by the Mesa County Health Department, State Health Department and Colorado Air Quality Control Commission;

(xvi) All water use and/or discharge shall conform to standards established by law and administered by the Environmental Protection Agency (EPA), the Colorado Department of Public Health and Environment (CDHPE), the City of Grand Junction and the Mesa County Health Department;

(xvii) All slopes shall be stabilized. Land remaining at the natural water level must be revegetated in a manner compatible in type as/with the immediately prevailing area. Revegetation plans are required and shall minimally meet the standards of the Colorado Mine Land Reclamation Board;

(xviii) All disturbed areas shall be revegetated in accordance with the vegetation plan;

(xix) Following initial revegetation efforts, the revegetated area shall be maintained for a period of three years or until all vegetation is firmly established in the reclamation area;

(xx) A timetable for reclamation shall be placed on each project. Time lines, including but not limited to milestones, if any, shall be dependent upon the type and size of reclamation effort;

(xxi) Proof of a reclamation bond shall be submitted, along with the required reclamation plan;

(xxii) A development schedule shall be submitted describing the life span of the project in years (ranges are acceptable) and, if applicable, the years per phase;

(xxiii) If the development schedule is not met the conditional use permit:

(A) May be revoked;

(B) The Director may grant a two-year extension per request;

(C) The Planning Commission shall have the power, after hearing, to revoke any conditional use permit for any violation;

(D) Upon at least 10 days' written notice to the owner, the Planning Commission may hold a hearing to determine the nature and extent of the alleged violation, and shall have the power, upon showing of good cause, to revoke the permit and the plan and to require reclamation of the land;

(E) If not extended or revoked, a new application and extraction plan will need to be submitted and reviewed in the manner described in this subsection;

(F) An extension request shall provide information in writing detailing the reasons for the request. The Director shall consider the stated reasons, as well as the extent conditions have changed in the area, if any, before granting an extension;

(G) If a written request to extend the development schedule is submitted to the Director it shall include but not necessarily be limited to the factors and reasons for the requested extension. New conditions may be imposed as a part of the granting of an extension. New conditions, if any, may be appealed to the Planning Commission to be considered at a public hearing;

(H) The Director may forward any extension request to the Planning Commission;

(I) Extension requests will be evaluated by the Director and/or Planning Commission on the same basis and with the same information as per the conditional use permit process;

(xxiv) If the use has not operated or if no material has been extracted in accordance with the development schedule or any extension thereof, the conditional use permit shall expire;

(xxv) Signage for public safety is required; and

(xxvi) Fencing around the perimeter of the property is required.

(l) Superstore/Big Box Development/Shopping Center.

(1) The following standards and guidelines are applicable to any retail commercial structure in excess of 50,000 square feet or any retail center in which any one structure exceeds 50,000 square feet (hereinafter "big box").

(2) Big box shall provide outdoor spaces and amenities to link structures with the community. Bus stops, drop-off/pick-up points, as well as pedestrian circulation routes, shall be integrated with traffic patterns on the site. Special design features enhance the building's function with its relationship to the community.

(i) Big box shall provide at least two of the following design features:

(A) Patio/seating area;

(B) Pedestrian plaza with benches;

(C) Window display area (covering at least 75 percent of the length of one facade or 50 percent of the length of two facades);

(D) Outdoor playground area;

(E) Kiosk area;

(F) Water feature;

(G) Clock tower;

(H) Public art; or

(I) Other features approved by the Planning Commission.

(ii) Each big box shall provide an off-street bus stop for customers and employees when located on an established or planned bus route.

(iii) Each of these features shall be constructed of material that is compatible with the principal structure and be linked by pedestrian connections as required by this code.

(3) Pedestrian accessibility from a big box to the neighborhood is key; traffic impacts are reduced and the big box projects a friendlier, more inviting image. This subsection sets forth standards for public sidewalks and internal pedestrian circulation systems that can provide user-friendly pedestrian access as well as pedestrian safety, shelter and convenience within the center grounds.

(i) Continuous internal pedestrian walkways, no less than eight feet in width, shall be provided from the public sidewalk or right-of-way to the principal customer entrance of the principal structure. At a minimum, walkways shall connect pedestrians to transit stops, street crossings, building and store entries and shall feature adjoining landscaped areas that include trees, shrubs, benches, flower beds, ground covers or other materials for no less than 50 percent of its length.

(ii) Sidewalks, no less than eight feet in width, shall be provided along the full length of the building along any facade featuring a customer entrance and along any facade abutting public parking.

(iii) Sidewalks shall be located an average of six feet from the facade of the building to provide planting beds for foundation landscaping, except where features such as arcades, display windows or entryways are part of the facade.

(iv) Walkways within 30 feet of at least half of the customer entrances shall have weather protection features such as awnings or arcades.

(v) Pedestrian walkways in public parking areas shall be distinguished from driving surfaces by the use of durable, low maintenance surface materials such as pavers, bricks or patterned concrete. Such walkways enhance pedestrian safety and comfort, as well as the attractiveness of the walkways.

(4) Parking areas should provide safe, convenient and efficient access. Parking shall be distributed to shorten the distance to buildings and public sidewalks and to reduce pavement. Where possible, no more than 75 percent of the off-street parking for the entire property shall be located between the front facade of the principal structure and the primary abutting street ("front parking area"). The front parking area shall be determined by drawing a line from the front corners of the building to the nearest property corners. If any such line, when connected to the plane of the front facade of the building, creates an angle that is greater than 180 degrees, then the line shall be adjusted to create an angle of 180 degrees when connected to the plane of the front facade of the building. If any such line, when connected to the plane of the front facade of the building, creates an angle that is less than 90 degrees, then the line shall be adjusted to create an angle of 90 degrees when connected to the plane of the front facade of the building. Parking spaces in the front parking area shall be counted to include all parking spaces within the boundaries of the front parking area, including:

(i) All partial parking spaces if the part inside the front parking area boundary lines constitutes more than one-half of said parking space; and

(ii) All parking spaces associated with any pad sites located within the front parking area boundaries.

(5) Where practicable, buildings shall be located closer to the street so that the scale of the building appears to be reduced, pedestrian traffic is encouraged and architectural detail is more apparent.

(6) Outdoor storage, loading and operations areas shall be attractively screened from adjacent parcels and streets.

(i) Outdoor storage, trash collection and/or compaction, loading or other such uses shall be located in the rear of the lot.

(ii) If because of lot configuration the Director determines that such placement is not feasible, then the side yard may be used, but in no case shall such area be located within 20 feet of any public street, public sidewalk or on-site pedestrian way.

(iii) Outdoor storage, HVAC equipment, trash collection, trash compaction and other service functions shall be incorporated into the overall site design. Views of these areas shall be screened from visibility from all property lines and separated from sidewalks and on-site pedestrian ways. Screening structures shall be made of the same materials as the principal structure.

(iv) Nonenclosed areas for the storage and sale of seasonal merchandise shall be permanently defined and screened with walls and/or fences. Fences must comply with GJMC 21.04.040(i), any design guidelines and other conditions of approval. Materials, colors and design of screening walls and/or fences shall conform to those used as in the principal structure. If such areas are to be covered, then the covering shall conform to the colors on the building. Outdoor display and storage shall not encroach on any portion of a walkway, drive aisles or required parking spaces.

(v) Portable outdoor display shall be allowed and shall be placed so that a minimum of eight feet of sidewalk remains open at all times in the display area. Display shall not be placed in the drive aisles or required parking spaces.

(vi) No delivery, loading, trash removal or compaction, or other such operations shall be permitted between the hours of 10:00 p.m and 7:00 a.m. unless the applicant submits proof that sound barriers between all areas for such operations effectively reduce noise emissions to a level of 45 decibels, as measured at the lot line of any abutting property.

(vii) One outdoor vendor shall be allowed for each tenant over 50,000 square feet. The area established for the vendor shall be identified on the site plan.

(viii) Any special event occurring in any outdoor area, including pedestrian ways and parking lots, shall comply with GJMC 21.02.070, Administrative development permits.

(7) The following standards shall apply to all building facades and exterior walls that are visible from adjacent public streets and/or parcels. These standards are intended to reduce the massive scale of large buildings, which, without application of these standards, may be incompatible with Grand Junction's desired character.

(i) Facades greater than 150 feet in length, measured horizontally, shall incorporate wall plane projections or recesses having a depth of at least three percent of the length of the facade and extending at least 20 percent of the length of the facade. No uninterrupted length of any facade shall exceed 150 horizontal feet.

(ii) Ground floor facades that face public streets shall have display windows, entry areas, awnings, or other such features along no less than 60 percent of their horizontal length. If the facade of the building facing the street is not the front, it shall provide the same features and/or landscaping in scale with the facade.

(8) Buildings should have visually interesting architectural features and patterns that are designed to reduce mass and scale and reflect local character.

(9) The following, in regard to trim, graphics or paint should be integral and not superficially applied: color and material change, texture change and relief such as offsets, projections and reveals.

(10) Variation in roof lines/roof materials, in order to add interest to and reduce the massive scale of large buildings, is required. Roofs shall have no less than two of the following features:

(i) Parapets concealing flat roofs and rooftop equipment, such as HVAC units, from public view. Parapets shall not exceed one-third of the height of the supporting wall and shall not be of a constant height for a distance of greater than 150 feet;

(ii) Overhanging eaves, extending no less than three feet past the supporting walls, for no less than 30 percent of the building perimeter;

(iii) Sloping roofs that do not exceed an average slope greater than or equal to one foot of vertical rise for every three feet of horizontal run and less than or equal to one foot of vertical rise for every one foot of horizontal run; and

(iv) Three or more roof slope planes.

(11) The following standards are intended to ensure that large structures are consistent with community values.

(i) Predominant exterior building materials shall be high quality material. These include, without limitation:

(A) Brick;

(B) Other native stone;

(C) Tinted, textured, concrete masonry units;

(D) Wood; and

(E) Sandstone.

(ii) Facade colors shall be nonspecular, neutral or earth tone colors. The Director shall prohibit the use of high intensity, metallic, black or fluorescent color.

(iii) Building trim and accent areas may feature brighter colors, including primary colors.

(iv) Predominant exterior building materials shall not include the following:

(A) Smooth-faced concrete block;

(B) Smooth-faced tilt-up concrete panels; or

(C) Prefabricated steel panels.

(12) Big boxes, where possible, shall provide multiple entrances. Multiple entrances reduce walking distances from cars, facilitate pedestrian and bicycle access from public sidewalks and provide convenience where certain entrances offer access to individual stores or identified departments of a store. Multiple entrances also mitigate the effect of unbroken walls and neglected areas that often characterize building facades that face other properties.

(13) Entryway design elements and variations should give orientation and aesthetically pleasing character to the building. The following standards identify desirable entryway design features. Each principal building on a site shall have clearly defined, highly visible customer entrances featuring no less than three of the following:

(i) Canopies or porticos;

(ii) Overhangs;

(iii) Recesses/projections;

(iv) Arcades;

(v) Raised corniced parapets over the door;

(vi) Peaked roof forms;

(vii) Arches;

(viii) Outdoor patios;

(ix) Display windows;

(x) Architectural details such as tile work and moldings which are integrated into the building structure and design; and

(xi) Integral planters or wing walls that incorporate landscaped areas and/or places for sitting.

(14) To the greatest extent possible, mechanical appurtenances shall be located within the structure. External mechanical appurtenances such as heating and air conditioning equipment shall be screened and finished to match the colors and materials of the building.

(15) All buildings and enclosures shall be designed to be compatible with the primary structure. Compatibility shall be measured in terms of design, form, use of materials, and color.

(16) All applications for any superstore/big box development/shopping center development shall submit, as part of their site plan review, a complete sign package consistent with the latest edition of the SSID manual.

(m) Manufactured Home.

(1) The following regulations apply to the construction or placement of a single-family home, manufactured home or modular home (dwelling) on a lot.

(2) No mobile home may be used as a dwelling in the City except in an established mobile home park.

(3) Every dwelling, with the exception of mobile or manufactured homes placed in mobile home parks, shall be placed or erected on a foundation which shall comply with the following minimum specifications and requirements of the National Conference of States on Building Codes and Standards, Inc., A225.1 Manufactured Home Installations 1987 (ANSI A225.1-1987) or as amended. Neither the Director of Public Works, as the Chief Building Official for the City, nor his designee nor any employee, officer or agent of the City, shall be liable for any direct, consequential or other damages to any person or property by the preparation, adoption and enforcement of minimum foundation specifications.

(i) The foundation for a manufactured home shall comply with the alternatives identified in Table 2-2, Alternative Manufactured Home Foundation Systems (Single or Multisection Homes), in ANSI A225.1-1987 or as amended for concrete slab or continuous foot foundations and the referenced Figures C-5, C-6, C-9, C-10, C-16 and accompanying section details. The alternate piers-ground anchor foundation, concrete or concrete block load bearing perimeter, pile/post or permanent wood foundations shall not be allowed.

(ii) The requirement for all dwellings to be placed on a permanent foundation shall apply to all dwellings constructed or placed after the effective date of this code.

(iii) Any nonconforming conventional, manufactured or mobile home use may be continued subject to the provisions of Chapter 21.08 GJMC.

(iv) The foundation system alternatives identified in ANSI A225.1-1987, approved April 26, 1989, or as amended, for manufactured residential units may be modified to allow the following:

(A) On permanent wood foundation systems, the footer may be a depth of six inches and a width of 12 inches as opposed to the 10-inch depth and 18-inch depth illustrated in the standard; and

(B) The anchor system may include any other system approved by the Chief Building Official for the City.

(4) Where local, State or federal standards conflict with these minimum standards for manufactured home foundations, the most restrictive of any regulation shall apply.

(n) Multifamily Development.

(1) To the extent practicable, as determined by the Director, multifamily dwellings shall be developed in small clusters in order to create a sense of place.

(2) Development with more than 10 units shall dedicate 10 percent of the gross acreage of the property or the equivalent of 10 percent of the value of the property in accordance with GJMC 21.06.020(a).

(3) The minimum dimension of any courtyard between dwellings from which either dwelling may be entered should be a minimum of the average of the heights of the dwelling adjacent to the yard (a yard is considered between two structures if the angle between the building lines of the structures is less than 90 degrees).

(4) Storage for things such as tools, bicycles, ski equipment, etc., shall be incorporated into a multifamily development. Storage should be designed as an integral part of the development and be integrated with the architectural character of the dwellings. Storage facilities being incorporated into garages, carports and screening walls using materials and details similar to those of the dwellings is encouraged.

(5) The following design elements shall be considered and, as appropriate, the Director may require that the developer address any or all of the same for any multifamily development:

(i) The residential scale and character of a development should be the foremost design concern;

(ii) In projects of more than five dwellings, the identity of the individual unit should be evident in the street elevation;

(iii) In conversion of an existing structure, an addition should respect the architectural character, detailing, lines and proportions of the existing structure. Additions should be integrated into the existing structure so that it is difficult to identify and it appears to have been a part of the original design of the structure;

(iv) Elevations which have different but compatible features for adjacent units should be considered;

(v) The use of balconies, overhangs, covered patios, and trellis provide relief and contrast to the building and assist in breaking up large wall surfaces;

(vi) When building elements such as decks, chimneys, etc., are repeated, some alterations to details of those elements such as varying orientation, etc., should be used within the context of the overall design to provide interest and avoid monotonous repetition;

(vii) Mass of the building should be reduced by varying setbacks and building heights of individual units;

(viii) Entries and stairwells should be an integral part of the building design. Consideration should be given to partially screening stairwells or using unique architectural treatments so that such features blend in with the overall building elevation;

(ix) Dwellings and other structures, such as carports, garages and storage units, should be designed in concert with each other by carrying certain details and design elements throughout the project;

(x) Long rooflines should be varied, providing different heights or varying roof orientations. Parapet walls should be interrupted by setbacks or varying heights to provide variety to the roof line;

(xi) The architectural detailing and treatment of windows and doorways should be strongly considered through the use of bay windows, recessed windows, raised borders, awnings, shutters or trellis. Use of clerestory windows is encouraged where appropriate;

(xii) The individuality and privacy of dwellings should be emphasized through the use of identifiable private or semiprivate entries;

(xiii) Catwalks or long corridors lined with entrances to units is strongly discouraged; patio walls and fences should be an integral part of building design and should match the principal structure's materials;

(xiv) Mechanical equipment should be screened from public view and be located so as to be perceived as an integral part of the buildings; and

(xv) Exterior perimeter walls of a project facing public streets should be compatible with the landscape theme and the main building materials.

(6) Energy conservation measures in building design such as the use of solar heating and/or use of in-line hot water systems, efficient lighting, insulation, etc., are strongly encouraged. Orientation and the use of appropriate landscape planting should optimize solar access in the winter while offering shade in the summer.

(7) The relationship between a multifamily project and adjacent uses should take into account the type of adjacent uses, building scale, density and building heights. Particular sensitivity should be used when a multifamily project is proposed adjacent to residential uses of lesser density.

(8) To minimize the impact of the multifamily development the Director shall have the authority to mitigate impacts through the imposition of one or more of the following conditions:

(i) Additional landscaping to serve as buffer area;

(ii) Wider setbacks from property line;

(iii) Modifying the orientation of buildings;

(iv) Modifying the orientation of windows and balconies;

(v) Providing screen walls;

(vi) Relocation of access ways;

(vii) Require that active recreation facilities be located to minimize the intrusion of noise into an adjacent residential area or require a method for mitigating noise from the recreation area; and

(viii) Require that multifamily buildings be oriented to take advantage of pleasant off-site views and/or constructed to minimize or screen poor or obtrusive views. Views from elevated use areas such as balconies should be given careful consideration.

(o) Religious Assemblies/Churches in Residential Districts.

(1) This subsection sets minimum standards for new construction and expansion of, or changes to, existing churches/church uses.

(2) These requirements shall be applied no later than at the time of the site plan review.

(i) Maximum seating capacity shall be based upon the seating capacity in the largest assembly area of the principal structure.

(ii) Calculation of maximum seating capacity shall include the rostrum, choir seats, fixed seating and overflow seating area. Seating capacity assumes one person per chair or other type of seat or one person per 18 lineal inches of pew space.

(iii) Churches with a maximum seating capacity of up to 300 and churches with a maximum seating capacity of 301 to 600 which are located on a parcel or lot abutting a principal or minor arterial or collector street, as identified on the City's Streets Classification Map, are allowed uses in all residential zones.

(iv) Churches with a maximum seating capacity of 301 to 600 require public notice if not located on a parcel or lot abutting a principal or minor arterial or collector street, as identified on the City's Grand Junction Circulation Plan.

(v) Churches with a maximum seating capacity greater than 600 require a public notice in all residential zones.

(vi) Notwithstanding subsections (o)(2)(iii) through (v) of this section, churches in planned development districts must comply with the provisions of Chapter 21.05 GJMC, planned developments and any and all requirements of general applicability as specified in this code.

(vii) Notwithstanding subsections (o)(2)(iii) through (vi) of this section, churches in airport critical zones or clear zones must comply with Chapter 21.07 GJMC, land use regulation for land around airports and any and all requirements of general applicability as specified in this code.

(viii) Churches in all residential districts shall comply with the following development standards:

(A) Parking shall not be allowed in the required front yard setback;

(B) The front yard setback shall be landscaped in accordance with GJMC 21.06.040(d). The front yard setback shall be counted towards the percentage of gross land area to be landscaped in multifamily zones;

(C) A minimum 15-foot side yard setback, or as required in the zone, whichever is greater, shall be required for the principal structure. A minimum five-foot side yard setback, or as required in the zone, whichever is greater, shall be required for accessory structure on the rear half of the parcel;

(D) Where parking lots containing fewer than 51 spaces extend into required side and rear yard setbacks abutting a residential use or zone, a minimum five-foot-wide landscaped area shall be provided along the property line or other appropriate location to minimize glare from lights associated with parking areas onto abutting properties;

(E) At least one tree for each 40 linear feet or fraction thereof;

(F) At least 40 percent of the landscaped area shall contain shrubs in accordance with the general landscaping requirements;

(G) Parking lots shall comply with GJMC 21.06.040(c);

(H) Required side and rear yard setbacks adjacent to a property line abutting a residential use or zone shall be landscaped in accordance with GJMC 21.06.040;

(I) All trash containers shall be screened by a six-foot-high sight-obscuring fence or wall. Fences must comply with GJMC 21.04.040(i), any design guidelines and other conditions of approval; and

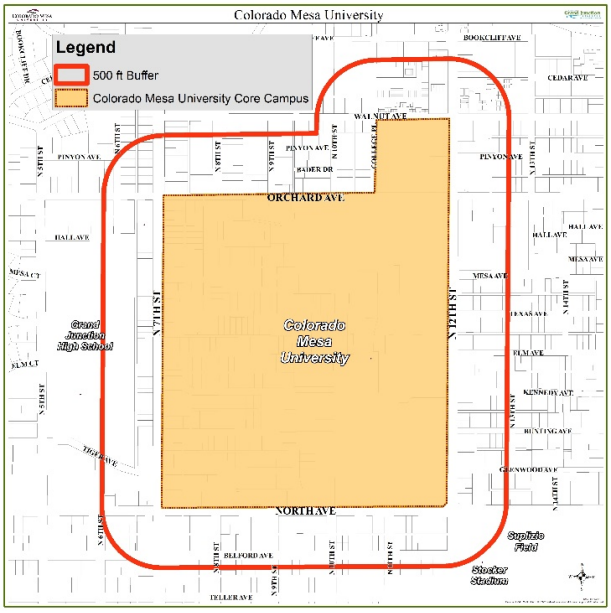
(J) Churches shall comply with all other applicable requirements of this code and any and all other regulations that may apply.

(p) Group Living. It is a violation of this code for more than four unrelated persons to reside together in a single residential structure without a conditional use permit, unless permitted by the City as a fraternity/sorority, group living facility, rooming/boarding house or dormitory style living in accordance with the standards and requirements in this section. "Related" means a person's child, stepchild, a foster child, or other descendant, spouse, aunt, uncle, niece, nephew, parent, grandparent, great grandparent, stepparent or foster parent. (See GJMC 21.10.020, "Group living," "family" and "household.") A household of more than four unrelated persons that is not a fraternity/sorority, group living facility or rooming/boarding house as defined herein is not allowed unless a conditional use permit has been approved.

(1) Fraternities and Sororities.

(i) Definition. A fraternity or sorority is a place of residence that is operated by a nationally or locally chartered membership organization and is used, occupied and maintained as living and dining quarters for its members who are enrolled in an accredited college or university or other accredited educational institution and which is recognized and subject to controls by such educational institution.

(ii) A fraternity or sorority is allowed only within the core campus of Colorado Mesa University or within 500 feet of the boundary of the core campus, and only in those zone districts so designated in the use table, GJMC 21.04.010. The core campus is that area situated south of Orchard Avenue, west of North 12th Street, north of North Avenue and east of North 7th Street, and that area north of Orchard Avenue, west of 12th Street, south of Walnut Avenue, and east of College Place, and is depicted to the right. The limitations, standards and requirements of this subsection (p)(1) do not apply to a fraternity or sorority located entirely within the core campus.



(iii) A fraternity or sorority may exceed the maximum residential density of the applicable zone district so long as the standards described in this subsection (p)(1) are met.

(iv) Standards for Fraternity/Sorority.

(A) Parking. Off-street parking shall be provided according to the parking table in GJMC 21.06.050(c).

(B) Each residential structure shall provide a minimum of 100 square feet per occupant. Regardless of square footage, the number of residential occupants shall not exceed 35.

(C) No more than four beds in a single room.

(D) Buffering and Screening. Each property line abutting a right-of-way, open/undeveloped tract or another property that is not used as a fraternity or sorority shall have, at a minimum, a six-foot solid fence and an eight-foot-wide landscaped strip located inside the fence.

(v) Process.

(A) Neighborhood Meeting. Prior to establishing a fraternity or sorority, the applicant shall give mailed notice to property owners and homeowners' associations within 1,000 feet of the proposed fraternity or sorority and shall hold a neighborhood meeting for those owners/associations. In all other respects the neighborhood meeting and notice shall comply with GJMC 21.02.080(e).

(B) Decision and Appeal. The Director shall approve, approve with conditions, or deny an application for a fraternity or sorority based on the standards and requirements of the code. Within 10 days of the Director's decision, an individual aggrieved by the Director's decision may appeal the Director's approval or denial of an application or a condition imposed by the Director to the Zoning Board of Appeals. Appeals shall be in writing and perfected in accordance with GJMC 21.02.210(c).

(vi) Annual Registration Required. A fraternity or sorority shall register with the City annually; that is, once every 12 calendar months. No person shall own, operate or manage a fraternity or sorority unless the facility is registered with the City. Annual registration shall include:

(A) Proof that the fraternity or sorority is recognized and in good standing with an accredited school, university or college;

(B) Proof that the fraternity or sorority is affiliated and in good standing with a nationally or locally chartered fraternal membership organization;

(C) Documentation that the fraternity or sorority has complied with the applicable City, State and other building, fire, health and safety codes as well as all applicable requirements of the zone district in which the fraternity or sorority is located;

(D) Statement that the only administrative activities conducted on the premises are those of the fraternal organization sponsored, conducted or related to the fraternity or sorority;

(E) Documentation that the fraternity or sorority complies with the applicable parking requirements, as demonstrated by accurate graphic depiction of parking lot(s), and/or copies of parking agreements, leases or licenses;

(F) Documentation that the maximum number of residents allowed is not exceeded, as demonstrated by the total square feet of the living areas, the number of residents, the number of sleeping rooms and the number of beds; and

(G) The total number of calls for police or emergency services to the premises within the previous year.

(vii) A fraternity or sorority that does not meet the standards and registration requirements of this subsection is subject to revocation of land use permit, abatement, prosecution and/or other enforcement as provided in this code.

(viii) A fraternity or sorority is subject to and shall permit annual inspection by the Building Department, Fire Department and Code Enforcement Division to ensure compliance with applicable standards.

(ix) Validity. A land use approval or permit for a fraternity or sorority is valid for a period of 12 months, with renewal by the Director upon a review of the facility's annual registration as described in subsection (p)(1)(vi) of this section and a finding that:

(A) The fraternity or sorority is recognized and in good standing with an accredited school, university or college;

(B) The fraternity or sorority is affiliated and in good standing with a nationally or locally chartered fraternal membership organization;

(C) The fraternity or sorority is in compliance with applicable City, State and other building, fire, health and safety codes as well as all applicable requirements of the zone district in which the fraternity or sorority is located;

(D) The only administrative activities conducted on the premises are those of the fraternal organization sponsored, conducted or related to the fraternity or sorority;

(E) The fraternity or sorority complies with the parking requirements of this code;

(F) The maximum number of residents allowed is not exceeded; and

(G) The facility has not adversely affected the neighborhood. A facility is considered to have an adverse effect on a neighborhood if one or more of the following are shown:

a. Public and private services such as street, sewers, water and/or utility systems are burdened by the facility, to the extent that usage exceeds that normally associated with such a use or in the particular neighborhood;

b. The facility unreasonably interferes with the peace, quiet and dignity of the neighborhood;

c. The facility creates, imposes, aggravates or leads to inadequate, impractical, unsafe or unhealthy conditions; or

d. The facility is found to be dangerous or unsafe due to an increased number of police or emergency visits, or to a single criminal act by a resident involving serious bodily injury or extensive property damage, or to an increased number of incidences of criminal acts by residents of the facility involving bodily injury or property damage.

(x) Within 10 days of the Director's renewal, nonrenewal or condition of renewal, an individual aggrieved by the Director's decision may appeal the Director's decision to the Zoning Board of Appeals. Appeals shall be in writing and perfected in accordance with GJMC 21.02.210(c).

(2) Group Living Facility.

(i) Definitions.

(A) A *group living facility* is a residential housekeeping unit for five or more unrelated persons receiving public or private supervision, care, support or treatment on site. A community corrections facility is not a group living facility and thus is not allowed in a residential zone. A facility providing temporary lodging for less than 30 days for any one person is not a group living facility, but is considered either lodging (see retail sales and service categories) or a shelter (see community service categories) and treated as such.

(B) An *unlimited group living facility* is a group living facility with 17 or more residents.

(C) A *large group living facility* is a group living facility with 10 to 16 residents.

(D) A *small group living facility* is a group living facility with five to nine residents.

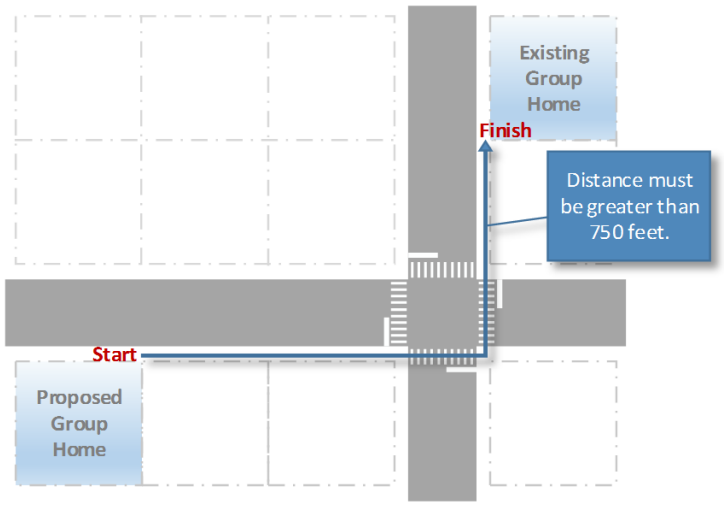
(ii) Standards.

(A) Spacing Requirement. A group living facility in the R-R, R-1, R-2, R-4, R-5 or R-8 zone shall be at least 750 feet from every other group living facility in any such zone district. There is no spacing requirement where either one of the two group

living facilities being measured against one another is in a zone district not listed in this subsection. The separation distance shall be measured in the following manner:

Computed by direct measurement from the nearest property line of the land used for a group living facility to the nearest property line of an existing group living facility, using the most direct route of public pedestrian access, measured as a person would walk along public right-of-way, with right angles at crossings and with the observance of traffic regulations and traffic signals (see Figure 1); except that a group living facility shall not be located adjacent to another even if by such route the distance is greater than 750 feet.

Figure 1



(B) The group living facility must comply with the applicable City, State and other building, fire, health and safety codes as well as all applicable requirements and development standards applicable to the zone district in which the group living facility is to be located except as modified in this subsection.

(C) For a group living facility in a residential zone, the architectural design of the group living facility must be residential in character, and the performance standards of the R-O zone district must be met (see GJMC 21.03.070(a)), except that if the zone district is R-12, R-16 or R-24, the R-O zone district standards shall not apply.

(D) Density and Minimum Lot Area. Group living facilities are allowed in residential zones as specified in the zone/use table in GJMC 21.04.010, and must not exceed maximum density for the zone district, with density of the facility calculated as four beds equal one dwelling unit. The site must contain at least 500 square feet per resident, except where a multifamily structure is being converted to a group living facility, in which case the minimum adequate lot area shall be in accordance with the requirements of the zone district.

(E) Accessory Uses. Accessory uses authorized with a group living facility are on-site recreational facilities, parking of vehicles for visitors, occupants and staff, and staff housing. The Director may approve other accessory uses that will have substantially similar impacts. Only the administrative activities of the person or organization operating the facility shall be conducted at the facility. No office or other space in the facility or on the site may be leased or used for activities unrelated to the group living facility.

(F) Parking. The group living facility must meet the requirements established for group living in GJMC 21.06.050(c).

(G) A group living facility located in a commercial or mixed use zone district shall meet the performance standards of the applicable zone district.

(H) A group living facility in a residential zone may provide services to nonresidents, but only up to the total number of residents permitted in the facility. For example, if there are nine residents at a group living facility that is allowed to have 16 residents, no more than seven nonresidents may use the services the facility provides at any one given time. This restriction does not apply in nonresidential zones.

(iii) Validity. A land use permit/approval for a group living facility is valid for a period of 12 months, subject to renewal by the Director upon review of the facility's annual registration as described in subsection (p)(2)(vi) of this section. The permit/approval is specific to a maximum number of residents and specifically permitted accessory use(s); if the applicant wants to increase these, a new permit is required.

(iv) Process.

(A) Neighborhood Meeting. Prior to establishing a new group living facility (whether a new structure or conversion of existing building(s)) the applicant shall give mailed notice to and hold a neighborhood meeting with property owners within 1,000 feet of the group living facility.

a. At the meeting, the applicant shall describe the proposed land use, including buildings, site, accessory uses and structures, residents served, and on-site services.

b. The neighborhood meeting shall be held at a location convenient to the neighborhood.

c. If a neighborhood meeting is required because of some other aspect of the development application, then only one neighborhood meeting is necessary, which shall be conducted in accordance with the more restrictive standards.

(B) Special Review. An application for a group living facility for adult or juvenile offenders, defined as persons who have committed a crime or are accused of having committed a crime and are housed at the facility for that reason, shall be reviewed as follows:

a. The Mesa County Juvenile Community Corrections Board shall conduct the review if the facility houses juvenile offenders or the Adult Community Corrections Board if the facility houses adult offenders. If the facility houses a combination of adult and juvenile offenders, the facility shall be reviewed by the Juvenile Board if there are a greater number of juveniles residing in the facility or, if there are a greater number of adults than juveniles residing in the facility, by the Adult Board.

b. The review shall include but not necessarily be limited to criteria established by the Board and adopted by the City. Criteria shall be established and maintained by the Board and shall be based upon researched factors that have been demonstrated to be correlative to risk to the community, community expectations, prudent land use practices and legal standards. Before any criteria being used by the Board, the City shall review and adopt such criteria.

c. It is the responsibility of the group living facility that is being reviewed to provide the Board with complete and accurate information regarding the types of offenders, the number of offenders, the average length of placements and responses to the other Board-established criteria.

d. The Board shall make a recommendation to the Director to approve, deny or approve with conditions the land use application for the facility. The Board shall take into consideration the interests of the community in light of the criteria established by the Board and approved by the City.

(C) Decision and Appeal.

a. The Director shall approve, approve with conditions, or deny an application for a group living facility, except as provided in subsection (p)(2)(iv)(C)(b) of this section, based on the standards and requirements of the code. Within 10 days of the Director's decision, a person aggrieved by the Director's decision may appeal the Director's approval or denial of an application or a condition imposed by the Director to the Zoning Board of Appeals. Appeals shall be in writing and perfected in accordance with GJMC 21.02.210(c).

b. The Director shall not render a decision on an application, notwithstanding a recommendation from the Juvenile and/or Adult Corrections Board(s), for a group living facility that houses one or more sex offenders, as defined by State law. The Planning Commission shall determine any such application. In addition to the other criteria provided herein, the Planning Commission shall consider whether the proposed owner/operator has established by clear and convincing evidence that the facility will not adversely impact the neighborhood and/or its residents. An appeal from a Planning Commission decision made under this subsection shall be in accordance with Rule 106 of the Colorado Rules of Civil Procedure.

(v) Registration Required. A group living facility shall register with the City annually; that is, once every 12 calendar months. No person shall own, operate or manage any group living facility unless the facility is registered with the City. A group living facility for adult or juvenile offenders shall also submit all registration documentation to the Juvenile and/or Adult Corrections Board for review in accordance with subsection (p)(2)(iv)(B) of this section. A group living facility that fails to register or does not meet the registration requirements may be denied renewal, abated, prosecuted and/or otherwise subject to enforcement action under this code. Annual registration shall include:

(A) Proof that the group living facility has a valid Colorado license, if any is required by State law, and documentation showing that the facility complies with the requirements of the State license. In the event there is a conflict between a City and a State requirement for the facility, the more stringent rule shall apply;

(B) Documentation showing that the group living facility has complied with the applicable City, State and other building, fire, health and safety codes as well as all applicable requirements of the zone district in which the group living facility is located;

(C) Documentation showing that the group living facility complies with the parking requirements of this code;

(D) Documentation showing that the maximum number of residents allowed is not exceeded;

(E) For a group living facility housing adult or juvenile offenders, all documentation necessary for review by the Juvenile and/or Adult Corrections Board(s) in accordance with subsection (p)(2)(iv)(B) of this section;

(F) Documentation showing that any and all conditions of the initial land use permit/approval are met;

(G) Description of the administrative or other activities that occur at the facility, including number of staff and general duties of each staff member;

(H) Description and documentation of any changes to the site or structure(s) made since the prior registration.

(vi) Renewal. The Director may renew the land use approval for a group living facility upon an annual registration of the facility if the Director finds that the registration requirements have been met and that the facility has not adversely affected the neighborhood. A facility is considered to have an adverse effect on a neighborhood if one or more of the following are shown:

(A) Public and private services such as street, sewers, water and/or utility systems are burdened by the group living facility, to the extent that usage exceeds that normally associated with such a use or in the particular neighborhood;

(B) The group living facility unreasonably interferes with the peace, quiet and dignity of the neighborhood;

(C) The group living facility creates, imposes, aggravates or leads to inadequate, impractical, unsafe or unhealthy conditions; or

(D) The group living facility is found to be dangerous or unsafe due to an increased number of police or emergency visits, or to a single criminal act by a resident involving serious bodily injury or extensive property damage, or to an increased number of incidences of criminal acts by residents of the facility involving bodily injury or property damage.

(E) When considering whether an adverse impact exists, the Director shall consider the following:

a. Whether the impact is real or perceived based upon stereotypes of the population served by the group living facility;

b. The existence of alarms and/or fences in and of itself shall not constitute a safety issue which would be an adverse impact; or

c. Whether complaints and/or police calls regarding the group living facility have been founded or unfounded.

In determining whether an adverse impact exists, the Director may rely on comments received by the residents of the neighborhood or other interested persons in making the decision whether to renew, renew with conditions, or non-renew the permit upon annual registration. The Director shall not be required to research the comment or otherwise investigate the motive of the commenting parties unless the Director relies on that information when making the decision.

(F) The Director may modify the land use permit/approval upon renewal (or renew with conditions) by limiting the number of residents and/or by limiting accessory uses if the Director finds that the neighborhood is adversely impacted by the number of residents or intensity or number of accessory uses occurring on the site.

(G) The Director shall issue a decision within 30 days of receiving a complete registration application from the facility; if a registration application is incomplete, the Director shall notify the registrant of the deficiencies and the time period to cure. If the Director does not issue a decision within 30 days of receiving a complete registration application, the registration shall be deemed renewed for the next year.

(H) Within 10 days of the Director's decision, an individual aggrieved by the decision may appeal the renewal, non-renewal or condition of renewal to the Zoning Board

of Appeals. Appeals shall be in writing and perfected in accordance with GJMC 21.02.210(c).

(3) Rooming/Boarding House.

(i) Definition. A rooming/boarding house is a single dwelling unit where a live-in or on-site owner provides lodging to others in three or more rooms, with or without meals, for compensation. "Compensation" may include money, services or other things of value. A boarding and rooming house differs from a rental house in that the owner lives on site and rents out sleeping rooms and may provide common access to other areas of the house. A rooming/boarding house differs from a group living facility in that the residents do not receive care, treatment or assistance with daily living at the facility.

(ii) Standards.

(A) The rooming/boarding house must comply with the applicable City, State and other building, fire, health and safety codes as well as all applicable requirements and development standards applicable to the zone district in which the boarding and rooming house is to be located, except as modified in this subsection.

(B) Density. A rooming/boarding house is allowed as shown in the use table in GJMC 21.04.010. In a residential zone the rooming/boarding house must not exceed maximum density for the zone, with density calculated as two rented rooms equal one dwelling unit.

(C) The rooming/boarding house site shall contain at least 500 square feet for each resident or room/suite, whichever is greater.

(D) The rooming/boarding house must meet the parking standards established in GJMC 21.06.050(c).

(iii) Neighborhood Meeting and Notice. Prior to establishing a new rooming/boarding house (including conversion of an existing building or buildings), the applicant shall give mailed notice to and hold a meeting inviting owners of property within 1,000 feet of the proposed facility.

(A) At the meeting, the applicant shall describe the facility and its proposed uses.

(B) The neighborhood meeting shall be held at a location convenient to the neighborhood.

(C) If a neighborhood meeting is required because of a development application then only one neighborhood meeting, conducted in accordance with the more restrictive or higher standards, shall be necessary.

(4) Other Group Living. Other types of group living, such as but not limited to dormitory style living, may be permitted as provided in the zone/use table (GJMC 21.04.010). Allowed density shall be as applicable to the zone district, with density calculated at two beds equals one dwelling unit. Off-street parking shall be provided in accordance with the parking table in GJMC 21.06.050(c).

(q) Telecommunications Facilities. This subsection (q) establishes standards and requirements for the locating of telecommunications facilities.

(1) Definitions.

Alternative Structure. A structure that is not primarily constructed for the purpose of holding antennas but on which one or more antennas may be mounted, such as buildings, water tanks, pole signs, billboards, church steeples, and electric power transmission towers.

Amateur Radio Tower. A tower used for noncommercial amateur radio transmissions consistent with the "Complete FCC U.S. Amateur Part 97 Rules and Regulations" for amateur radio towers.

Ancillary Structure. For the purposes of this section, any form of development associated with a telecommunications facility, including foundations, concrete slabs on grade, guy anchors, generators, and transmission cable supports, but excluding equipment cabinets.

Antenna. Any apparatus designed for the transmitting and/or receiving of electromagnetic waves, including telephonic, radio or television communications. Types of elements include omni-directional (whip) antennas, sectionalized (panel) antennas, multi or single bay (FM and TV), yagi, or parabolic (dish) antennas.

Antenna Array. A single or group of antenna elements and associated mounting hardware, transmission lines, or other appurtenances which share a common attachment device such as a mounting frame or mounting support structure for the sole purpose of transmitting or receiving electromagnetic waves.

Antenna Element. Any antenna or antenna array.

ASR. The antenna structure registration number as required by the FAA and FCC.

Base Station. Equipment and nontower supporting structure at a fixed location that enable wireless telecommunications between user equipment and a communications network. Examples include transmission equipment mounted on a rooftop, water tank, silo or other above ground structure other than a tower. The term does not encompass a tower as defined herein or any equipment associated with a tower. "Base station" includes, but is not limited to:

(i) Equipment associated with wireless telecommunications services such as private, broadcast, and public safety services, as well as unlicensed wireless services and fixed wireless services such as microwave backhaul;

(ii) Radio transceivers, antennas, coaxial or fiber optic cable, regular and backup power supplies, and comparable equipment, regardless of technological configuration (including distributed antenna systems and small cell networks);

(iii) Any structure other than a tower that, at the time the application is filed under this section, supports or houses equipment described in this definition that has been reviewed and approved under the applicable zoning or siting process, or under another City regulatory review process, even if the structure was not built for the sole or primary purpose of providing such support.

"Base station" does not include any structure that, at the time the application is filed under this section, does not support or house wireless communication equipment.

Breakpoint Technology. The engineering design of a monopole, or any applicable support structure, wherein a specified point on the monopole is designed to have stresses concentrated so that the point is at least five percent more susceptible to failure than any other point along the monopole so that in the event of a structural failure of the monopole, the failure will occur at the breakpoint rather than at the base plate, anchor bolts, or any other point on the monopole.

Broadband Facility. Any infrastructure used to deliver broadband services or for the provision of broadband service.

Broadband Service. Any technology identified by the U.S. Secretary of Agriculture as having the capacity to transmit data to enable a subscriber to the service to originate and receive high-quality Internet access, voice, data, graphics, and video. Broadband service includes, but is not limited to:

(i) Cable Service. The one-way transmission to subscribers of video programming or other programming services and subscriber interaction required for the selection or use of such video programming or other programming service.

(ii) Telecommunications Service. The offering of telecommunications for a fee directly to the public, or to such classes of users as to be effectively available directly to the public, regardless of the facilities used.

(iii) Wireless Service. Data and telecommunications services, including commercial mobile services, commercial mobile data services, unlicensed wireless service and common carrier wireless exchange access services, as all of these terms are defined by federal law and regulations.

Co-Location. The mounting or installation of transmission equipment on an eligible support structure for the purposes of transmitting and/or receiving radio frequency signals for communications purposes so that installation of a new support structure will not be required.

Combined Antenna. An antenna or an antenna array designed and utilized to provide services for more than one wireless provider, or a single wireless provider utilizing more than one frequency band or spectrum, for the same or similar type of services.

Concealed. A tower, ancillary structure, or equipment compound that is not readily identifiable as a telecommunications facility and that is designed to be aesthetically compatible with existing and proposed building(s) and uses on a site or in the neighborhood or area.

There are two types of concealed facilities: (i) antenna attachments, including painted antenna and feed lines to match the color of a building or structure, faux windows, dormers or other architectural features that blend with an existing or proposed building or structure and (ii) a freestanding concealed tower which looks like something else that is common in the geographic region such as a church steeple, windmill, bell tower, clock tower, light standard, flagpole with a flag that is proportional in size to the height and girth of the tower, or tree that grows naturally or is commonly found in the area.

COW – "Cellular on Wheels." A temporary PWSF placed on property to provide short term, high volume telecommunications services to a specific location and which can be easily removed from the property.

DAS – Distributed Antenna System. A system consisting of: (i) a number of remote communications nodes deployed throughout the desired coverage area, each including at least one antenna for transmission and reception; (ii) a high capacity signal transport medium (typically fiber optic cable) connecting each node to a central communications hub site; and (iii) radio transceivers located at the hub site (rather than at each individual node as is the case for small cells) to process or control the communications signals transmitted and received through the antennas.

DAS Hub. Ancillary equipment usually contained in a shelter or other enclosure which does not have any wireless transmission or receive equipment contained therein but is utilized in the deployment and operation of wireless DAS receive/transmit infrastructure that is located elsewhere.

Development Area. The area occupied by a telecommunications facility including areas inside or under an antenna-support structure's framework, equipment cabinets, ancillary structures, and/or access ways.

Dual Purpose Facility. A new banner pole, light stanchion, support tower for overhead electric lines, or other similar utility structure onto which one or more antenna(s) are or can be mounted or attached, and which is built for the primary purpose of providing PWSF.

Eligible Facilities Request. Any request for modification of an existing tower or base station involving co-location of new transmission equipment, removal of transmission equipment, or

replacement of transmission equipment that does not substantially change the physical dimensions of such tower or base station.

Eligible Facility. Existing wireless tower or base station that has been approved through a local government land use review process prescribed for the tower or base station.

Eligible Support Structure. Any tower or base station existing at the time the application is filed with the City.

Equipment Cabinet. Any structure used exclusively to contain equipment necessary for the transmission or reception of communication signals.

Equipment Compound. The fenced-in area surrounding, inside or under a ground-based wireless communication facility containing ancillary structures and equipment (such as cabinets, shelters, and pedestals) necessary to operate an antenna that is above the base flood elevation.

Equipment Shelter. A self-contained building housing ancillary electronic equipment typically including a generator.

Existing. A constructed tower or base station is "existing" for purposes of this section if it has been reviewed and approved under an applicable City land use review process. "Existing" also includes a tower that was lawfully constructed but not reviewed because it was not in a zoned area when it was built.

Feed Lines. Cables or fiber optic lines used as the interconnecting media between the base station and the antenna.

Flush-Mounted. Antenna or antenna array attached to the face of a support structure or building such that no portion of the antenna(s) extend(s) above the height of the support structure or building. The maximum flush-mounting distance, if prescribed, shall be measured from the outside edge of the support structure or building to the inside edge of the antenna.

Geographic Search Ring. An area designated by a wireless provider or operator for a new base station and/or tower produced in accordance with generally accepted principles of wireless engineering.

Handoff Candidate. A wireless communication facility that receives call transference from another wireless facility, usually located in an adjacent first "tier" surrounding the initial wireless facility.

Least Visually Obtrusive Profile. The design of a telecommunications facility presenting the minimum visual profile necessary for proper function.

Nonconcealed. A telecommunications facility that is readily identifiable as such (whether freestanding or attached).

OTARD. Over the air reception devices which are limited to either a "dish" antenna one meter (39.37 inches) or less in diameter designed to receive direct broadcast satellite service, including direct-to-home satellite service, or to receive or transmit fixed wireless signals via satellite, or an antenna that is one meter or less in diameter and is designed to receive video programming services via broadband radio service (wireless cable), or to receive or transmit fixed wireless signals other than via satellite or an antenna that is designed to receive local television broadcast signals.

Personal Wireless Service Facility ("PWSF"). Any staffed or unstaffed location for the transmission and/or reception of radio frequency signals or other personal wireless communications, including commercial mobile services, unlicensed wireless services, wireless broadband services, and common carrier wireless exchange access services as defined in the Telecommunications Act of 1996, and usually consisting of an antenna or group of antennas, transmission cables, feed lines, equipment cabinets or shelters, and may include a tower. Facilities may include new or existing towers, replacement towers, co-location on existing

towers, base station attached concealed and nonconcealed antenna, dual purpose facilities, concealed towers, and nonconcealed towers (monopoles, lattice and guyed), so long as those facilities are used in the provision of personal wireless services as that term is defined in the Telecommunications Act.

Qualified Co-Location Request. Co-location of PWSF on a tower or base station that creates a substantial change in the facility but is entitled to processing within 90 days under 47 U.S.C. §332(c)(7).

Radio Frequency Emissions. Any electromagnetic radiation or other communications signal emitted from an antenna or antenna-related equipment.

Radio Frequency Propagation Analysis. Computer modeling to show the level of signal saturation in a given geographical area.

Replacement. A modification of an existing tower to increase the height, or to improve its integrity, by replacing or removing one or several tower(s) located in proximity to a proposed new tower in order to encourage compliance with this section, or improve aesthetics or functionality of the overall wireless network.

Satellite Earth Station. A single or group of parabolic or dish antennas mounted to a support device that may be a pole or truss assembly attached to a foundation in the ground, or in some other configuration, including the associated separate equipment cabinets necessary for the transmission or reception of wireless communications signals with satellites.

Site. For towers other than towers in the public rights-of-way, the boundaries of the leased or owned property on which the facilities are or are proposed to be situated.

Small Cell Facility. A wireless service facility that meets both of the following qualifications:

(i) Each antenna is located inside an enclosure of no more than three cubic feet in volume or, in the case of an antenna that has exposed elements, the antenna and all of its exposed elements could fit within an enclosure of no more than three cubic feet; and

(ii) Primary equipment enclosures are no larger than 17 cubic feet in volume. The following associated equipment may be located outside of the primary equipment enclosure and, if so located, is not included in the calculation of equipment volume: electric meter, concealment, telecommunications demarcation box, ground-based enclosures, backup power systems, grounding equipment, power transfer switch, and cutoff switch.

Small Cell Network. A collection of interrelated small cell facilities designed to deliver wireless service.

Stanchion. A vertical support structure generally utilized to support exterior lighting elements.

Streamlined Processing. Expedited review process for co-locations required by the federal government (Congress and/or the FCC) for PWSF.

Substantial Change. A modification or co-location constitutes a “substantial change” of an eligible support structure if it meets any of the following criteria:

(i) A PWSF co-location or modification of an existing antenna-supporting structure not in a public right-of-way increases the overall height of the antenna-supporting structure, antenna and/or antenna array more than 10 percent or 20 feet, whichever is greater. A PWSF co-location on an existing antenna-supporting structure within a public right-of-way increases the overall height of the antenna-supporting structure, antenna and/or antenna array more than 10 percent or 10 feet, whichever is greater.

(ii) A PWSF co-location for towers not in a public right-of-way protrudes from the antenna-supporting structure more than 20 feet or the width of the structure at the elevation of the

co-location, and for towers within a public right-of-way, protrudes from the antenna-supporting structure more than six feet.

(iii) A PWSF co-location on an existing antenna-supporting structure fails to meet current building code requirements (including windloading).

(iv) A PWSF co-location adds more than four additional equipment cabinets or one additional equipment shelter.

(v) A PWSF co-location requires excavation outside of existing leased or owned parcel or existing easements.

(vi) A PWSF co-location defeats any existing concealment elements of the antenna-supporting structure.

(vii) A PWSF co-location fails to comply with all conditions associated with the prior approval of the antenna-supporting structure except for modification of parameters as permitted in this section.

Support Structure. Anything constructed or erected, the use of which requires permanent location on the ground, or attachment to something having a permanent location on the ground.

Telecommunications Facility(ies). At a specific physical location, one or more antenna, tower, base station, mechanical and/or electronic equipment, conduit, cable, and associated structures, enclosures, assemblages, devices and supporting elements that generate or transmit non-ionizing electromagnetic radiation or light operating to produce a signal used for communication, including but not limited to all types of communication facilities defined further herein.

Temporary PWSF. A temporary tower or other structure that provides interim short-term telecommunications needed to meet an immediate demand for service in the event of an emergency or a public event where a permanent wireless network is unavailable or insufficient to satisfy the temporary increase in demand or when permanent PWSF equipment is temporarily unavailable or off line.

Transmission Equipment. Equipment that facilitates transmission of communication service (whether commercial, private, broadcast, microwave, public, public safety, licensed or unlicensed, fixed or wireless), such as radio transceivers, antennas, coaxial or fiber-optic cable, and regular and backup power supply.

Tower. Any support structure built for the primary purpose of supporting any antennas and associated facilities for commercial, private, broadcast, microwave, public, public safety, licensed or unlicensed, and/or fixed or wireless services. A tower may be concealed or nonconcealed. Nonconcealed towers include:

(i) Guyed. A style of tower consisting of a single truss assembly composed of sections with bracing incorporated. The sections are attached to each other, and the assembly is attached to a foundation and supported by a series of wires that are connected to anchors placed in the ground or on a building.

(ii) Lattice. A self-supporting tapered style of tower that consists of vertical and horizontal supports with multiple legs and cross bracing, and metal crossed strips or bars to support antennas.

(iii) Monopole. A style of freestanding tower consisting of a single shaft usually composed of two or more hollow sections that are in turn attached to a foundation. This type of tower is designed to support itself without the use of guy wires or other stabilization devices. These facilities are mounted to a foundation that rests on or in the ground or on a building's roof. All feed lines shall be installed within the shaft of the structure.

Tower Base. The foundation, usually concrete, on which the tower and other support equipment are situated. For measurement calculations, the tower base is that point on the foundation reached by dropping a perpendicular from the geometric center of the tower.

Tower Height. The vertical distance measured from the grade line to the highest point of the tower, including any antenna, lighting or other equipment affixed thereto.

Tower Site. The land area that contains, or will contain, a proposed tower, equipment compound, support structures and other related buildings and improvements.

Wireless Service Facility. A telecommunications facility for the provision of wireless services.

(2) Permit Required – Exemptions – Permit Types – General Requirements – Decision-Making – Fees.

(i) No telecommunications facility shall be installed, constructed, altered, added to, or permitted unless the Director has first approved a site plan review for the property and the facilities and a permit has been issued. Telecommunications facilities and infrastructure shall be constructed and maintained in conformance with all applicable building code requirements as well as with the terms of the permit issued under this section.

(ii) No telecommunications facility shall be altered, added to, installed or permitted unless the applicant has shown compliance with all the requirements of this section. The requirements of this section apply to all telecommunications facilities, whether concealed or not, whether aboveground or underground, including but not limited to existing towers, proposed towers, public towers, replacement of towers, ancillary structures and equipment, co-location on existing towers, base stations, temporary telecommunications facilities, PWSF facilities, DAS facilities, small cell sites and/or networks, and broadcast towers, except that the following are exempt and no permit is required:

(A) An amateur radio tower that is used exclusively for noncommercial purposes;

(B) A government-owned telecommunications facility erected for a state of emergency officially declared by a federal, State or local government and where the City Manager or designee has made a written determination of public necessity for the facility, and only during the duration of the state of emergency;

(C) A government-owned public safety facility;

(D) Over-the-air reception devices (OTARD), including satellite earth stations, so long as the device does not require construction of a tower or other structure exceeding 12 feet above the home or building and the device is no more than one meter in diameter in a residential zone or two meters in any other zone district.

(iii) General Requirements Applicable to All Telecommunications Facilities.

(A) Signage. Commercial messages shall not be displayed on any tower, support structure or ancillary structure, unless the tower is concealed and the means of concealment is or includes an existing sign or unless a sign is serving as a dual purpose facility or a base station. Required noncommercial signage shall be subject to the following:

a. The only signage that is permitted upon a concealed tower, equipment cabinet, shelter or fence shall be informational, and for the purpose of identifying the tower (such as ASR registration number), as well as the party responsible for the operation and maintenance of the facility, and any additional security and/or safety signs as applicable.

b. If more than 220 voltage is necessary for the operation of the facility and is present in a ground grid or in the tower, signs located every 20 feet and

attached to the fence or wall shall display in large, bold, high contrast letters, minimum height of each letter four inches, the following: "HIGH VOLTAGE – DANGER."

c. Name plate signage shall be provided, in an easily visible location, including the address and telephone number of the contact to reach in the event of an emergency or equipment malfunction, including property manager signs as applicable.

(B) Lighting. Lighting on PWSF towers shall not exceed the Federal Aviation Administration (FAA) minimum standards. All other lighting shall be subject to the following:

a. Any lighting required by the FAA must be of the minimum intensity and number of flashes per minute (i.e., the longest duration between flashes) allowable by the FAA. Dual lighting standards are required with strobe during daytime and red flashing lights at night unless prohibited by the FAA.

b. Lights shall be filtered or oriented so as not to project directly onto surrounding property or rights-of-way, consistent with FAA requirements.

(iv) Telecommunications facilities shall be located in accordance with the use table in GJMC 21.04.010. One or more of several types of permits may be required for a given facility or group of facilities.

(A) Administrative Permit. For those types of facilities that are allowed in the given zone district, and for qualified co-locations, an administrative permit (a permit issued by the Director) is required. The permit shall be processed and decided in accordance with GJMC 21.02.070 and this subsection (q).

(B) Conditional Use Permit (CUP). For those types of facilities that require a conditional use permit (see GJMC 21.04.010, Use table), the Director shall review the application and make a recommendation to the Planning Commission who shall hold a hearing on the application and who may approve, approve with conditions, or deny the application in accordance with GJMC 21.02.110 and with this subsection (q).

(C) Right-of-Way Work/Use Permit. Facilities/structures located in the public right-of-way shall be placed so as not to interfere with vehicular or pedestrian use of the rights-of-way or with traffic safety. Any/all work in the public right-of-way requires a separate permit pursuant to the City's right-of-way management ordinance. The provider shall comply with all the provisions and terms of the right-of-way management ordinance and right-of-way work permit. As-built construction drawings shall be provided to the City for all structures, equipment, cable, pipes and conduit located within the public right-of-way or within a public or City-owned utility or multipurpose easement, which must include, for fiber optic cable, the number of strands of fiber in the conduit.

(D) Consolidated Application/Permit. For the following facility types, the applicant shall be allowed, at the applicant's discretion, to file a single, consolidated application for multiple facilities and receive a single review/permit/decision instead of filing separate applications for each facility (however, right-of-way work permit(s) may also be required):

a. For small cell networks involving multiple individual small cell facilities within the City;

b. For an applicant desiring to co-locate on several wireless service facilities within the City.

(E) Shadow Conduit. For all telecommunications facility development/installation that involves trenching or excavation in the public right-of-way or in a public or City-owned utility or multipurpose easement, the applicant shall notify the City 30 days prior to commencing such excavation and provide the City the opportunity to install conduit in the same trench/excavation area. The City will pay for the incremental costs of the shadow conduit only.

(v) Siting of Telecommunications Facilities.

(A) Compliance with Siting Preferences. For every application for siting of new telecommunications facilities on or above ground level (except temporary PWSF and co-locations), the applicant must submit an affidavit by a radio frequency engineer demonstrating compliance with the siting preferences of subsection (q)(5) of this section. Where a lower ranking alternative is proposed, the affidavit must address why each of the higher ranked options are not technically feasible, practical, and/or justified.

(B) Where the application is for siting of PWSF, whether for a new facility, modification of existing facility, replacement facility or co-location, and whether the permit is administrative or a CUP, the following additional decision-making requirements apply:

a. If the application is denied, the decision maker shall issue the decision in writing, including the basis for the denial, which must be supported by substantial evidence contained in a written record. The written basis for the decision must be issued contemporaneously with the decision.

b. The application cannot be denied, nor can conditions be applied or required, based upon considerations of radio frequency (RF) emissions safety, other than to require the applicant to demonstrate that all applicable FCC rules are satisfied.

(vi) Streamlined Processing for Co-Location of PWSF.

(A) If the applicant believes its co-location application is an eligible facilities request or a qualified co-location request, the applicant must submit:

a. A complete co-location application specifically requesting streamlined processing and stating the applicable permitting time frame (e.g., 60 days for eligible facilities request or 90 days for qualified co-location request);

b. Documentation evidencing that any structure proposed to be replaced or modified has previously been subject to zoning/development approval by the City;

c. Documentation evidencing the replacement/modification does not create a substantial change in the underlying support structure or tower, or a statement that it does create a substantial change;

d. Documentation that the proposed modifications will be used to provide personal wireless services.

(B) The Director shall review and decide applications for co-location of PWSF.

(C) The Director will notify the applicant within 30 days of submission (or within some other mutually agreed upon time frame) if the submission is incomplete, identifying the specific deficiencies in the application which, if cured, would make the application complete.

(D) Upon notice of deficiency, the timeline for a decision shall be tolled until the applicant resubmits to correct such deficiency. The City shall, within 10 days of resub-

mission, notify the applicant of continuing deficiencies or the application will be deemed complete. The timeline for a decision shall be likewise tolled during the additional resubmission deficiency period until the second resubmission. Upon resubmitting of the revised application the City shall follow the process identified in this section, above, until all deficiencies identified are deemed cured.

(E) If the Director fails to provide such notification, the application will be deemed complete.

(F) The Director's decision shall be in writing and shall be postmarked to the applicant within 60 days after the initial submission, excluding any tolling period, for an eligible facilities request, or, for a qualified co-location, within 90 days after the initial submission, excluding any tolling period, or within some other mutually agreed upon time frame.

(G) If the City does not respond in writing to an eligible facilities request within the specified time frame, the application shall be deemed approved. If the City does not respond in writing to a request for a qualified co-location within the specified time frame, the applicant may pursue its remedies established by federal or State law.

(vii) Timing for Review of New PWSF Tower Applications. A new PWSF tower, whether concealed or nonconcealed, shall be reviewed and a decision rendered within 150 days of receipt of the application, subject to any applicable tolling for application deficiencies and resubmissions as described in subsection (q)(2)(v) of this section, so long as the applicant demonstrates that the facilities will be used, immediately upon completion of construction, to provide personal wireless services, or within such other mutually agreed upon time. ("Spec" towers are not entitled to review and decision within 150 days, or to any of the other protections of the Telecommunications Act.) Construction permits issued for new PWSF towers shall be valid for a term of 18 months and shall lapse and be void if construction of the contemplated PWSF structure is not completed within that time.

(viii) Application and Fees.

(A) Application materials required for telecommunications facilities shall be in accordance with this section and with the specific application requirements in the City's Submittal Standards for Improvements and Development (SSID) Manual. The application form and requirements are specific to the type of telecommunications facility.

(B) The City Council shall establish fees to cover or offset the processing cost of all permits under this section which will be included in the development fee schedule. Every application for a telecommunications facility shall be accompanied by the full payment of the fee established for the type of facility requested. Payment of fees is required in order for an application to be considered complete. The fee shall not be, in whole or in part, deferred or waived.

(C) The City reserves the right to require, in its sole discretion, a supplemental review by experts for any application for a telecommunications facility where the complexity of the analysis requires technical expertise, and/or for any request to vary a standard under subsection (q)(14) of this section, and all the costs of such review shall be borne by the applicant, in addition to scheduled fees.

(D) Based on the results of the supplemental review, City staff responsible for the initial application review may require changes to or supplementation of the applicant's submittal(s).

(E) The supplemental review may address any or all of the following:

a. The accuracy and completeness of the application and any accompanying documentation.

b. The applicability of analysis techniques and methodologies.

c. The validity of conclusions reached.

d. Whether the proposed telecommunications facility complies with the applicable approval criteria and standards of the Zoning and Development Code and other applicable law.

(3) Abandonment/Discontinued Use.

(i) All telecommunications facility structures, equipment, fencing and devices shall be removed from the property and the site returned to its natural state and topography and vegetated consistent with the natural surroundings or current surrounding land uses at the property owner's and/or service provider's expense within 180 days of cessation of use, or within 90 days of cessation of use if the abandonment is associated with a replacement.

(ii) The City may extend the time for removal and site restoration up to 60 additional days if the owner or service provider so requests and shows good and unique cause for the extension.

(iii) If removal and/or site restoration is not accomplished within the prescribed time, the City may initiate removal and restoration within 30 days following written notice to the property owner, and the property owner and service provider shall be jointly and severally responsible for all costs associated with the removal and restoration.

(iv) Conduit and/or fiber optic cable, whether below or above ground, that is or has been abandoned or the use of which is discontinued for one year shall become the property of the City of Grand Junction. Easements for the maintenance of such conduit/cable shall also become the property of the City of Grand Junction, which shall have all the benefit and interest of the original easement holder with respect to installation, maintenance and repair of conduit/cable.

(4) No Interference with Public Safety Communications.

(i) Applicant shall, regardless of the type of facility, comply with "Good Engineering Practices" as defined by FCC regulations and shall provide a composite analysis of all users of the site to determine that the proposed facilities will not cause radio frequency interference with any governmental public safety communications and shall implement appropriate technical measures to prevent such interference.

(ii) When the City notifies a wireless service provider that it believes the provider's antenna(s) or array(s) are creating such interference, the provider shall investigate and mitigate the interference, if any, utilizing the procedures set forth in the joint wireless industry-public safety "Enhanced Best Practices Guide," released by the FCC in Appendix D of FCC 04-168 (released August 6, 2004), including the "Good Engineering Practices," as may be amended or revised by the FCC from time to time in any successor regulations.

(iii) If the provider fails to comply with this subsection (q)(4), including but not limited to by initiating an appropriate response within 24 hours of the City's notification, the provider and the property owner shall be jointly and severally responsible for reimbursing the City for all costs associated with ascertaining and resolving the interference.

(5) Siting Preferences for New Telecommunications Facilities. Siting of new PWSF of any type shall be in accordance with the siting preferences below and with the use table in GJMC

21.04.010. Where a lower ranked alternative is proposed, the applicant must demonstrate through relevant information including, but not limited to, an affidavit by a radio frequency engineer demonstrating that despite diligent efforts to adhere to the established hierarchy within the geographic search area, higher ranked options are not technically feasible, practical or justified given the location of the proposed facilities, by clear and convincing evidence. The applicant must provide such evidence in its application in order for the application to be considered complete.

The siting preferences are, in order:

(i) Co-located or combined PWSF.

(ii) Concealed antenna(s) on a base station.

(iii) Nonconcealed antenna(s) on a base station.

(A) On a wireless master plan priority site.

(B) On City-owned property in any nonresidential zoning district.

(C) On other public property in any nonresidential zoning district.

(D) On nonpublic property in the following zoning districts, ranked highest to lowest:

a. I-2, I-1 or I-O.

b. C-2.

c. B-P or C-1.

d. CSR.

e. Other zone districts in accordance with the use table in GJMC 21.04.010.

(iv) Replacement of existing telecommunications facility in any zoning district.

(v) Dual purpose facility.

(vi) Concealed small cell site.

(vii) Nonconcealed small cell site.

(viii) Distributed Antenna System.

(A) Attached.

a. Concealed on City-owned property, right-of-way or public easement.

b. Concealed on other public property.

c. Concealed on nonpublic property.

d. Nonconcealed on City-owned property, right-of-way or public easement.

e. Nonconcealed on other public property.

f. Nonconcealed on nonpublic property.

(B) New Freestanding DAS Facility.

a. Concealed on City-owned property, right-of-way or public easement.

b. Concealed on other public property.

c. Concealed on nonpublic property.

d. Nonconcealed on City-owned property, right-of-way or public easement.

e. Nonconcealed on other public property.

f. Nonconcealed on nonpublic property.

(ix) Concealed Freestanding Towers.

(A) On a wireless master plan priority site.

(B) On City-owned property in any nonresidential zoning district.

(C) On other public property in any nonresidential zoning district.

(D) On nonpublic property in the following districts, ranked highest to lowest:

a. I-2 or I-1.

b. C-2.

c. C-1.

d. Other zone districts, in accordance with the use table in GJMC 21.04.010.

(E) Preferred Concealment Type (Wherever Located). Concealment types listed below are general preferences, in no particular order. The appropriate means of concealment will depend upon the structures and developed features already existing in the area. Innovative concealment is encouraged so long as it is visually integrated into the immediate surroundings.

a. Tree of a type naturally occurring or normally found in the geographic area.

b. Church steeple.

c. Bell or clock tower.

d. Belfries, domes or chimneys.

e. Elevator towers.

f. Flag poles.

g. Water towers.

h. Cupolas.

i. Other architectural or art feature.

Examples of concealed facilities:

(x) Nonconcealed Towers.

(A) On a wireless master plan priority site.

(B) On City-owned property in any nonresidential zoning district.

(C) On other public property in any nonresidential zoning district.

(D) On nonpublic property in the following districts, ranked highest to lowest:

a. I-2;

b. I-1;

c. C-2;

d. C-1.

(E) Preferred Tower Type (Wherever Located).

a. Monopole.

b. Lattice.

c. Guyed.

Broadcast towers are not subject to the siting preferences; they may be sited in accordance with the use table (GJMC 21.04.010). Broadcast towers shall not be located on a wireless master plan priority site; those are reserved and planned for PWSF and public safety telecommunications facilities.

(6) Temporary PWSF Specifications and Requirements.

(i) Development Standards. Temporary PWSF shall be permitted by the Director in those zone districts specified in the use table in GJMC 21.04.010 where all of the following are met:

(A) It will be in place for no more than 60 days (subject to a one time extension of an additional 60 days for good cause);

(B) Notification of construction is provided by the applicant to the FAA;

(C) It does not require marking or lighting by the FAA;

(D) It will be less than 200 feet in height;

(E) It does not involve any excavation (or excavation where prior disturbance exceeds proposed excavation by at least two feet).

(7) Telecommunications Facility Co-Location and Combination.

(i) Development Standards. The City requires co-location and combining of telecommunications facilities on existing towers, existing base stations or existing alternative support structures (dual purpose facilities) as a highest priority where such co-location is possible. A permit shall be required for co-location of facilities on an existing tower, existing base station or dual purpose facility. Co-location or combination of telecommunications facilities requires an administrative permit, and is subject to the following:

(A) A co-located or combined antenna or antenna array shall not exceed the maximum height prescribed in the applicable land use permit or increase the height of an existing tower by more than 20 feet and shall not affect any tower lighting, except as provided for herein below. A PWSF co-location that does not create a substantial change in the tower or support structure shall be approved within 60 days (subject to tolling) in accordance with subsection (q)(2)(v) of this section.

(B) If the applicant who seeks to co-locate PWSF demonstrates a coverage gap that cannot be addressed by a co-location that meets subsection (q)(7)(i)(A) of this section, the applicant may request a variance of the height limitation in accordance with subsection (q)(14) of this section. If the co-location is a qualified co-location under 47 U.S.C. §332(c)(7), the Director shall render a decision within 90 days, subject to tolling, in accordance with subsection (q)(2)(v) of this section.

(C) New antenna mounts shall be flush-mounted onto existing structures where flush mounting was a condition of the original approval, unless it is demonstrated through radio frequency (RF) propagation analysis that flush-mounted antennas will not meet the network objectives of the desired coverage area, or unless applicant demonstrates that flush-mounting would interfere with existing antenna mounting or coax arrangements that were previously approved.

(D) The equipment cabinet shall be subject to the setback requirements of the underlying zoning district.

(E) When a co-located or combined antenna is to be located on a nonconforming building or structure, then the existing permitted nonconforming setback shall prevail.

(F) No signage shall be permitted on an antenna or antenna array that is combined with or co-located on an alternative support structure; however, the support structure may itself be an existing sign, so long as the sign was approved through a non-telecommunications facility development permit or sign permit.

(8) New Base Stations – Concealed and Nonconcealed.

(i) Antennas and equipment may be mounted onto a structure which is not primarily constructed for telecommunications purposes in accordance with the use table of GJMC 21.04.010. A permit is required for base station antennas and equipment mounted onto such an alternative structure. In residential districts, the following structures shall not be used as base stations or to support PWSF or commercial antenna(s): single-family dwelling, two-family dwelling, multifamily dwelling of fewer than three stories in height, group living facility, or day care.

(ii) Development Standards. Antenna(s) and equipment to be located on an alternative structure shall be subject to the following:

(A) If the facility is concealed, the top of antenna(s) shall not be more than 35 feet above the existing or proposed building or structure, except that antenna(s) located on the perimeter of the supporting structure shall not be more than 10 feet above the supporting structure;

(B) If the facility is nonconcealed, the top of the antenna shall not be more than 20 feet above the existing or proposed building or structure and shall not be located on the perimeter of the supporting structure;

(C) New antenna mounts shall be flush-mounted onto existing structures, unless it is demonstrated through radio frequency (RF) propagation analysis that flush-mounted antennas will not meet the network objectives of the desired coverage area;

(D) New antenna mounts shall meet the setbacks and height restrictions of the underlying zone district;

(E) When attached base station antenna(s) and equipment is/are to be located on a nonconforming building or structure, the existing permitted nonconforming setback or height shall prevail;

(F) Concealed base station attached antennas, feed lines and antennas shall be designed to architecturally match the facade, roof, wall, and/or structure on which they are affixed so that they blend with the existing structural design, color, and texture; and

(G) No signage shall be allowed on an antenna or antenna array that is located on an alternative structure; however, the alternative structure itself may have a sign that was otherwise approved as part of a non-telecommunications facility development application or sign permit.

(9) Antenna Element Replacement or Modification.

(i) Development Standards. A permit is required for any replacement or modification of existing antenna(s) and associated equipment, and the replacement or modification must comply with the following:

(A) Height. The increase in height of a PWSF that is modified shall not create a "substantial change" in the PWSF.

(B) Equipment Cabinets and Equipment Shelters. Electronic equipment shall be contained in either (a) equipment cabinets or (b) equipment shelters. Equipment cabinets shall not be visible from pedestrian and right-of-way views. Equipment cabinets may be provided within the principal building on the lot, behind a screen on a rooftop, or on the ground within the fenced-in and screened equipment compound.

(C) Sounds. No unusual sound emissions such as alarms, bells, buzzers, or the like are permitted. Emergency generators are allowed. Sound levels shall not exceed 65 decibels as measured at the property boundaries for the facility.

(10) Tower/Support Structure Replacement.

(i) A permit is required for replacement of a tower and support structure. Applicant must demonstrate by clear and convincing competent evidence that replacement will accomplish at least one of the following:

(A) Reduction in the number of telecommunications facility support structures or towers;

(B) Replacement of a nonconcealed tower with a concealed tower;

(C) Significant reduction of the visual impact of a telecommunications facility;

(D) Replacement of an existing tower with a new tower so as to improve network functionality resulting in compliance with this section; and/or

(E) Replacement of an existing support structure to increase the number of personal wireless service providers located on such structure.

(ii) Development Standards.

(A) Setbacks. A new tower approved for replacement shall not be required to meet new setback standards so long as the new tower and its equipment compound are no closer to any property lines or dwelling units as the tower and equipment compound being replaced. The intent is to encourage the replacement process, not penalize the tower owner for the change out of the old facility. (For example, if a new tower is replacing an old tower, the new tower is permitted to have the same setbacks as the tower being removed, even if the old tower had nonconforming setbacks.)

(B) Height. The height of the replacement tower or support structure shall not create a substantial change of the facility being replaced.

(C) Breakpoint Technology. A replacement monopole tower shall use breakpoint technology in the design of the replacement facility.

(D) Visibility. Replacement towers or support structures shall be configured and located in a manner that minimizes adverse effects on the landscape and adjacent properties, with specific design considerations as to height, scale, color, texture, and architectural design of the buildings on the same and adjacent zoned lots.

(E) All replacement towers shall be constructed and maintained to meet ANSI/EIA/TIA-G (as amended) Series III, Exposure C structural standards.

(11) DAS and Concealed Small Cell Facilities.

(i) Attached DAS Development Standards.

(A) Where feasible, antennas can be placed directly above, below or incorporated with vertical design elements of a building or structure to maximize concealment. The top of the antenna(s) shall not exceed more than seven feet above the tallest level of the structure on which it is attaching.

(B) Attached equipment box and power meter is discouraged; however, if attachment is justified, equipment box and meter shall be located on the pole at a height that does not interfere with pedestrian or vehicular traffic or visibility and where applicable shall not interfere with street name signs or traffic lighting standards.

(C) Freestanding equipment box and/or power meter not attached to an existing structure shall be located no farther than two feet from the base of the structure and shall not interfere with pedestrian or vehicular traffic. Screening materials may be required if the equipment box and/or meter are adjacent to a public right-of-way or along a pedestrian sidewalk or pathway.

(D) All cables shall be installed internally; but where internal mounting is not possible, surface mounted wires shall be enclosed within conduit or a similar cable cover which should be painted to match the structure or building on which that DAS is mounted.

(ii) New Freestanding DAS Facility and Concealed Small Cell Facility Development Standards.

(A) Height. The total height of DAS facility/small cell facility including antenna shall not exceed one foot above the height of existing public utility poles for power or light in the same geographic area.

(B) Setbacks for DAS/small cell outside of the right-of-way shall meet the same setbacks of the underlying zoning district for similar structures.

(C) The use of foliage and vegetation around ground equipment may be required by the City based on conditions of the specific area where the ground equipment is to be located. In order to avoid the clustering of multiple items of ground equipment in a single area, a maximum of two ground equipment boxes may be grouped together in any single location. In addition, such locations must be spaced a minimum of 500 linear feet of right-of-way apart from each other. Individual ground equipment boxes shall not exceed three feet wide by three feet deep by five feet high in size. The size and height of new freestanding DAS and concealed small cell facility poles shall be no greater than the size and height of any other telecommunications facility poles located in the same or similar type of rights-of-way in the City.

(D) Visibility of New DAS/Small Cell Poles.

a. New DAS/small cell structures shall be configured and located in a manner that minimizes adverse effects on the landscape and adjacent properties, with specific design considerations as to height, scale, color, texture, and architectural design of the buildings on the same and adjacent zoned lots. Concealment design is required to minimize the visual impact of wireless communications facilities.

b. All cables, conduits, electronics and wires shall be enclosed within the structure.

c. Small cell facilities shall be no larger in size than what is specified in the definitions (subsection (q)(1) of this section).

d. New DAS/small cell structures shall be located in arterial rights-of-way whenever possible. Placement of new DAS/small cell structures in rights-of-way other than arterials shall be justified by an engineering analysis from the applicant to the satisfaction of the city engineer prior to the issuance of any permit. Whenever new DAS/small cell structures must be placed in a right-of-way with residential uses on one or both sides of the street, no pole, equipment, antenna or other structure may be placed directly in front of a residential structure. If a right-of-way has residential structures on only one side of the street, the new DAS/small cell structure shall be located on the opposite side of the right-of-way whenever possible. All new DAS/small cell structures shall be located such that views from residential structures are not significantly impaired. Newly installed poles for new DAS/small cell structures should be located in areas with existing foliage or other aesthetic features in order to obscure the view of the pole.

e. New DAS/small cell structures located in rights-of-way shall be constructed and maintained so as not to interfere with, displace, damage, inhibit or destroy any other utilities or facilities, including but not limited to sewer, gas or water mains or service lines, storm drains, pipes, cables or conduits, or any other facilities lawfully occupying the right-of-way, whether public or private. All wireless communications facilities shall be placed and maintained so as not to create interference with the operations of public safety telecommunications service. The City reserves the right to place and maintain, and permit to be placed or maintained, sewer, gas, water, electric, storm drainage, communications, and other utilities and facilities, cables or conduit, and to do, and to permit to be done, any underground and overhead installation or improvement that may be deemed necessary or proper by the City in public rights-of-way occupied by the new DAS/small cell structure.

(E) Equipment Cabinets. Equipment shelters or cabinets shall be consistent with the general character of the neighborhood and historic character if applicable. Equipment shelters or cabinets shall be screened from the public view by using landscaping, or materials and colors consistent with the surrounding backdrop.

a. Screening enclosures shall be allowed when the design is architecturally compatible with the building.

b. Screening materials shall consist of materials and colors consistent with the surrounding backdrop and/or textured to match the existing structure.

c. The use of foliage and vegetation around ground equipment may be required based on conditions of the specific area where the ground equipment is to be located.

d. Small cell equipment cabinets shall comply with the size requirements set forth in the definitions above.

(iii) DAS Hub Development Standards.

(A) Setbacks for DAS hubs outside of the right-of-way shall meet the setback standards of the underlying zoning district.

(B) DAS Hub. Equipment shelters or cabinets shall be consistent with the general character of the neighborhood and historic character if applicable. Equipment shelters or cabinets shall be screened from the public view by using landscaping, or materials and colors consistent with the surrounding backdrop.

a. Screening enclosures shall be allowed when the design is architecturally compatible with the building.

b. Screening materials shall consist of materials and colors consistent with the surrounding backdrop and/or textured to match the existing structure.

c. The use of foliage and vegetation around ground equipment may be required based on conditions of the specific area where the ground equipment is to be located.

(12) Concealed and Nonconcealed Telecommunications Towers (Not Including DAS or Broadcast Tower, Which Are Addressed in Other Subsections).

(i) A pre-application conference is required for a new telecommunications tower. A permit and a major site plan review shall be required for a new telecommunications tower. The permit required may be an administrative permit or a CUP, depending upon the zone district (See GJMC 21.04.010, Use table) and/or whether or not the site is a priority site on the wireless master plan.

(ii) No new tower shall be permitted unless the applicant demonstrates that no existing tower or qualified alternative support structure can accommodate the applicant's proposed use, or that co-location on such existing facilities would have the effect of prohibiting personal wireless services in the geographic search area to be served by the proposed tower.

(iii) Development Standards.

(A) Height.

a. New concealed towers shall be limited to 200 feet in height. Height calculations shall be made in accordance with FAA standards, and shall include all appurtenances.

b. New nonconcealed (nonbroadcast) towers shall be limited to 150 feet in height. An applicant desiring a new nonconcealed tower taller than 150 feet must request a variance in accordance with subsection (q)(14) of this section. However, under no circumstance shall any nonconcealed tower exceed 199 feet.

(B) Setbacks and Spacing from Residential Structures. A new tower shall be subject to the principal structure setbacks of the underlying zone district, and, with respect to any residential structure on adjacent property:

a. If the tower has been constructed using breakpoint design technology (see "Definitions"), the minimum distance from any residential structure shall be equal to 110 percent of the distance from the top of the structure to the breakpoint level of the structure, or the minimum principle structure setbacks, whichever is greater. Certification by a registered professional engineer licensed by the State of Colorado of the breakpoint design and the design's fall radius must be provided together with the other information required herein from an applicant. (For example, on a 100-foot-tall monopole with a breakpoint at 80 feet, the minimum distance from the residential structure would be 22 feet (110 percent of 20 feet, the distance from the top of the monopole to the breakpoint) plus the minimum principle structure setback requirements for that zoning district.)

b. If the tower is not constructed using breakpoint design technology, the minimum distance from any residential structure shall be equal to the height of the proposed tower.

(C) Equipment Cabinets and Equipment Shelters. Electronic equipment shall be contained in either (a) equipment cabinets or (b) equipment shelters. Equipment cabinets shall not be visible from pedestrian and right-of-way views. Equipment cabinets may be provided within the principal building on the lot, behind a screen on a rooftop, or on the ground within the fenced-in and screened equipment compound.

(D) Fencing. All equipment compounds shall be enclosed with an opaque fence or masonry wall in residential zoning districts and in any zoning district when the equipment compound adjoins a public right-of-way. Alternative equivalent screening may be approved through the site plan approval process described in subsection (q)(12)(iii)(E) of this section.

(E) Buffers. The equipment compound shall be landscaped with a minimum 10-foot-wide perimeter buffer containing the following planting standards:

a. All plants and trees shall be indigenous to this part of Colorado.

b. Existing trees and shrubs on the site should be preserved and may be used in lieu of required landscaping as approved by the Planning Department.

c. One row of evergreen trees with a minimum two-inch caliper, 25-foot on center.

d. Evergreen shrubs capable of creating a continuous hedge and obtaining a height of at least five feet shall be planted, minimum three-gallon or 24 inches tall at the time of planting, five-foot on center.

e. Alternative landscaping plans which provide for the same average canopy and understory trees but propose alternative locating on the entire subject property may be considered and approved by the Director, provided the proposed alternative maximizes screening as provided above, and is otherwise consistent with the requirements of this section.

(F) Equipment Compound. The fenced-in compounds shall not be used for the storage of any excess equipment or hazardous materials. No outdoor storage yards shall be allowed in a tower equipment compound. The compound shall not be used as habitable space.

(G) Structural Standards. All new concealed or nonconcealed PWSF towers shall be constructed and maintained to meet ANSI/EIA/TIA-G (as amended) Series III, Exposure C structural standards.

(H) Visibility.

a. Concealed.

1. New concealed towers shall be designed to match adjacent structures and landscapes with specific design considerations such as architectural designs, height, scale, color, and texture.

2. New antenna mounts shall be concealed and match the concealed tower.

3. In residential zoning districts and in mixed use zoning districts that include residential uses, new concealed towers shall not be permitted on lots where the primary use or principal structure is single-family or two-family residential, group living, day care, or a multifamily structure of fewer than three stories. Examples of land uses/structure types in residential areas where the site may include a concealed tower are: school, religious assembly, fire station, stadium tower or stand, or other similar institutional/civic uses/structures.

b. Nonconcealed. New antenna mounts shall be flush-mounted unless the applicant can demonstrate that flush-mounted antennas will not reasonably meet the network objectives of the desired coverage area or that more co-locations will be available on the tower if flush-mounting is not required.

c. Concealed and Nonconcealed.

1. New concealed and nonconcealed towers shall be configured and located in a manner that shall minimize adverse effects including visual impacts on the landscape and adjacent properties.

2. A balloon test shall be required subsequent to the receipt of the photo simulations in order to demonstrate the proposed height and concealment solution of the PWSF. The applicant shall arrange to raise a red or orange colored balloon no less than three feet in diameter at the maximum height of the proposed tower, and within 25 horizontal feet of the center of the proposed tower. The applicant shall meet the following for the balloon test:

i. Applicant must inform the Planning Department and abutting property owners in writing of the date and times, including alternative date and times, of the test at least 14 days in advance.

ii. A three-foot-by-five-foot sign with lettering no less than three inches high stating the purpose of the balloon test shall be placed at closest major intersection of proposed site.

iii. The date, time, and location, including alternative date, time and location, of the balloon test shall be advertised in a locally distributed paper by the applicant at least seven but no more than 14 days in advance of the test date.

iv. The balloon shall be flown for at least four consecutive hours during daylight hours on the date chosen. The applicant shall record the weather, including wind speed, during the balloon test.

v. Re-advertisement will not be required if inclement weather occurs.

3. Towers shall be constructed to accommodate antenna arrays as follows:

i. Up to 120 feet in height shall be engineered and constructed to accommodate no fewer than four antenna arrays.

ii. All towers between 121 feet and 150 feet shall be engineered and constructed to accommodate no fewer than five antenna arrays.

4. Grading shall be minimized and limited only to the area necessary for the new tower and equipment compound.

5. Sounds. No unusual sound emissions such as alarms, bells, buzzers, or the like are permitted. Emergency generators are allowed. Sound levels shall not exceed 65 decibels as measured at the property boundaries.

(13) Broadcast Towers. No new broadcast facilities shall be constructed or installed without a site plan review and a permit under this section. No new broadcast facilities shall be permitted unless the applicant provides a valid FCC construction permit and demonstrates that no existing broadcast tower can accommodate the applicant's proposed use. A pre-application conference shall be required for any new broadcast facility.

(i) Development Standards.

(A) Height. Height for broadcast facilities shall be evaluated on a case-by-case basis; the determination of height contained in the applicant's FCC Form 351/352 construction permit or application for construction permit and an FAA determination of no hazard (FAA Form 7460/2) shall be considered prima facie evidence of the tower height required for such broadcast facilities.

(B) Setbacks. New broadcast facilities and anchors shall be set back a minimum of 500 feet from any single-family dwelling unit on same zone lot; and a minimum of one foot for every one foot of tower height from all adjacent lots of record.

(C) Equipment Cabinets. Except for AM broadcast facilities, cabinets shall not be visible from pedestrian views.

(D) Fencing. All broadcast facility towers, AM antenna(s) towers, and guy anchors shall each be surrounded with an anti-climbing fence compliant with applicable FCC regulations.

(E) Buffers.

a. Except for AM broadcast facilities, it is the intent that all pedestrian views from public rights-of-way and adjacent residential land uses be screened from proposed broadcast facilities. AM broadcast facilities shall, where practicable, use artificial screening devices in lieu of natural vegetation for screening its ground equipment located at the base of AM tower(s).

b. Alternative landscaping plans which provide for the same average canopy and understory trees but propose alternative siting on the entire subject property on which the proposed facility is projected may be considered and approved by the Planning Division, provided the proposed alternative maximizes screening as provided above, and is otherwise consistent with the requirements of this section.

(F) Signage.

a. Commercial messages shall not be displayed on any tower.

b. The only signage that is permitted upon an antenna support structure, equipment cabinets, or fence shall be informational, and for the purpose of identifying the antenna support structure (such as ASR registration number), as well as the party responsible for the operation and maintenance of the facility; i.e., the address and telephone number, security or safety signs, and property manager signs (if applicable).

(G) If more than 220 volts are necessary for the operation of the facility, signs located every 20 feet and attached to the fence or wall shall display in large, bold, high contrast letters (minimum height of each letter four inches) the following: "HIGH VOLTAGE – DANGER."

(H) Lighting.

a. Lighting on towers shall meet and not exceed the FAA minimum standards.

b. Any lighting required by the FAA must be of the minimum intensity and number of flashes per minute (i.e., the longest duration between flashes) allowable by the FAA. Dual lighting standards are required and strobe light standards are prohibited unless required by the FAA. The lights shall be oriented so as not to project directly onto surrounding property, consistent with FAA requirements.

(I) Equipment Compound. The fenced-in compounds shall not be used for the storage of any excess equipment or hazardous materials. No outdoor storage yards shall be allowed in a tower equipment compound. The compound shall not be used as habitable space.

(J) Grading shall be minimized and limited only to the area necessary for the new tower and equipment.

(K) Sounds. No unusual sound emissions such as alarms, bells, buzzers, or the like are permitted. Emergency generators are allowed. Sound levels shall not exceed 65 decibels as measured at the closest property boundaries for the facility.

(L) Parking. One parking space is required for each tower development area. The space shall be provided within the leased area, or equipment compound or the development area as defined on the site plan.

(14) Variance – PWSF Only. The purpose of this subsection is to ensure that land use decisions with respect to siting of personal wireless service facilities (PWSF) comply with 47 U.S.C. §332(c)(7)(B).

From time to time, due to unique characteristics specific to a single application, such as terrain, existing infrastructure, or other factors unique to the particular location and proposed PWSF thereon, strict application of a specific development standard for siting of PWSF could have the effect of unreasonably discriminating among providers of functionally equivalent services within the meaning of 47 U.S.C. §332(c)(7)(B)(i)(I) or of prohibiting personal wireless services within the meaning of 47 U.S.C. §332(c)(7)(B)(i)(II). In such a case the applicant, so long as the applicant is a provider of personal wireless services who will be using the facility for provision of personal wireless services, may seek a variance from such standard under this section. Considerations of increased financial costs are not unique characteristics and shall not constitute a valid basis for a variance under this subsection (q)(14). Moreover, the only development standards from which a variance can be sought/approved under this subsection (q)(14) are the following:

• Maximum tower height.

• Flush mounting requirement.

• Maximum height of antenna above base station/supporting structure (for nonconcealed PWSF only).

To obtain a variance under this subsection, the provider must demonstrate by clear and convincing evidence that:

(i) Due to characteristics specific and unique to the particular facilities and location, strict application of the development standard would not permit the applicant to address a demonstrable coverage gap or would result in unreasonable discrimination among providers of functionally equivalent services; and

(ii) There is no reasonable alternative available, other than varying the standard, to address the demonstrable coverage gap or to avoid unreasonable discrimination among providers of functionally equivalent services, including but not limited to use of another site, co-location on another facility, or modification of the proposed facility so as to meet the applicable standard; and

(iii) The extent of the variance proposed is the minimum necessary to address the demonstrable coverage gap or to avoid unreasonable discrimination among providers of functionally equivalent services, as confirmed by qualified, independent third party review of the proposal.

The decision-maker for the variance shall be the decision-maker for the underlying permit type required in accordance with this section and with the use table of GJMC 21.04.010. For example, if the facility requires an administrative permit, the Director would decide the variance request. If the facility requires a conditional use permit, the Planning Commission would decide the variance request.

(r) Transit Shelters and Benches.

(1) A permittee shall only locate a transit shelter or bench at designated bus stops on designated bus routes.

(2) The permittee shall remove each shelter, bench, concrete pad and any supports within 30 days after the transit stop or route is no longer designated.

(3) The permittee shall only place a transit shelter or bench if it is anchored to a concrete pad or equivalent that is approved by the City Engineer.

(4) The permittee shall only place or locate shelters and benches within the public right-of-way unless the City Engineer approves placement on private property. The permittee shall deliver the owner's written consent to such placement.

(5) The permittee shall not place or locate or use any shelter or bench until the City has issued its planning clearance. The planning clearance shall not be valid unless any necessary license or revocable permit has also been issued and is valid. The planning clearance shall identify the boundaries of the shelter site.

(6) The permittee shall comply with the Americans with Disabilities Act and the applicable regulations.

(7) The permittee shall provide regular maintenance and cleaning of all shelters and benches in accordance with the permittee's proposed maintenance schedule, as approved by the City Engineer. At a minimum, the permittee shall clean and maintain each shelter and bench and shelter and bench site twice each calendar week. The permittee shall continuously maintain each shelter and bench site to a good and workmanlike state, including but not limited to general repair, painting, removal of graffiti, removal of trash and debris and maintenance of lawn or landscaping around the shelter and bench area. The permittee shall clean and maintain shelters and benches within 24 hours when requested by the City Engineer, Director or other City official.

(8) The permittee shall diligently and continuously inspect, repair and replace as needed each shelter and bench so that no safety hazard exists at or on any shelter or shelter site of bench. In any event, the permittee shall remedy any such problem immediately when notified by a citizen, transit user or the City.

(9) Before placement or construction, the permittee shall have obtained the City Engineer's approval of the permittee's proposed site plan of each transit shelter and bench site.

(10) The permittee shall not place, locate or construct a shelter or bench within State or CDOT right-of-way without first having obtained a permit therefor from CDOT and having delivered a copy thereof to the City Engineer.

(11) Unless the City Engineer approves otherwise in writing, the permittee shall not place any shelter or bench within five feet of any curb and/or gutter or in an area where the speed limit is 35 miles per hour or less. The City Engineer is not authorized to reduce said setback to be less than three feet from the curb and/or gutter.

(12) Unless the City Engineer approves otherwise in writing, when there is no curb and/or gutter or the posted speed limit is greater than 35 miles per hour, the permittee shall not place a shelter or bench within 10 feet of the edge of pavement or the travel portion, whichever is closer.

The City Engineer is not authorized to reduce said setback to less five feet from the edge of pavement or traveled portion.

(13) The permittee shall not place any shelter or bench in a way which impedes pedestrian, bicycle, wheelchair or motor vehicle travel. Site distance limitations also apply. No vertical or other supports for a shelter or bench shall be located closer than one foot from any portion of any sidewalk or other pedestrian way.

(14) The permittee shall not place a bench or shelter on City property other than right-of-way without first obtaining the approval of the Director.

(15) The permittee shall abide by and enforce the following rules:

(i) The amount or size of the sign (i.e., advertising) on each transit shelter shall be limited to two side panels (two sign faces) on the transit shelter, each of which shall not exceed 48 inches wide and 72 inches high.

(ii) The advertising panels shall only be illuminated by "back lighting" using fluorescent bulbs.

(iii) The Director may limit the lumens of any bulbs.

(iv) Shelter lighting shall be operated and maintained so it does not shine at, create glare for or constitute a hazard to pedestrians, bicyclists or motorists.

(v) A third advertising panel may be provided along the rear of the transit shelter but only for public service messages or other public purposes as exempted in GJMC 21.06.070(c).

(16) The permittee shall not place a bench or shelter with a sign or advertising on or incorporated into it except on a principal arterial; minor arterial, major collector or designated Dial-A-Ride stop, provided the adjacent property is not zoned for residential use.

(17) For purposes of this section, these road classifications are as approved by the City in the Grand Junction Circulation Plan.

(18) The permittee shall not place or use a transit shelter or bench with a sign or incorporated advertising within the Main Street Shopping Park bounded by 2nd Street and 7th Street or within the North 7th Street Residential Historic District.

(19) Transit Benches.

(i) Normally, one bench may be allowed by the City Engineer at each designated transit stop; however, s/he may authorize a second bench if the permittee demonstrates a need based on ridership data.

(ii) The permittee shall ensure that each bench is located on a concrete pad sufficient in size to accommodate the bench supports and that there are two feet of foot space along the front of the bench.

(iii) The permittee may orient benches towards approaching traffic at an angle not to exceed 30 degrees from parallel to the traveled portion of the right-of-way.

(iv) The permittee shall ensure that no transit bench is located further than 20 feet from a stop.

(v) The permittee shall not replace nor install any bench after the date hereof unless permittee has first obtained the written approval of the City Engineer.

(vi) The permittee shall ensure that each bench is constructed and maintained using a "breakaway" anchor design. The City Engineer may specify the specifications of such design for all benches.

(vii) The permittee shall ensure that the only sign or advertising on any bench is limited to a single face oriented to and parallel with the traveled portion of the right-of-way. The single sign face shall not exceed 12 square feet in size with a maximum height of two feet. Each bench sign shall not be illuminated nor reflective.

(s) Service Stations. No above ground equipment at any gasoline service station or retail garage for the service of gasoline, oil, air, water, etc., shall be closer than 10 feet to any public right-of-way.

(t) Mixed Use. Use is only allowed as part of a mixed use development.

(u) Produce Stand. Produce stands are allowed in residential zone districts only for products produced on the premises provided no hazards are created with parking, ingress, egress and signage and the operation does not disrupt the peace, quiet and dignity of the neighborhood. Produce stands in nonresidential zone districts may include products produced off-premises and require a temporary use permit.

(Ord. 4858, 6-5-19; Ord. 4813, 8-15-18; Ord. 4744, 4-5-17; Ord. 4704, 6-1-16; Ord. 4554, 9-19-12; Ord. 4462, 4-4-11; Ord. 4419, 4-5-10)

21.04.040 Accessory uses and structures.

(a) Accessory Structure and Accessory Use Regulations.

(1) Establish and promote neighborhoods with integrity and character;

(2) Provide residents with the opportunity to use their property to enhance or fulfill personal objectives so long as the use of the property is not incompatible with this code;

(3) Provide an appropriate level of flexibility for the use of nonresidential property while maintaining compatibility; and

(4) Assure public services, such as streets, sewers and water facilities, are available in adequate supply for the primary use of the property.

(b) Accessory Structures and Uses Permitted.

(1) Only those structures and/or uses that are clearly accessory are allowed. Accessory structures/uses shall be constructed, maintained and conducted so as not to produce noise, vibration, concussion, dust, dirt, smoke, odors, noxious gases, fly ash, heat, glare from artificial illumination or from reflection of natural light.

(2) Accessory uses/structures and buildings shall have an appearance consistent with that of the neighborhood and shall have an appearance consistent with the character of the principal structure, building or use on the property.

(3) In all zones, accessory structures shall not be located in the front yard or the exterior side yard of a corner lot unless approved by administrative adjustment in accordance with GJMC 21.02.070(l).

(4) In residential zone districts with a density of two units per acre or higher (R-2 and above), the size of accessory structures will be limited to a maximum of 75 percent of the square footage of the principal structure. For all other residential zone districts, accessory structures will be allowed up to a maximum of 75 percent of the square footage of the principal structure or 10 percent of the parcel size, whichever is greater. All activities meeting the definition of agriculture in GJMC 21.04.020(aa) will be exempt from these size regulations.

(c) Accessory Structures, Buildings and Uses Appeals. The decision disallowing any accessory use may be appealed to the Board of Appeals pursuant to GJMC 21.02.210.

(d) Antennas. Telecommunications receiving or transmitting antennas are permitted subject to the following performance standards:

(1) Ground-mounted satellite dishes shall not exceed 10 feet in height from the grade where mounted;

(2) Ground mounted satellite dishes shall be located within the rear yard or in any side yard which does not abut a street and shall meet accessory structure setbacks;

(3) All cables and lines serving the satellite dish shall be located underground;

(4) Satellite dishes larger than 32 inches in diameter shall only be ground-mounted and the above provisions shall apply unless otherwise approved as to location or ground mounting by a conditional use permit as provided in GJMC 21.02.110;

(5) Roof mounted antennas shall not extend more than 10 feet above the roof line on which mounted; and

(6) Nothing contained herein shall relieve a person from the necessity of satisfying any and all governmental licenses or permits required for operation of telecommunications equipment.

(e) Storage of Vehicles. Storage of recreational vehicles or commercial vehicles or trailers is governed by the following:

(1) Recreational and commercial vehicles and trailers in residential zones shall be stored within an enclosed building, or in the rear yard, or behind the front setback line in a side yard other than the street side yard of a corner lot;

(2) No recreational vehicle shall be used for living, sleeping or housekeeping purposes for longer than two weeks total during any 12-month period when parked in any location not zoned and approved for such use. Any use of this provision shall be limited to one recreational vehicle per lot. Persons shall not live, sleep or housekeep in a recreational vehicle parked on a public street, a public or private parking lot, or any vacant lot; and

(3) Under no circumstances shall recreational or commercial vehicles be parked on a public street or public or private parking lot for more than 72 consecutive hours.

(f) Accessory Dwelling Unit. An accessory dwelling unit (ADU) is allowed only in conjunction with a single-family use and only on a lot of 3,000 square feet or more. The ADU is not included in the density calculation. The ADU must comply with the following:

(1) No more than one ADU is allowed in conjunction with a single-family use.

(2) The design and location of the ADU shall be clearly subordinate to the principal structure.

(3) The ADU must meet all requirements of the building and fire codes.

(4) One additional off-street parking space shall be provided for the ADU.

(5) The ADU shall share utility meters with the principal structure, except where the utility provider requires separate meters for an accessory dwelling unit.

(6) The ADU shall not be more than 900 square feet.

(7) The ADU shall be integrated into the site by appropriate site grading, earthwork and landscaping and be harmonious with the character of the neighborhood.

(8) The outside appearance of the principal structure shall not be changed from that of a single-family residence.

(9) Private entrances to the ADU shall be located on the side or rear of the residence and shall not be located on the same side as the primary residence’s entrance.

(10) The ADU shall not be located in front of the principal structure.

(11) The design and construction material of the ADU shall be complementary to those of the principal structure.

A planning clearance is required to establish an accessory dwelling unit; to obtain a planning clearance, the applicant must demonstrate that the unit will meet all the foregoing standards, limitations and requirements.

(g) Home Occupations.

(1) A home occupation is allowed as an accessory use in the zones shown in subsection (g)(2) of this section. A "Y" indicates that the performance standard applies in the applicable zone. No home occupation may be initiated, established or maintained in the City except in conformance with this code's home occupation standards and which:

(i) Establish criteria for operation of home occupations in conforming residential units;

(ii) Regulate the conduct of home occupations as an accessory use in a dwelling unit;

(iii) Ensure that home occupations are reasonably compatible with adjacent and nearby residential properties and uses;

(iv) Ensure that public and private services such as streets, sewers, water and/or utility systems are not burdened by the home occupation to the extent that usage exceeds that normally associated with residential use;

(v) Allow residents of the community to reasonably use their residences for commercial purposes under certain specified standards, conditions and criteria; and

(vi) Promote and protect the public health, safety and general welfare.

(2) Home Occupation Performance Standards by Zoning District.

HOME OCCUPATION PERFORMANCE STANDARDS	R-R	R-E	R-1	R-2	R-4	R-5	R-8	R-12	R-16	R-24	R-O	B or C	MU
1. Conform with applicable State and County statutes, City code and regulations and has obtained permits	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
2. Full-time resident operator	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
3a. No employees other than those residing in home				Y	Y	Y	Y						
3b. No more than one nonresident employee	Y	Y	Y					Y	Y	Y	Y		
4. Maintain residential appearance	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
5. Not more than six customers or clients/day are allowed to visit home occupation. Customer hours shall be between 8:00 a.m. and 8:00 p.m.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y
6. Not more than 25 percent gross floor area of the residence, including accessory structure for home occupation	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
7. Music, art, craft or similar lessons:													
a. Six or fewer clients per day	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y
b. Six to 12 clients per day	Y	Y	Y	Y				Y	Y	Y	Y		
8. Adequate public facilities and utilities are adequate to safely accommodate equipment used for home occupation	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
9. Storage of goods and materials shall be inside and shall not include flammable, combustible or explosive materials other than those customary to household uses	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

HOME OCCUPATION PERFORMANCE STANDARDS	R-R	R-E	R-1	R-2	R-4	R-5	R-8	R-12	R-16	R-24	R-O	B or C	MU
10. Parking shall be provided and shall not create hazard or street congestion	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
11. Mechanized equipment shall be used only in a completely enclosed building		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
12. Dust, odors, noise, vibration or electrical interference or fluctuation that is not perceptible beyond the property line	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
13. Deliveries and pickups shall be those normally associated with residential services and shall:													
a. Not block traffic circulation	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y
b. Occur only between 8:00 a.m. and 8:00 p.m. Monday – Saturday	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y

(3) Permitted home occupations shall not interfere with the peace, quiet and dignity of the neighborhood. The following examples are of uses that would be acceptable as home occupations: low volume office (insurance, realty), beauty shop, seamstress, instruction (as limited in item number 7 of table above), home-based day care, word processing and other computer applications, and door-to-door sales.

(4) Home Occupations Not Permitted. The following, by way of example, but not limitation, would not be acceptable as home occupations in residential districts: medical/dental office (includes massage therapists, chiropractors, acupuncturists, naturopaths, etc.), motor vehicle repair or similar uses, restoration or conversion, engine repair, medical/cosmetic facilities for animals including animal care or boarding facilities, machine shop/metal working, retail sales, contractors' shops, mortuaries, medical procedures, body piercing and/or painting, tattoos, any type of physical or psychotherapy, escort services, or marijuana businesses.

(5) Exempt Home Occupations. All home occupations listed below shall not be subject to all applicable home occupation regulations and standards if all persons engaged in such activities reside on the premises and all applicable conditions are satisfied:

(i) Artists, sculptors, composers not selling their artistic product to the public on the premises;

(ii) Craft work, such as jewelry-making and pottery with no sales permitted on the premises;

(iii) Home offices with no client visits to the home permitted;

(iv) Telephone answering and message services; and

(v) Medical marijuana cultivation by a patient or primary caregiver; provided, however, that:

(A) There shall not be more than one primary caregiver per dwelling unit growing, storing or providing medical marijuana in any form to his/her patients; and

(B) Such growing, storing or providing of medical marijuana is conducted in accordance with Article XVIII, Section 14 of the Colorado Constitution and § 25-1.5-106, C.R.S. as amended; and

(C) The primary caregiver shall have not more than six plants per patient with a maximum of 30 plants for five patients being grown on the premises of the dwelling unit at any given time; and

(D) Accessory buildings such as detached garage, shed, green house or other structure used for growing, storing or providing medical marijuana must comply with all zoning bulk standards and building and fire code provisions applicable thereto.

(6) Unsafe Home Occupations. If the Director finds that any home occupation is dangerous or unsafe, the Director shall issue an order to the dwelling owner and/or tenant of the property on which the home occupation is being undertaken directing that the home occupation be immediately made safe, as determined by the Director, or be terminated. The property owner and/or tenant shall be responsible for taking the necessary corrective steps or measures, but in the event of a failure to do so by the owner and/or tenant, after notice and a reasonable period of time, the Director may take any and all available enforcement actions to render the home occupation/dwelling/ property safe. Enforcement cost shall be paid by the property owner and shall be treated as a zoning violation pursuant to Chapter 21.09 GJMC.

(7) Home Occupation Signage. A nameplate not exceeding two square feet containing only the name of the resident, title of the person conducting a permitted home occupation, name of building, business name and/or name of agent. The nameplate may be located anywhere on the property.

(h) Outdoor Storage and Display.

(1) Residential Outdoor Storage.

(i) Outdoor storage is permitted in all residential districts. Residential outdoor storage is presumed if the following or like materials are outside of a dwelling for a period of longer than 48 consecutive hours and occupy a volume of more than 150 cubic feet:

(A) Appliances;

(B) Building materials, except for periods where a valid building period is in effect for construction on the property; and

(C) Inoperable automobile, truck, commercial vehicle and RV.

(ii) Junk or rubbish shall not be stored.

(iii) All outdoor storage shall be located in the rear half of the lot and shall be screened.

(iv) A maximum of two vehicles intended for repair or restoration, also known as “junk vehicles,” may be stored on a property provided all of the following conditions are satisfied:

(A) Vehicle shall be owned by the owner or occupant of the premises upon which the vehicles are located; and

(B) The vehicle shall be kept in an enclosed garage or under an opaque cover designed for the vehicle or otherwise screened from off-premises view.

(v) All outdoor storage shall be screened. Acceptable screening consists of any combination of fences, walls, berms and landscaping that is at least six feet in height and provides a permanent, opaque, year-round screening around the entire perimeter of the outdoor storage area. Plant materials are encouraged as screening. Fences must comply with subsection (h)(1)(i) of this section, any design guidelines and other conditions of approval.

(vi) All outdoor storage shall meet the following additional requirements, as applicable:

(A) All storage shall conform to the performance standards of the zone as described in GJMC 21.03.040, Residential districts;

(B) Except for integral units, stored items shall not project above the screening;

(C) Dumpsters and refuse containers for new multifamily dwelling, commercial and industrial uses shall be enclosed in a solid, opaque enclosure constructed of brick, masonry, stucco or wood at least six feet tall; and

(D) Nonconforming property shall comply with Chapter 21.08 GJMC.

(2) Nonresidential Outdoor Storage. Where outdoor storage is permitted in nonresidential districts it shall be subject to the provisions of this code. Nonresidential outdoor storage is materials stored outside of business or commercial uses for a period of longer than 48 consecutive hours and occupying a volume of more than 150 cubic feet:

(i) Junk or rubbish is not permissible outdoor storage unless the use is a permitted junkyard/salvage yard or landfill.

(ii) If the principal use of the property is other than a legal vehicle repair operation, impound lot, junkyard/salvage yard or fleet vehicle service center, a maximum of two vehicles intended for repair or restoration may be stored on a property provided all of the following conditions are satisfied:

(A) Vehicles shall be owned by the owner or occupant of the premises upon which the vehicles are located;

(B) The vehicles shall be kept in an enclosed garage, under an opaque cover designed for the vehicle or otherwise screened from off-premises view; and

(C) There shall be no outdoor storage of vehicle parts.

(iii) Existing Salvage/Recycling and Impound Lots. If the principal use of the property is recycling to include car/auto recycler, end recycler (salvage yard) or wrecking yard storing inoperable vehicles, vehicle parts, dismantled machinery and associated parts, appliance recycler and impound lot and if the use was an existing legal use as of January 1, 2002, outdoor storage shall meet the following conditions.

(A) Storage and dismantling areas shall require screening along all street frontages and along the first 50 feet of the side perimeter from the street. Sites may use opaque slats in existing chain link fences or vegetation to meet the screening requirement as long as the screening is at least six feet in height. Any new fencing shall be a minimum of six feet.

(B) If the recycler abuts a property with zoning which is not C-2, I-1 or I-2, the recycler shall also screen each perimeter that abuts such zone that is not C-2, I-1 or I-2. Buildings on property lines shall serve as screening.

(C) No item shall be allowed to project above the screening except: integral units as defined in Chapter 21.10 GJMC; and stacking of no more than two vehicles on top of a wheel stand. Integral units shall include shelving up to 20 feet in height for the purpose of storing recyclable parts. End recyclers are exempt from this requirement.

(D) Each owner, operator, independent contractor and employee of a recycling business, and every other person who dismantles, repairs or installs motor vehicle parts or appliances or other equipment containing any fluid, gas or liquid or other regulated substance shall, in accordance with applicable laws and rules, control, contain, collect, and dispose of all fluids, hazardous wastes, and other regulated fluids in or generated by the dismantling, shredding, baling or storage of motor vehicles, appliances, other equipment or parts, including but not limited to oils, antifreezes, CFCs, transmission fluids, diesel fuel, and gasoline.

(E) Tires shall be stored as required by this code.

(F) A recycler shall have a five-day grace period to remove items placed outside of a perimeter fence. If the City gives a notice after the fifth working day, the recycler shall remove such items within five working days.

(iv) If the principal use of the property is legal auto repair as of the adoption of this code, the vehicles intended for repair shall not be stored in any right-of-way or in required parking spaces. Areas for storage of vehicles intended for repair must be screened along any street frontage.

(v) Unless otherwise indicated, screening of all outdoor storage shall consist of any combination of fences, slats in chain link fences, walls, berms and landscaping that is at least six feet in height and provides a permanent, opaque, year-round screening on all street frontages and the first 50 feet of side perimeters of the outdoor storage area. Buildings on property line shall serve as screening. Plant materials are encouraged as screening.

(vi) All nonresidential outdoor storage shall meet the following additional requirements, as applicable:

(A) All storage shall conform to the specific zone performance criteria in GJMC 21.03.070 and the use-specific requirements of that particular use;

(B) Unless otherwise indicated, no outdoor storage shall be located in a required front yard setback or in any setback adjacent to a residential or business zone;

(C) Except for integral units, stored items shall not project above the screening;

(D) Dumpsters and refuse containers for new uses in all zones except I-1 and I-2 shall be enclosed in a solid, opaque enclosure constructed of brick, masonry, stucco or wood at least six feet tall. Nonconforming sites shall comply with Chapter 21.08 GJMC.

(3) Outdoor Display. "Outdoor display" includes portable display taken inside at the close of each business day or a display of items of merchandise for immediate sale and open to customers for browsing (such as, but not limited to, operable autos, RVs, trucks, modular homes, hot tubs) that is permanently located outdoors. Retail displays including shelving or rack areas higher than six feet, wholesale merchandise displays and other areas not accessible to the general public are considered outdoor storage and subject to the provisions of subsections (h)(1) and (2) of this section. "Outdoor display" does not include merchandise displayed immediately adjacent to the primary facade near the customer entrance(s) that does not protrude into parking areas or drive aisles or beyond the eaves, roof overhang or covered entrance area; rather, these displays are considered permissible extensions of the indoor retail operations. All outdoor display shall comply with the following requirements, except as otherwise indicated:

(i) All outdoor display shall conform to specific zone performance criteria in GJMC 21.03.070 and the use-specific requirements of that particular use;

(ii) No permanent outdoor display area shall be located in a required landscaped area;

(iii) Outdoor display areas shall meet all landscaping requirements, but shall not be subject to the screening requirements for storage lots;

(iv) No portion of a right-of-way shall be used for any type of display without a valid revocable permit;

(v) For vehicle sales, not more than one vehicle display pad, elevated up to six feet in height as measured at the highest point, shall be permitted per 100 feet of street frontage;

(vi) Display lots shall be paved, except that only the access roads shall be required to be paved for lots displaying large merchandise, such as manufactured homes or heavy equipment;

(vii) All outdoor display shall conform to all requirements of TEDS (GJMC Title 29) and the applicable sight distance triangle. Regardless of any provision to the contrary, no display shall be maintained in a location if it obstructs view, thereby constituting a traffic or pedestrian hazard; and

(viii) Nonconforming sites shall comply with Chapter 21.08 GJMC.

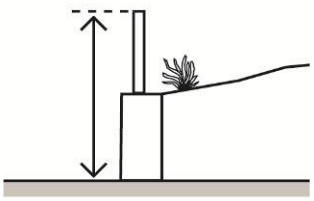
(4) Fleet Vehicles. Unless otherwise indicated, fleet vehicle parking areas shall meet the permanent outdoor display requirements of each district. In districts where permanent outdoor display is not permitted, a maximum of four fleet vehicles per use shall be permitted in areas meeting all parking lot requirements of this code.

(i) Fences. A fence permit is required for installation of any fence, except that a fence or wall that exceeds six feet in height and a retaining wall of four feet or higher are considered a structure requiring a planning clearance and building permit rather than a fence permit, and setbacks for structures apply (except where otherwise specifically provided). All fences, including those considered structures, shall meet the standards, limitations and requirements of this section, and shall comply with GJMC Title 29, Transportation Engineering Design Standards (TEDS).

(1) Fence Height Measurement.

(i) The height of fences shall be determined by measurement from the ground level upon which the fence is located. Grade shall not be altered for the sole purpose of increasing fence height. An increase of up to two inches in height shall be allowed when spacing for drainage under the fence is needed.

(ii) For fences erected on retaining walls, the height of the retaining wall shall be included in the height of the fence.



(iii) Pillars or other support structures for a fence shall be allowed to exceed the maximum fence height by up to one foot at intervals no closer than eight feet.

(iv) The height and location requirements of this subsection may be modified as part of subdivision, planned development or conditional use approval.

(2) Fence Materials.

(i) Fences and walls shall be constructed of materials approved by the Director.

(ii) Acceptable materials include wire, wrought iron, plastic, wood and other materials with a similar look.

(iii) Unacceptable materials that are visible include glass, tires, razor wire and concertina wire, or unconventional salvaged materials or similar materials. Electric fencing shall be allowed to contain large animals.

(iv) The Director may approve materials for security facilities.

(3) Residential Districts. Fences in all residential zones, including the residential office (R-O) district, shall meet the following standards:

(i) Fences in the required front yard setback shall not exceed 30 inches in height. Such fences may be increased to 48 inches maximum height if the fencing material is at a ratio of two-thirds open space to one-third closed space per square foot for that part of the fence extending above the 30-inch height.

(ii) Unless the approval of the development required a landscape strip, fences up to six feet in height are permitted within front yard setbacks along arterial or major collector roads, except those portions within a designated Neighborhood Center, Village Center, Downtown or Mixed Use Opportunity Corridor on the Future Land Use Map of the Comprehensive Plan, provided they are in accordance with adopted corridor overlay zone standards, TEDS (GJMC Title 29) and all other engineering standards and meet the following minimum standards:

(A) Fences or walls four feet or less in height consisting of an open design that has at least two-thirds open space to one-third closed space (e.g., picket and split rail fences), or a decorative wall, with no required landscape strip;

(B) Fences or walls over four feet in height with a minimum five-foot-wide planting strip between the fence or wall and right-of-way. The landscaped strip shall contain at least one tree per 40 feet and have adequate ground cover; or

(C) Perimeter fences and walls in new developments must meet the requirements of GJMC 21.06.040(g), Residential Subdivision Perimeter Enclosures.

(iii) On that part of the lot other than the required front yard setback area, fences may be erected to six feet in height. Fences within a required principal structure setback exceeding six feet in height require a special permit (see GJMC 21.02.120). Fences meeting principal structure setbacks shall not exceed eight feet in height without a special permit.

(iv) On corner lots, that part of a backyard fence that extends to and along the side property line on the street side may be six feet high, but is subject to the provisions of TEDS (GJMC Title 29) and other engineering standards.

(4) Nonresidential Districts. Fences in all nonresidential districts shall meet the following standards:

(i) Location of these fences must be approved by the City Engineer to ensure that adequate sight distance is maintained.

(ii) On those sites located within a designated Neighborhood Center, Village Center, Downtown or Mixed Use Opportunity Corridor on the Future Land Use Map of the Comprehensive Plan, fences in the required front yard setback area shall not exceed 30 inches in height. Such fences may be increased to 48 inches maximum height if the fencing material is at a ratio of two-thirds open space to one-third closed space per square foot for that part of the fence extending above the 30-inch height.

(iii) In all other nonresidential district locations, fences to a height of six feet shall be located outside the front yard setback. Fences which are 30-inch solid height or four feet in height if two-thirds open may be located within the front yard setback. The addition of not more than three strands of barbed wire shall be allowed and shall not be considered in the height calculation.

(5) Maintenance. All fences or walls shall be maintained in good repair. Fences in common areas of subdivisions shall be so maintained by the property owners' association.

(Ord. 4831, 2-6-19; Ord. 4778, 1-3-18; Ord. 4655, 2-18-15; Ord. 4599, 9-4-13; Ord. 4553, 9-19-12; Ord. 4437, 10-4-10; Ord. 4419, 4-5-10)

21.04.050 Temporary uses and structures.

(a) The temporary use permit is a mechanism by which the City may allow a use to locate within the City on a temporary basis and by which seasonal or transient uses may also be allowed.

(b) Prior to conducting or establishing a temporary use or temporary structure, approval of a temporary use permit by the Public Works and Planning Department is required.

(c) Any allowed use or structure in nonresidential zones may be approved for a temporary use permit; provided, that:

(1) The allowance of a temporary use and/or temporary structure shall not be detrimental to the public health, safety and general welfare. The use shall be consistent with the purpose and intent of this code and the specific zoning district in which it will be located and the use shall be compatible in intensity, characteristics and appearance with existing land uses in the immediate vicinity of the temporary use.

(2) Factors such as location, noise, odor, light, dust control and hours of operation may be specifically considered when determining compatibility.

(3) The location and/or intensity of the temporary use and/or temporary structure is such that adverse effects on adjacent parcels will be minimized, as determined by the Director.

(4) Erosion, sedimentation, and other pollution of surface and subsurface water is adequately controlled.

(5) Particular attention shall be given to the type and volume of traffic generated and/or the impact that the temporary use/temporary structure will have on traffic circulation in the neighborhood. The Director shall determine that increased traffic does not unduly impact the neighborhood. A finding that traffic does unduly impact the neighborhood shall be a basis for denial of a permit.

(d) Adequate off-street parking, as defined by this code, shall be provided:

(1) The use shall not displace the required off-street parking spaces or loading areas of the principal use/structure on the site; and

(2) The entrance and exit shall be designed to prevent traffic hazards, nuisances and as required by TEDS (GJMC Title 29).

(e) The use shall not be allowed on publicly owned property unless the applicant first obtains a revocable or other applicable permit through the City or the property owner, if not the City.

(f) Special events and activities conducted on public property, such as school sites and City parks, shall be exempt from the provisions of this code, but must comply with any guidelines, regulations and permitting process required by the authorizing agency (e.g., School District 51 or City Parks and Recreation Department).

(g) Structures and/or display shall comply with the setback requirements of the zone. Displays must not interfere with the sight distance triangle of the intersection of the curb line of any two streets or a driveway and a street. In no case shall sales or display occur within the public right-of-way.

(h) Before a temporary use involving the sale of merchandise may begin, a sales tax license must be obtained from the City Finance Department. If not obtained, the temporary use permit shall be revoked if issued or shall not be issued until licensure.

(i) Temporary use sign shall be permitted only for and during the time of the temporary use. The total sign allowance for a temporary use shall be 32 square feet, not including permanent signage that may be on a vehicle or booth. All signs for temporary uses shall be attached to a structure, vehicle or existing signpost. Portable signs, such as sandwich boards, etc., shall not be allowed. Off-premises signage is not allowed.

(j) Temporary use must comply with criteria in subsection (n) of this section.

(k) A temporary low-traffic storage yard may be permitted in a C-2, I-1 or I-2 zone district for up to one year from the date of issuance. One extension of one year may be granted by the Director upon showing of good cause. Any additional extensions may be granted by the Planning Commission. The Planning Commission must find good cause for granting an extension.

(l) All other temporary uses shall not exceed 120 calendar days and shall not be allowed until a minimum of 30 calendar days have passed since any previous temporary use on the parcel or lot.

(m) Prior to the issuance of a temporary use permit, the Director may require the applicant to post security with the City as required to cover expected costs of enforcement, monitoring, clean-up and site restoration.

(n) General Review Criteria. The applicant shall demonstrate that:

(1) The use is an authorized temporary use pursuant to subsection (c) of this section;

(2) There is no other temporary use on the parcel or lot;

(3) The use will not be detrimental to the public health, safety and general welfare;

(4) The use is consistent with the purpose and intent of the code and the specific zoning district in which it will be located;

(5) The use is compatible (intensity, characteristics and appearance) with existing land uses in the neighborhood. Factors to determine compatibility include: location, noise, odor and light, dust control and hours of operation;

(6) The use will not cause traffic to exceed the capacity of affected streets;

(7) Adequate off-street parking exists in accordance with GJMC 21.06.050. The use shall not displace the required off-street parking spaces or loading areas of the principal permitted uses on the site;

(8) Access to public right-of-way complies with City requirements, except that hard surface travel lanes are not required for a temporary use;

(9) Permanent hookups to utilities are not provided;

(10) Yard and property line setbacks are met for structures and/or display of merchandise. Displays shall not interfere with the sight visibility triangle of the intersection of the curb line of any two streets or a driveway and a street. No personal property, including structures, tents, etc., shall be located within the public right-of-way; and

(11) Signage is allowed only while the temporary use is permitted. A temporary use sign shall not exceed 32 square feet, excluding signage fixed to an operable motor vehicle. There shall be no portable signs. No off-premises sign shall advertise a temporary use.

(Ord. 4419, 4-5-10)

Chapter 21.05

PLANNED DEVELOPMENT (PD)

Sections:
21.05.010 Purpose.
21.05.020 Default standards.
21.05.030 Establishment of uses.
21.05.040 Development standards.
21.05.050 Planned development phases.

21.05.010 Purpose.

The planned development (PD) zone applies to mixed use or unique single-use projects where design flexibility is desired and is not available through application of the standards established in Chapter 21.03 GJMC. Planned development zoning should be used when long-term community benefits will be derived and the vision, goals and policies of the Comprehensive Plan can be achieved. The Director shall determine whether substantial community benefits will be derived. Specific benefits that the Director may find that would support a PD zoning include, but are not limited to:

(a) More effective infrastructure;

(b) Reduced traffic demands;

(c) A greater quality and quantity of public and/or private open space;

(d) Other recreational amenities;

(e) Needed housing types and/or mix;

(f) Innovative designs;

(g) Protection and/or preservation of natural resources, habitat areas and natural features; and/or

(h) Public art.

(Ord. 4419, 4-5-10)

21.05.020 Default standards.

The use, bulk, development, improvement and other standards for each planned development shall be derived from the underlying zoning, as defined in Chapter 21.03 GJMC. In a planned development context, those standards shall be referred to as default standards or default zone. The Director shall determine whether the character of the proposed planned development is consistent with the default zone upon which the planned development is based. Deviations from any of the default standards may be approved only as provided in this chapter and shall be explicitly stated in the zoning/rezoning ordinance. The planned development ordinance shall contain a provision that if the planned development approval expires or becomes invalid for any reason, the property shall be fully subject to the default standards.

(Ord. 4419, 4-5-10)

21.05.030 Establishment of uses.

(a) Uses Allowed. At the time of zoning a parcel to PD, the City Council shall determine the allowed uses. Only uses consistent in type and density with the Comprehensive Plan may be allowed within a PD. The type and density of allowed uses should generally be limited to uses allowed in the default zoning.

(b) Adoption and Modification of Authorized Uses. The City Council, at the time of establishing a PD zone, shall list uses that are authorized by right or by conditional use permit. All uses, whether by right or conditional use permit, shall be subject to all applicable permit and approval processes

established in this code. The rezoning process shall be used to modify the authorized use list for any planned development.

(Ord. 4419, 4-5-10)

21.05.040 Development standards.

(a) Generally. Planned development shall minimally comply with the development standards of the default zone and all other applicable code provisions, except when the City Council specifically finds that a standard or standards should not be applied. Planned development shall comply with GJMC 21.02.150.

(b) Residential Density. Dwelling unit densities in planned development shall comply with the maximum and minimum densities of the Comprehensive Plan or default zone.

(c) Nonresidential Intensity. A maximum floor area shall be established at the time of planned development approval. In determining the maximum floor area, the Planning Commission and City Council shall consider:

(1) The intensity of adjacent development;

(2) The demand for and/or mix of residential and nonresidential development in the proposed PD and in the vicinity of the proposed PD;

(3) The availability of transportation facilities, including streets, parking, transit facilities and bicycle/pedestrian facilities;

(4) The adequacy of utilities and public services.

(d) Mixed Use Intensity.

(1) In mixed use developments in areas designated for residential development in the Comprehensive Plan, no more than 10 percent of the land area may be dedicated to nonresidential uses.

(2) The maximum residential densities within mixed use developments designated for nonresidential development in the Comprehensive Plan shall not exceed 24 dwelling units per acre. In such developments, residential uses shall not constitute more than 75 percent of total floor area.

(e) Minimum District Size. A minimum of five acres is recommended for a planned development unless the Planning Commission recommends and the City Council finds that a smaller site is appropriate for the development or redevelopment as a PD. In approving a planned development smaller than five acres, the Planning Commission and City Council shall find that the proposed development:

(1) Is adequately buffered from adjacent residential property;

(2) Mitigates adverse impacts on adjacent properties; and

(3) Is consistent with the goals and policies of the Comprehensive Plan.

(f) Development Standards. Planned development shall meet the development standards of the default zone or the following, whichever is more restrictive. Exceptions may be allowed only in accordance with this section.

(1) Setback Standards. Principal structure setbacks shall not be less than the minimum setbacks for the default zone unless the applicant can demonstrate that:

(i) Buildings can be safely designed and that the design is compatible with lesser setbacks. Compatibility shall be evaluated under the International Fire Code and any other applicable life, health or safety codes;

(ii) Reduced setbacks are offset by increased screening or primary recreation facilities in private or common open space;

(iii) Reduction of setbacks is required for protection of steep hillsides, wetlands or other environmentally sensitive natural features.

(2) Open Space. All residential planned developments shall comply with the minimum open space standards established in the open space requirements of the default zone.

(3) Fencing/Screening. Fencing shall comply with GJMC 21.04.040(i).

(4) Landscaping. Landscaping shall meet or exceed the requirements of GJMC 21.06.040.

(5) Parking. Off-street parking shall be provided in accordance with GJMC 21.06.050.

(6) Street Development Standards. Streets, alleys and easements shall be designed and constructed in accordance with TEDS (GJMC Title 29) and applicable portions of GJMC 21.06.060.

(g) Deviation from Development Default Standards. The Planning Commission may recommend that the City Council deviate from the default district standards subject to the provision of any of the community amenities listed below. In order for the Planning Commission to recommend and the City Council to approve deviation, the listed amenities to be provided shall be in excess of what would otherwise be required by the code. These amenities include:

(1) Transportation amenities including, but not limited to, trails other than required by the multimodal plan, bike or pedestrian amenities or transit oriented improvements, including school and transit bus shelters;

(2) Open space, agricultural land reservation or land dedication of 20 percent or greater;

(3) Community facilities for provision of public services beyond those required for development within the PD;

(4) The provision of affordable housing for moderate, low and very low income households pursuant to HUD definitions for no less than 20 years; and

(5) Other amenities, in excess of minimum standards required by this code, that the Council specifically finds provide sufficient community benefit to offset the proposed deviation.

(Ord. 4419, 4-5-10)

21.05.050 Planned development phases.

(a) Transfer of Ownership. No developer, owner or agent thereof shall sell, convey or otherwise transfer ownership of any planned development that has not been finally approved until such person has informed the buyer, in writing, of the property's exact status with respect to the planned development process and conditions of approval, if any. The City shall bear no liability for misrepresentation or failure to disclose terms and conditions by the owner or agent.

(b) Outline Development Plan (ODP). An outline development plan (ODP) is required. The purpose of an ODP is to demonstrate conformance with the Comprehensive Plan, compatibility of land use and coordination of improvements within and among individually platted parcels, sections or phases of a development prior to the approval of an ODP. Zoning for the entire property or for each development "pod" is established at ODP. With an ODP, the pattern of development is established with densities assigned to individual "pods," which shall be the subject of future, more detailed planning.

(c) Signage. No sign shall be allowed on properties in a planned development zone unless the sign has been approved as part of the final development plan. Variance of the maximum total surface area of signs shall not be permitted, but the maximum sign allowance for the entire development or use may be aggregated and the total allowance redistributed. See GJMC 21.06.070 for sign regulations.

(d) Final Development Plan. The final development plan and/or the subdivision plat are necessary to ensure consistency with the approved outline development plan, specific development requirements and construction requirements. See GJMC 21.02.150(c).

(Ord. 4419, 4-5-10)

Chapter 21.06

DEVELOPMENT STANDARDS

Sections:

21.06.010 Infrastructure standards.
21.06.020 Public and private parks and open spaces.
21.06.030 School land dedication fee.
21.06.040 Landscape, buffering and screening standards.
21.06.050 Off-street parking, loading and bicycle storage.
21.06.060 Subdivision standards.
21.06.070 Sign regulation.
21.06.080 Outdoor lighting.
21.06.090 Site circulation.
21.06.100 Private streets, shared driveways and loop lanes.

21.06.010 Infrastructure standards.

(a) General.

(1) Public Improvements. The improvements described in this section must be built by the applicant and constructed in accordance with adopted standards, unless otherwise indicated. No improvements shall be made until the following required plans, profiles and specifications have been submitted to, and approved by, the City:

(i) Roads, streets and alleys;

(ii) Street lights and street signs for all street intersections;

(iii) Sanitary sewer pipes and facilities;

(iv) Fire hydrants and water distribution system and storage;

(v) Storm drainage system;

(vi) Irrigation system;

(vii) Right-of-way landscaping;

(viii) Other improvements and/or facilities as may be required by changing technology and the approval process;

(ix) Permanent survey reference monuments and monument boxes (see § 38-51-101 C.R.S.).

(2) Guarantee of Public Improvements. No development shall be approved until the City has accepted constructed infrastructure or the developer has executed a development improvements agreement and provided adequate security (see GJMC 21.02.070(m)).

(3) No planning clearance for any use or activity shall be issued until minimum street improvements have been constructed, paid for or adequately secured.

(4) City Participation. The City may elect to require the developer to coordinate construction with the City as required in this chapter.

(b) Streets, Alleys, Trails and Easements.

(1) Design Standards.

(i) Streets, alleys, sidewalks, trails and bike paths shall be designed and constructed in accordance with applicable City standards also known as Transportation Engineering Design Standards TEDS (GJMC Title 29).

(ii) No owner or developer shall propose a site design or plan which could result in the applicant controlling access to a street, alley or right-of-way.

(iii) Easements shall be provided as required for improvements and utilities. Alleys may be used for placement of utilities and infrastructure.

(iv) If needed to provide safe and adequate access and circulation for residents, visitors, users and occupants, the applicant shall provide off-site infrastructure.

(v) Each project with one or more buildings (except detached dwellings) shall provide paved pedestrian walkway/sidewalk connections to nearby rights-of-way. Said connections shall be separate from parking and driveway areas.

(2) Right-of-Way Dedication.

(i) A developer shall dedicate to the City such rights-of-way (i.e., streets, sidewalks, trails, bicycle paths and easements) needed to serve the project in accordance with the Grand Junction Circulation Plan, as amended.

(ii) Required right-of-way dedications shall be at no cost to the City. Such dedications shall not be eligible for transportation impact fee credit.

(3) Required Improvements.

(i) The developer shall construct minimum street improvements, local streets, alleys, sidewalks, trails and bike paths as required by this code. The type of improvements and required design (i.e., cross sections) shall be those provided in TEDS (GJMC Title 29).

(A) Minimum street improvements shall be those required for the safe ingress and egress of traffic to and from the development and include the design and construction of all streets internal to and fronting a development that are designated as local or unclassified in the Grand Junction Circulation Plan.

(B) Any unbuilt street that is designated in the Grand Junction Circulation Plan as a collector or arterial and is internal to the development shall be constructed to a local street standard by the developer.

a. The City may require the developer based on the City's Circulation Plan and input from the Public Works Director to design and construct the street to a collector or arterial standard, thereby requiring the oversizing of streets.

b. When oversizing is required, the developer may be eligible for a City cost-share agreement in the differential amount between the required local street improvement and the required collector or arterial street improvement.

(C) All streets connecting the existing street network to the development shall be at least 20 feet wide, serve the development's traffic demands, meet the Fire Code, and be designed structurally to meet fire equipment load requirements.

(ii) Commencing January 1, 2021, the developer shall construct improvements necessary for the safe ingress and/or egress of traffic to the development, as required by the Director.

(A) To achieve safe ingress and/or egress, if turn lanes to and from the development are warranted based on a traffic impact study, the developer will be responsible for the design and construction of said lanes.

(B) Where a safety improvement is for the benefit of a development but will benefit other future developments, the developer may request the City to provide a reimbursement agreement for a period of up to 20 years to recapture a portion of the improvement costs based on a proportionate usage of the improvement as determined by an approved traffic study. The developer may request extension of the reimbursement agreement term.

(4) Existing Streets.

(i) Existing Local Streets.

(A) General. Many areas of the City were developed in the unincorporated areas of Mesa County without modern urban street and drainage facilities. In many such neighborhoods and areas, the existing local streets do not have curbs, gutters or sidewalks. Given that there are no serious safety or drainage problems associated with these local streets, there is no current reason to improve these streets or to install curbs, gutters and/or sidewalks. When an owner in one of these established neighborhoods chooses to subdivide a lot or parcel or an owner in a commercial or industrial area chooses to develop a lot or parcel, unless such improvements are extended off site to connect to a larger system, the new "short runs" of curbing, gutters and/or sidewalks are of little value as drainage facilities or pedestrian ways until some future development or improvement district extends them to other connecting facilities.

(B) Instead of constructing "short run" improvements, the owner may apply to the Director to defer full and permanent improvements ("permanent improvements") by:

a. Signing an agreement to form an improvement district for the construction of certain required curb(s), gutter(s) and sidewalk(s) and street improvements ("temporary improvements") in lieu of construction at the time of approval of the development application; and

b. Constructing, as required by the City, certain temporary curb(s), gutter(s), sidewalk(s), and street improvement(s) required by the City as a condition of approval of the development application. Temporary improvements shall be constructed with the same materials and to the same standards as required of permanent improvements.

c. The agreement to form an improvement district shall be in a form approved by the City Attorney. The agreement shall run with the land and shall be recorded with the Mesa County Clerk and Recorder.

(C) The Director may defer for a period and on terms established by the Director residential street improvements if all of the following criteria are met:

a. The development is for three or less residential lots;

b. The zoning or existing uses in the block or neighborhood are residential. The Director shall determine the boundaries of the block or neighborhood, based on topography, traffic patterns, and the character of the neighborhood;

c. The existing local residential street that provides access to the lots or development meets minimum safety and drainage standards, and has a design use of less than 1,000 average daily traffic ("ADT") based on an assumed typical 10 trips per day per residence and the volume is expected to be less than 1,000 ADT when the neighborhood or block is fully developed;

d. At least 80 percent of the lots and tracts in the neighborhood or block are already built upon, so that the street and drainage character is well established;

e. If an existing safety hazard or drainage problem, including pedestrian or bicycle traffic, exists and it can be improved or remedied without the street improvements being built; and

f. There is at least 250 feet from any point on the development to the nearest existing street improvements (on the same side of the street) that substantially comply with the City standard for similar street improvements.

(D) The Director may defer, for a period and terms established by the Director, nonresidential street improvements if all of the following criteria have been met:

a. The development is for a single commercial or industrial lot or parcel that does not create a new lot or parcel;

b. The proposed development or use of the lot or parcel must be consistent with the allowed uses and requirements of the current zone district;

c. The lot or parcel size is two acres or less;

d. The lot or parcel does not have more than 500 feet of frontage on the local nonresidential street;

e. If an existing safety hazard or drainage problem, including pedestrian or bicycle traffic, exists and it can be improved or remedied without the local nonresidential street improvements being built; and

f. There is at least 250 feet from any point on the development to the nearest existing street improvements (on the same side of the street) that substantially comply with the City standard for similar local nonresidential street improvements.

(5) Public Right-of-Way and Private Parking Lot Use.

(i) No structure, fence, sign, parking lot, detention/retention pond, or other temporary or permanent object or structure shall be constructed, maintained, or erected in any portion of any public right-of-way without first obtaining a revocable permit from the City. The City Engineer or other City official may allow traffic control devices, street signs, public notices, utility poles, lines and street banners consistent with this code.

(ii) No person shall use, store, display or sell any goods, merchandise or any structure without having first obtained a revocable permit, except that this provision shall not be enforced in a manner which limits unreasonably any person's freedom of speech or assembly.

(iii) No commercial vehicle which exceeds one and one-half tons rated carrying capacity shall be parked in a public right-of-way which abuts any residential zone.

(iv) Parking of an RV or any vehicle for more than 72 hours shall not be allowed in a public right-of-way or on any vacant lot.

(6) Partially Dedicated Street. Prior to any development or change of use which is projected to increase traffic generation by the greater of five percent or 10 vehicle trips per day, the applicant shall dedicate right-of-way required to bring abutting streets into compliance with the adopted street classification map, or as otherwise approved by the City Engineer. Upon receipt of the appropriate deed, and if all other requirements have been met, the final development permit shall be issued.

(7) Street Naming and Addressing System. A street naming system shall be maintained to facilitate the provisions of necessary public services (police, fire, mail), reduce public costs for administration, and provide more efficient movement of traffic. For consistency, this system shall be adhered to on all newly platted, dedicated, or named streets and roads. The Director shall check all new street names for compliance to this system and issue all street addresses. Existing streets and roads not conforming to this system shall be made conforming as the opportunity occurs.

(c) Irrigation Systems and Design. All required landscaped areas shall be irrigated according to GJMC 21.06.040(b). The applicant shall comply with the standards in the SSID manual.

(d) Potable Water System.

(1) All development and all uses shall be served by a water treatment and distribution system operated or approved by the City, unless such requirement is deemed unreasonable or impracticable, as determined by the Public Works and Planning Director.

(2) Fire hydrants shall be placed and have fire flow capabilities in accordance with the City's ordinances.

(e) Sanitary Sewer System. All lots and uses must be served by a sewer system connected to a public wastewater treatment facility. Requests for variances to this requirement shall be decided by the City Council, upon recommendation by the Planning Commission, in accordance with GJMC 21.02.200(c)(5). Sewer variance requests shall also be subject to "Permit Application for Sewer Variance" administered by the Manager of the Persigo Wastewater Treatment Plant.

(f) Utilities. Utilities, including, but not limited to, telephone, cable, television, electric, and natural gas, shall be provided and paid for by the developer and shall be installed underground. All existing overhead utilities along streets contiguous with the development shall be installed underground prior to street construction. When the development has less than 700 feet of frontage along a street, the Director has discretion to accept a payment of cash in lieu of requiring the developer to underground the existing overhead utilities. The payment amount shall be determined as set forth in the adopted fee schedule. Necessary above-ground facilities (e.g., pedestals, transformers, and transmission lines of 50 KV capacity or greater) and temporary overhead lines may be allowed if deemed necessary by the Director.

(g) Stormwater Management.

(1) Requirement. All proposed development must provide for on-site runoff collection and conveyance in accordance with Stormwater Management Manual (SWMM) (GJMC Title 28) and applicable federal and State laws.

(2) Drainage Fee in Lieu of Providing Drainage Detention/Retention Facilities. Detention/retention and metered outlet facilities shall be required unless the Director of Public Works and Planning, pursuant to the City's adopted stormwater drainage impact fee ordinance, finds:

(i) The site runoff to private property will not increase due to development; and

(ii) The Director determines that off-site public streets or other public drainage conveyance facilities are adequate to receive and convey additional runoff from the proposed development site without adversely impacting the public's facilities, interest, health, or safety.

(3) Generally, options will be restricted to proposed developments which are five acres or less for all phases and/or filings. There may be circumstances, however, where the Director may allow an option for larger sites if they are located low in a watershed basin or adjacent to major outfall facilities.

(4) The Director shall require submittal of certain information on the part of the developer in order to determine if the drainage fee option is allowed or if construction of drainage detention/retention facilities is required. Such information may include but is not necessarily limited to the type and percent of impervious surfaces, measurements of property including elevations, distance to conveyance structure, type of conveyance structure, availability of regional detention facilities, flood control structures and location of the development within the watershed.

(5) Upon written approval from the Director the developer shall be given the option of paying a drainage fee in lieu of providing drainage detention/retention and metering facilities. The required drainage fee shall be accordance with the adopted fee schedule.

(6) Developer selection of the drainage fee option, when allowed, does not waive the requirements for:

(i) Providing an on-site grading and drainage plan; and

(ii) Construction of on-site collection and conveyance facilities and providing drainage calculations as required therefor. However, payment of the drainage fee, when approved by the Director, shall constitute compliance with City policy regarding development-related increased runoff.

(7) Drainage fees shall be paid to the City and will be allocated for the construction of drainage facilities at locations, determined by the City, in its sole and absolute discretion, to be of greatest priority. Fees shall be paid prior to the recording of residential plats, or prior to issuance of planning clearance for all other development.

(8) The City may, from time to time, by resolution of the City Council, change the method or formula of calculating the drainage fee, based upon projections, estimates or opinions of the Director of Public Works and Planning of the need for additional specific facilities, and/or upon the need of the drainage system.

(Ord. 4878, 10-16-19; Ord. 4833, 4-17-19; Ord. 4569, 3-6-13; Ord. 4498, 2-1-12; Ord. 4466, 4-18-11; Ord. 4419, 4-5-10)

21.06.020 Public and private parks and open spaces.

(a) Open Space Dedication.

(1) The owner of any residential development of 10 or more lots or dwelling units shall dedicate 10 percent of the gross acreage of the property or the equivalent of 10 percent of the value of the property. The decision as to whether to accept money or land as required by this section shall be made by the Director. Subdivisions with less than 10 lots or residential dwelling units are not required to dedicate 10 percent of the gross acreage of the property or the equivalent of 10 percent of the value of the property unless the developer or owner owns land adjacent to the proposed subdivision, in which case the Planning Commission shall determine the open space requirement.

(2) For any residential development required to provide open space, the owner shall hire an MAI appraiser to appraise the property. For purposes of this requirement, the property shall be considered the total acreage notwithstanding the fact that the owner may develop or propose to develop the property in filings or phases.

(3) The appraiser's report shall be submitted to the City for purposes of determining fair market value and otherwise determining compliance with this section. The owner shall pay all costs of the appraisal. The owner waives any privilege and/or protection that may exist or be asserted to exist over the details of the appraisal. The appraisal is and shall be considered by the City as an open record under the Colorado Open Records Act.

(4) The required dedication and/or payment shall be subject to and made in accordance with this code. The City Council may accept the dedication of land in lieu of payment so long as the fair market value of the land dedicated to the City is not less than 10 percent of the value of the property.

(5) As part of any project approval, the owner shall dedicate, at no cost to the City, public trails, rights-of-way and waterfront greenbelts/access as designed on and as needed to implement adopted plans of the City. If such dedication is claimed to exceed constitutional standards, the owner shall so inform the City Attorney who, if he agrees, shall ask the City Council to pay a fair share of the value of such dedication or waive all or part of such required dedication.

(6) For creation of a homeowners' association, each subdivision of five or more lots shall record covenants which shall contain provisions for assessments, liens and enforcement of mainte-

nance of all private open space areas and provisions for enforcement by and reimbursement to the City should the homeowners' association fail to maintain the areas properly and the City elects to do so.

(7) For subdivisions, the land dedication or open space fee is required and payable at the time of platting, when applicable.

(8) Private open space and/or recreational area in any development, or outdoor living area required in a multifamily development, shall not be a substitute for the required land dedication.

(b) Trails. The owner of each project or change of use which will increase pedestrian and/or bicycle use or trips shall dedicate trail easements consistent with the City's adopted plans, subject to any claims as provided in GJMC 21.06.010(b)(1). Trails shall be constructed in accordance with applicable City standards. If a trail(s) is constructed in addition to the construction of required sidewalks, then the owner may request an offset for the cost of construction of the trail(s) against the project's open space fee in an amount not to exceed the total open space fee. The amount of the credit or offset will be determined by the City using established and uniform cost for labor and materials for the specific type and width of the trail(s) constructed.

(Ord. 4878, 10-16-19; Ord. 4428, 6-14-10; Ord. 4419, 4-5-10)

21.06.030 School land dedication fee.

(a) Standard for School Land Dedication. Dedication of suitable school lands for school purposes shall be required of any development if the school district determines that such development includes within it land which is necessary for implementing a school plan. In all other cases, the fee required under subsection (a)(2) of this section shall be paid in lieu of a school land dedication.

(1) Standard for Fee in Lieu of School Land Dedication. Except in cases where a school land dedication is required in accordance with this chapter, or an exemption under this chapter applies, all development and all projects which contain a new dwelling shall be subject to fees in lieu of school land dedication (SLD fee) in an amount per dwelling unit determined by resolution of the City Council. SLD fees shall be collected by the City for the exclusive use and benefit of the school district in which such development is located, and shall be expended by the school district solely to acquire real property or interests in real property reasonably needed for development or expansion of school sites and facilities, or to reimburse the school district for sums expended to acquire such property or interests. Revenues from such fees shall be used only for such purposes.

(2) Payment, Prepayment, Exemption, Credit, and Refund of SLD Fee.

(i) No building permit shall be issued for a dwelling, multiple-family dwelling or multifamily dwelling which is or contains one or more dwelling units until and unless the SLD fee for such dwelling unit in effect at the time such permit is applied for has been paid as required by this section.

(ii) Nothing in subsection (a)(1) of this section shall preclude a holder of a development permit for a residential development or mixed use development containing a residential development component from prepaying the SLD fees to become due under this section for one or more dwellings, multiple-family dwellings or multifamily dwellings to be constructed in such development. Such prepayment shall be made upon the filing of a final plat for residential development, at the SLD fee rate then in effect and in the amount which would have been due had a building permit application for such dwelling been pending at the time of prepayment. A subsequent building permit for a dwelling, multiple-family dwelling or multifamily dwelling which is or contains one or more dwelling units for which the SLD fees have been prepaid shall be issued without payment of any additional SLD fees. However, if such permit would allow additional dwelling units for

which SLD fees have not been prepaid, such permit shall not be issued until the SLD fees for such additional dwelling units have been paid at the rate per dwelling unit in effect at the time the building permit application was made.

(iii) Any prepayment of SLD fees in accordance with this section shall be documented by a memorandum of prepayment which shall contain, at minimum, the following:

(A) The legal description of the real property subject to residential development for which an SLD fee is being prepaid;

(B) A description of the development permit issued concerning such real property, and a detailed statement of the SLD fees owed pursuant to such permit which are being prepaid;

(C) The notarized signatures of the record owner of the property or their duly authorized agents;

(D) The notarized signature of the County Manager indicating approval of the prepayment plan, if the fee was paid while the real property was outside the limits of the City; or if the fee was paid at the time the real property was within the limits of the City, of the City Manager, indicating approval of the prepayment plan.

(3) Exemptions. The following shall be exempted from payment of the SLD fee:

(i) Alterations or expansion of an existing building except where the use is changed from nonresidential to residential and except where additional dwelling units result;

(ii) The construction of accessory buildings or structures;

(iii) The replacement of a destroyed or partially destroyed building or structure with a new building or structure of the same size and use;

(iv) The installation of a replacement mobile home on a lot or other parcel when a fee in lieu of land dedication for such mobile home has previously been paid pursuant to this section or where a residential mobile home legally existed on such site on or before the effective date of the ordinance codified in this section;

(v) Nonresidential buildings, nonresidential structures, or nonresidential mobile homes;

(vi) Nursing homes, adult foster care facilities or specialized group facilities;

(vii) City- or County-approved planned residential developments that are subject to recorded covenants restricting the age of the residents of said dwelling units such that the dwelling units may be classified as housing for older persons pursuant to the Federal Fair Housing Amendments Act of 1988.

(4) Credits.

(i) An applicant for a development permit (or a holder of such a permit) who owns other suitable school lands within the school district in which the development is located may offer to convey such lands to the school district in exchange for credit against all or a portion of the SLD fees otherwise due or to become due. The offer must be in writing, specifically request credit against fees in lieu of school land dedication, and set forth the amount of credit requested. If the City and the school district accept such offer, the credit shall be in the amount of the value of the suitable school lands conveyed, as determined by written agreement between the City, the school district and the permit holder or applicant.

(ii) Credit against SLD fees otherwise due or to become due will not be provided until good and sufficient title to the property offered under this subsection is conveyed to and accepted by the school district. Upon such conveyance, the school district and the City shall provide the applicant with a letter or certificate setting forth the dollar amount of

the credit, the reason for the credit, and a description of the project or development to which the credit shall be applied.

(iii) Credits shall not be transferable from one project or development to another.

(5) Refund of Fees Paid.

(i) Any SLD fee which has not been expended by the school district within five years of the date of collection shall be refunded, with interest at the rate of five percent per annum compounded annually, to the person who paid the fee. Prior to such refund, such amount shall be reduced by an amount equal to three percent of the principal amount to be refunded, for the costs incurred by the City in the refund of such fee. The City shall give written notice by U.S. mail to the person who paid the fee at his or her address as reflected in the records of the Mesa County Clerk and Recorder. If such person does not file a written claim for such refund with the City within 90 days of the mailing of such notice, such refund shall be forfeited and shall be retained and used for the purposes set forth in this section.

(ii) The City Council may, upon the school district's request, extend the five-year period of time specified in subsection (a)(5)(i) of this section upon a showing that such extension is reasonably necessary in order for the school district to complete or close a purchase transaction entered into in writing by such district prior to expiration of such period, or to give the school district an opportunity to exercise a purchase option it acquired prior to expiration of such period. Such request shall be made at a public hearing of the City Council. In no event shall any extension of time exceed an additional five-year period.

(b) Fees in Lieu of School Land Dedication (SLD Fees).

(1) SLD fees shall be collected and held in trust for the use and benefit of the school district containing the residential development for which the fee is collected. Such fees shall be expended by the school district to acquire additional real property for expansion of school facilities and construction of new school facilities necessitated by new residential development in the school district, or to reimburse the school district for sums expended to acquire such property. The amount of the SLD fee shall be based on a methodology which takes into account the student generation rates of new residential development, the quantity of land required to build new school facilities on a per pupil basis, and the anticipated cost of acquiring suitable school lands in the school district to expand existing school facilities and construct new school facilities to accommodate new residential development without decreasing current levels of educational services.

(2) The SLD fee and the value of the variables in the formula to determine the SLD fee shall be set by resolution of the City Council in accordance with the following formula:

Average Cost per Acre of Suitable School Lands within the School District	X	Student Generation Fee Factor	=	SLD Fee per Dwelling Unit

(For example, if the average cost of suitable school lands within the school district is $15,000 per acre and the student generation fee factor is 0.023, the SLD fee per dwelling unit would be $15,000 x 0.023, or $345.00.)

(3) The average cost per acre of suitable school lands within the school district ("average cost per acre for SLD fee") and the student generation fee factor ("SGF factor") shall be determined by City Council. Before City Council considers modification of either, a 60-day prior written notice shall be provided to the school district. If a written request for a public hearing specifying which factor, the average cost per acre for SLD fee and/or the SGF factor, the school district wants to be heard on is received by the City from the school district at least 30 days

before the matter is scheduled to be determined by City Council, a public hearing shall occur. At a hearing where City Council is considering the modification of the average cost per acre for SLD fee, City Council shall consider the school district's long range capital improvement plans and any other evidence, comments or recommendations submitted by the school district. At a hearing where City Council is considering the modification of the SGF factor, City Council shall consider the school district's school facilities plan currently in place, the methodology and data supporting the proposed modification, and any evidence, comments or recommendations submitted by the school district.

(4) The SLD fee in effect as of January 1, 2006, was $460.00. The SGF factor used to determine the SLD fee was 0.023. This SLD fee and SGF factor shall continue until otherwise modified by City Council as set forth in this code.

(Ord. 4419, 4-5-10)

21.06.040 Landscape, buffering and screening standards.

(a) Purpose and Goals. The purpose of this section is to enhance the aesthetic appeal of new development. Landscaping reduces heat and glare, facilitates movement of traffic within parking areas, shades cars and parking surfaces reducing local and ambient temperatures, buffers and screens cars from adjacent properties, promotes natural percolation of surface waters, improves air quality, buffers and screens potentially incompatible uses from one another, and conserves the value of property and neighborhoods within the City.

(b) General Landscape Standards.

(1) All landscaping required by this code shall comply with the standards and requirements of this section. The landscaping requirements of this code shall not apply to a lot zoned for one or two dwellings. Landscaping for new developments shall occur in buffer areas, all interior parking areas, along the perimeter of the property, around new and existing structures, and along street frontages and within any right-of-way not used nor planned to be used for infrastructure.

(2) Plant Quantities. The amount of landscaping is based on gross area of proposed development.

(3) Landscaping Standards. All new development must install and maintain landscaping as required by this code. (See subsection (b)(1) of this section for an example of the landscaping requirements of this section.)

(i) On-site frontage landscaping may not apply in the B-2 zone downtown commercial. (See zone district standards.)

(ii) Landscaping in the abutting right-of-way is required in addition to overall site landscaping requirements.

(iii) Buffer landscaping is required in addition to overall site landscaping requirements.

(4) Acceptable Plant Material. Vegetation must be suitable for Grand Junction's climate and soils. The Director may allow the use of any plant if sufficient information is provided to show suitability including salt tolerance, sun and shade requirements based on planting locations, growth habit, etc. Noxious weeds are not allowed. (The Director will keep a list of suitable plants.)

(5) Minimum plant sizes are:

(i) Shade tree, two-inch caliper (measured six inches above root ball) at time of planting. At maturity, a shade tree has a height and/or spread of 30 feet or greater. If two-inch caliper trees are not available due to seasonal shortages or shortages in desired varieties, the Director may approve the installation of smaller trees, provided the proportional difference in caliper inches is compensated for by installing additional trees. For example, the

installation of six one-and-one-half-inch caliper shade trees would result in a shortfall of three caliper inches, which could be compensated for with two additional one-and-one-half-inch trees. However, a minimum caliper of one and one-half inches shall be required.

(ii) Ornamental tree, one-and-one-half-inch caliper (measured six inches above root ball) at time of planting. At maturity, an ornamental tree has a spread and height between 15 feet and 30 feet.

(iii) Evergreen tree, six feet tall at time of planting.

(iv) Deciduous shrub, five-gallon container.

(v) Evergreen shrub, five-gallon container.

(vi) Perennials and ground covers, one-gallon container.

(vii) Turf mix, native grasses and wild flower mix are the only vegetation that may be planted as seed.

(6) Irrigation. All vegetation and landscaped areas must be provided with a permanent irrigation system.

(i) Nonpotable irrigation water shall be used unless the Director allows the use of potable water.

(ii) An underground pressurized irrigation system and/or drip system is required for all landscape areas on the property and in any right-of-way.

(iii) If connected to a drinking water system, all irrigation systems require State-approved backflow prevention devices.

(iv) All irrigation for nonpotable irrigation water systems must have adequate filters easily accessible above ground or within an appropriately sized valve box.

(v) Native grasses must have a permanent irrigation source that is zoned separately from higher water demand landscapes. Once the grasses are established, irrigation to native grass areas can be reduced to a level that maintains coverage typical of the grass mix and to suppress weed growth.

(7) Landscape Plans and Equivalent Plants.

(i) Landscape plans must identify the species and sizes of vegetation (SSID manual).

(ii) All landscaping shall be installed as shown on the approved plan.

(iii) An equivalent species may be substituted in the field without prior approval of the Director, provided a revised drawing is submitted to the Department. Plants are “equivalent” if they have the same growth habit and rate, same cover, leafing, shade characteristics and function, have similar water requirements, thrive in the same microclimate, soils and water conditions.

(iv) All other changes to the landscape plan require prior approval from the Director.

(v) All development plans shall designate required landscaping areas. Subdivision plats shall designate required landscaping areas.

(vi) The owner shall keep each fire hydrant unobscured by plant material.

(vii) Landscape plans shall be stamped by a licensed landscape architect. Inspection and compliance with approved landscape plan must be certified by a licensed landscape architect prior to issuance of a certificate of occupancy.

(8) Preservation of Significant Landscape Features. Existing landscape features such as escarpments, large or old trees or stands, heavy vegetative cover, ponds and bluffs shall be identified by the Director as part of the development review process. To the extent the Director deems practicable, such features shall be preserved by the final plans and to such extent, count toward landscape and open space area requirements. Features to be preserved shall be protected throughout site development. If a significant live feature which was to be preserved dies or is substantially damaged, the developer shall replace it with an equivalent feature as determined by the Director. No person shall kill or damage a landscape feature required to be preserved by this section. The developer shall protect trees from compaction under the canopy drip line of the tree unless the City Forester says otherwise.

(i) During construction, fencing or similar barriers shall isolate and protect the landscape features to be preserved.

(ii) All protection measures shall be clearly identified on the construction and landscape plans.

(iii) No vehicles or equipment shall be driven or parked nor shall any materials be piled within the canopy drip line of any tree to be preserved.

(9) Protection of Landscape Areas. All landscape areas (except in the right-of-way where a street side curb does not exist) shall be protected from vehicles through the use of concrete curbing, large rocks, or other similar obstructions.

(10) Utility Lines. If the location of utilities conflicts with the landscaping provisions, the Director may approve an equivalent alternative.

(i) Utility composite plans must be submitted with landscape plans.

(ii) Trees which will grow to a height of greater than 15 feet at maturity shall not be planted under electrical lines.

(iii) Ornamental and evergreen trees planted under an electrical line may count towards the total tree requirement.

(11) Sight Distance. The owner shall maintain all vegetation, fences, walls and berms so that there is no site distance hazard nor road or pedestrian hazard.

(12) Soil. Soil in landscape areas must be amended and all vegetation planted in accordance with good horticultural practices.

(i) Details for the planting of trees, shrubs and other vegetation must be shown on the landscaping plans.

(ii) Shrub beds adjacent to turf or native grass areas are to be edged with concrete, metal, brick or substantial wood material. Plastic and other light duty edgings are not allowed.

(iii) Mulch and weed fabric are required for all shrub beds.

(iv) The minimum square footage of planting area for a five-gallon evergreen or deciduous shrub is 16 square feet. These minimum square footages may be varied by a qualified professional.

(13) Trees.

(i) Trees should not be planted near a light pole if eclipsing of light will occur at maturity. Placing light poles in the parking lot, away from landscape area and between parking bays, helps eliminate this conflict and should be considered.

(ii) Tree canopies may overlap by up to 20 percent of the diameter of the tree at maturity. Tree clustering may be allowed with some species so long as clustering does not adversely affect the mature canopy.

(iii) At planting, tree trunks must be reasonably straight with minimal doglegs.

(iv) Wire baskets, burlap wrappings, rope, twine or any similar shipping materials shall be removed before planting.

(v) The minimum square footage of planting area for a shade tree is 140 square feet. The Director may vary the minimum square footage.

(vi) Species Diversity. The percent of any one type of tree that can be planted in a development shall be as follows:

(A) Zero through five trees: No limitation.

(B) Six to 21 trees: No more than 50 percent of one species.

(C) 21 or more trees: No more than 20 percent of one species.

(14) Shrubs.

(i) Twenty-five percent of the required shrubs may be converted to turf based on one five-gallon shrub per 50 square feet of turf.

(ii) Ten percent of the required shrubs may be converted to perennials and/or ground covers at a ratio of three one-gallon perennials and/or ground covers for one five-gallon shrub.

(iii) Species Diversity. The percent of any one type of shrub that can be planted in a development shall be as follows:

(A) Ten through 19 shrubs: 50 percent.

(B) Twenty through 39 shrubs: 33 percent.

(C) Forty through 59 shrubs: 25 percent.

(D) 60 or more shrubs: 15 percent.

(iv) When calculating tree and shrub quantities, any fraction of a shrub or tree or other requirement is rounded up to the next whole number.

(v) With the approval of the Director, the number of shrubs may be reduced in exchange for additional trees or tree size at a rate of three shrubs per caliper inch.

(15) Maintenance. The owners, tenants and occupants for all new and existing uses in the City must:

(i) Maintain landscaping in a healthy, growing, neat and well-maintained condition.

(ii) Maintenance includes watering, weeding, pruning, pest control, trash and litter removal, replacement of dead or diseased plant material, reseeding and other reasonable efforts.

(iii) Any plant that dies must be replaced with an equivalent live plant within 90 days of notification or, if during the winter, by the next April 1st.

(iv) Hay mulch used during the preparation or establishment of landscaping must be certified weed-free by the Colorado Department of Agriculture.

(v) On his own or based on a citizen complaint, the Director may, without notice and without a warrant, walk on the landscaped portion of the property from time to time to inspect the condition of landscaping.

(vi) Between one and two years after installation of required landscaping, Code Enforcement shall conduct a site inspection to verify that all required landscaping has been maintained in a healthy, growing, neat and well-maintained condition. Property owners shall be notified of necessary corrective action for failure to comply with the maintenance provisions of this section.

(16) Public Right-of-Way. Except where a detached sidewalk exists or is proposed and approved (see subsection (b)(16)(iv) of this section), landscaping on public right-of-way shall not be counted toward any landscape or open space requirements of this code, unless specifically provided otherwise in this code.

(i) All unimproved right-of-way adjacent on the side abutting a development which is not in the City's one-year capital plan to be improved must be landscaped. All right-of-way landscaping shall be irrigated and maintained by the adjoining private property owner, unless the City agrees to accept it for maintenance. If it is to be maintained by the City, a separate irrigation system shall be provided.

(ii) At least 75 percent of the unpaved adjacent right-of-way shall be landscaped with turf, low shrubs or ground cover. The Director may vary the required landscaping to obtain a consistent appearance in the area or with existing or planned right-of-way landscaping.

(iii) The owner of the nearest property shall keep all rights-of-way, which are not hard surfaced, free of weeds, litter, junk, rubbish and obstructions. To prevent weed growth, erosion and blowing dust, right-of-way areas not covered by vegetation or paving shall be covered with mulch, wood chips, bark chips, decorative rocks or cobble or similar natural materials, to be underlain by weed fabric or other barrier.

(iv) Where detached sidewalks exist, or are proposed, a maximum of 50 percent of the public right-of-way landscaping may be counted toward the total required landscaping. The right-of-way landscaping between the curb and sidewalk shall contain street trees spaced every 40 feet.

(v) The Director may allow decorative paving in landscaped areas in commercial or other high pedestrian traffic areas if the decorative paving is compatible with nearby right-of-way paving and landscaping.

(17) Pervious Coverage. Landscaped and buffer areas count toward the pervious area requirement.

(18) Authority.

(i) The Director shall decide all questions of soils, plant selection and care, irrigation installation and other vegetation and landscaping questions.

(ii) The Director may approve an applicant's request to vary from the required number and types of plants or landscaped area if:

(A) The number of trees exceeds 25 percent of the minimum number of trees; and/or

(B) Trees exceed the minimum caliper requirement by one inch or more; and/or

(C) Additional berming or other attractive buffering, public art, enhanced paving treatments for public plazas (brick or concrete pavers, tinted and stamped concrete, etc.) is provided. The Director may grant up to a 10 percent reduction of the square footage of improved area used to calculate the landscape requirement where these types of enhancements are included in a development.

(D) Additional trees or larger trees can be exchanged on a per-caliper-inch basis with three shrubs equaling one caliper inch. Credit for using larger trees would be based on a direct exchange of caliper inches. For example: 10 three-inch caliper trees equaling 30 caliper inches is the same as 15 two-inch caliper trees equaling 30 caliper inches; one two-inch caliper tree equals six shrubs. Trees may be substituted for shrubs, but shrubs may not be substituted for trees.

(E) If the total amount of required landscaping is provided, the Director may allow the owner to place the landscaping on another appropriate part of the lot.

(19) Water Wise. Because of Grand Junction's desert environment, water wise design and the use of xeric (low water use) plants are strongly encouraged. Water wise designs shall employ the seven basic principles of xeric design which include "comprehensive planning and design for low water use, creating practical turf areas, selecting low water use plants and organizing plants by water usage, using adequate soil prep, using water conserving mulches, irrigating efficiently and maintaining the landscape appropriately" (source: Denver Water Board).

(i) Low water use plants are encouraged for use in the "typical" urbanized landscape, especially where the plants can be irrigated (zoned) separately from higher water use plant material. This way of using xeric plants is compatible with any of the requirements of this code.

(ii) Landscaping designs that mimic the "desert" character of Grand Junction's setting are also encouraged, but must be carefully designed so that the basic requirements for shade, screening and buffering are met. Because of this, the Director must approve "desert" or xeric landscape plans as well as variances from the required plant coverage ratios. To further encourage xeriscaping, one-gallon xeric plants shall be equivalent to five-gallon traditional plants. Trees shall be installed in accordance with subsection (b) of this section.

(c) Parking Lots.

(1) Interior Landscaping Requirement. Landscaping is required in the interior of parking lots to direct traffic, to shade cars and structures, to reduce heat and glare and to screen cars from adjacent properties. The interior of all parking lots shall be landscaped as follows:

(i) One landscaped island, parallel to parking spaces, is required for each 20 parking spaces. In lieu of the standard landscape island, one "orchard style" landscape island may be used for every six parking spaces. The orchard style landscape islands shall be evenly spaced between end landscape islands. (See subsection (j) of this section.)

(ii) Landscape islands must be at least 140 square feet. The narrowest/smallest dimension of a parking lot island shall be eight feet, measured from back of curb to back of curb.

(iii) One landscaped divider island, parallel to the parking lot drive aisles, designed to prevent diagonal movement across the parking lot, shall be located for every three parking lot drive aisles.

(iv) A landscape island is required at the end of every row of parking spaces, regardless of length or number of spaces.

(v) Wheel stop barriers on all sides adjacent to the parking lot surface are required to protect landscape islands from vehicles.

(vi) A corner area (where it is not feasible to park a vehicle) may be considered an end island for the rows on the perimeter of the parking lot.

(vii) Landscaping of the interior of a parking lot shall include trees and shrubs.

(2) Parking Lot Perimeter. Landscaping is required around the entire perimeter of a parking lot to assist in the shading of cars, to assist in the abatement of heat and to reduce the amount of glare from glass and metal, and to assist in the screening of cars from adjacent properties. The perimeter of a parking lot is defined as the curb line defining the outer boundaries of the parking lot, including dumpster enclosures, bike racks, or other support facilities that are adjacent to the outer curb. Entry drives between a parking lot and the street, drives connecting two internal parking lots or building entry plazas are not included in the perimeter area.

(i) Screening shall occur between a street and a parking lot and street frontage landscape shall apply. (See subsections (c)(3) and (l) of this section.)

(ii) The minimum dimension allowed for the parking lot perimeter landscape strip is six feet. The width of a landscape strip can be modified by the Director, provided the intent of this section is met.

(iii) Landscaping along the perimeter of parking lots shall include trees and shrubs.

(iv) Parking lots shared by more than one owner shall be landscaped around the perimeter of the combined lots.

(3) Screening. All parking lots abutting rights-of-way, entry drives, and adjacent properties must be screened. For this subsection, a "screen" means a turf berm and/or shrubs.

(i) A 30-inch-high screen is required along 70 percent of parking lots abutting rights-of-way, entry drives, and adjacent properties, excluding curb cuts. The 30-inch screen shall be placed so as to maximize screening of the cars in the parking lot, when viewed from the right-of-way and shall be measured from the ground surface, or the elevation of the roadway if the adjacent road is higher than the property.

(ii) Screening shall not be required between parking lots on adjoining lots where the two lots are designed to function as one.

(iii) If a landscape area is 30 feet wide or greater between a parking lot and a right-of-way, the 30-inch-high screen is not required. This 30-foot-wide or greater area must be 100 percent covered in plant material within three years. Turf is allowed.

(iv) The Director may approve a screen wall between a parking lot and a right-of-way if the lot or parcel is unusually small.

(v) A screen wall must not be taller than 30 inches, unless the adjacent roadway is higher than the property, in which case the screen wall shall be 30 inches higher than the adjacent roadway.

(vi) Two five-gallon shrubs may be substituted for four linear feet of wall; shrubs must reach a height of at least 30 inches at maturity.

(vii) A column or jog or equivalent architectural feature is required for every 25 linear feet of wall.

(viii) The back of the wall must be at least 30 inches from the face of curb for bumper overhang.

(ix) Shrubs must be planted on the street side of the wall.

(x) There must be at least five feet between the right-of-way and the paved part of a parking lot to use a wall as a screen.

(xi) Wall elevations and typical cross sections must be submitted with the landscape plan at a minimum scale of one-half inch equals one foot.

(xii) Walls shall be solid masonry with finish on both sides. The finish may consist of stucco, brick, stone or similar material. Unfinished or merely painted concrete block is not permitted.

(xiii) Shrub plantings in front of a wall are not required in the B-2 downtown district.

(d) Street Frontage Landscape.

(1) Within all zones (except single-family uses in single-family, B-2 and form based zone districts), the owner shall provide and maintain a minimum 14-foot-wide street frontage landscape adjacent to the public right-of-way.

(2) A minimum of 75 percent of the street frontage landscape shall be covered by plant material at maturity.

(3) The Director may allow for up to 50 percent of the 14-foot-wide street frontage to be turf, or up to 100 percent turf coverage may be allowed if the parking lot setback from the right-of-way exceeds 30 feet. Low water usage turf is encouraged.

(4) All unimproved right-of-way adjacent to new development projects shall be landscaped and irrigated by the owner and/or homeowners' association as per subsection (b)(16) of this section.

(5) Landscaping within the street frontage shall include trees and shrubs. If detached walks are not provided with street trees, street trees shall be provided in the street frontage landscape, including one tree for every 40 feet of street frontage.

(6) Where detached walks are provided, a minimum street frontage landscape of five feet is acceptable.

(e) Buffers.

(1) Buffers shall be provided between different zoning districts as indicated in subsection (k) of this section.

(i) Seventy-five percent of each buffer area shall be landscaped with turf, low shrubs or ground cover.

(ii) One medium sized tree is required per every 40 linear feet of boundary between different zones.

(2) Exceptions.

(i) Where residential or collector streets or alleys separate zoning districts, the Director can require more landscaping instead of a wall or fence.

(ii) Where walkways, paths, or a body of water separates zoning districts, the Director may waive a fence or wall requirement provided the buffering objectives are met by private yards.

(iii) Where a railroad or other right-of-way separates zoning districts, the Director may waive the buffer strip if the buffering objectives are met without them.

(f) Fences, Walls and Berms.

(1) Fences and Walls. When a higher density or intensity zoning district abuts a lower density or intensity zone district, it is the responsibility of the higher density or intensity property to buffer the abutting zone district according to subsection (k) of this section. When an existing fence or wall substantially meets the requirements of this section, and subsection (k) of this section requires the same form of buffering, an additional fence on the adjacent developing property shall not be required. However, if the new development requires the placement of a wall, and a fence exists on the adjacent property, the wall shall be required. If a wall is required and a fence is in place, the wall must be placed adjacent to the fence. (Subsection (k) of this section should be referenced to determine when a wall or a fence is required. The more stringent standard shall apply; i.e., if a wall is required and a fence is in place, the wall must be placed adjacent to the fence.) Fences must comply with GJMC 21.04.040(i), any design guidelines and other conditions of approval. Fences and walls required by this section must meet the following:

(i) Maximum height: six feet (outside of front setback, 30-inch solid height or four feet height if two-thirds open within the front setback and must meet all sight distance requirements).

(ii) Fence type: solid wood or material with a similar appearance, finished on both sides.

(iii) Wall type: solid masonry finished on both sides. Finish may consist of stucco, brick, stone or similar material but unfinished or merely painted concrete block is not permitted.

(iv) Location: within three feet of the property line unless the space is needed to meet landscaping requirements.

(v) A wall must have a column or other significant architectural feature every 30 feet of length.

(vi) Any fence or wall over six feet in height requires a building permit.

(vii) No person shall construct or maintain a fence or a wall without first getting a fence/wall permit from the Director.

(2) Berms. Minimum requirements for berms are as follows:

(i) Maximum slope of 4:1 for turf areas and 3:1 for shrub beds; and

(ii) To control erosion and dust, berm slopes must be stabilized with vegetation or by other means consistent with the requirements for the particular landscape area.

(g) Residential Subdivision Perimeter Enclosures.

(1) Intent. The decision-maker may require (where deemed necessary) perimeter enclosures (fences and/or walls) around all or part of the perimeter of a residential development. Perimeter enclosures shall be designed to meet the following objectives of protecting public health, safety and welfare: screen negative impacts of adjoining land uses, including streets; protect privacy; maintain a consistent or complementary appearance with enclosures in the vicinity; maintain consistent appearance of the subdivision; and comply with corridor overlay requirements.

(2) Specifications. Unless specified otherwise at the time of final approval:

(i) A perimeter enclosure includes fences, walls or berms, and combinations thereof, located within five feet of the exterior boundary of a development.

(ii) The maximum height is six feet, including within front setbacks; however, an enclosure constructed on a berm shall not extend more than eight feet above the adjoining sidewalk or crown of road, whichever is lower.

(iii) New enclosures shall be compatible with existing enclosures in the vicinity, if such enclosures meet the requirements of this code.

(iv) A perimeter enclosure in excess of six feet is a structure and requires a building permit.

(v) A perimeter wall must have a column or other significant architectural feature every 30 feet.

(3) Required Perimeter Enclosures. The decision-maker may require a perimeter enclosure as a condition of the final approval if:

(i) Use or enjoyment of property within the development or in the vicinity of the development might be impaired without a perimeter enclosure.

(ii) A perimeter enclosure is necessary to maintain a consistent and complementary appearance with existing or proposed perimeter enclosures in the vicinity.

(iii) A perimeter enclosure is necessary to control ingress and egress for the development.

(iv) A perimeter enclosure is necessary to promote the safety of the public or residents in the vicinity.

(v) A perimeter enclosure is needed to comply with the purpose, objectives or regulations of the subdivision requirements.

(vi) A perimeter enclosure is needed to comply with a corridor overlay district.

(vii) The Director will notify applicants of the need for a perimeter enclosure, if required.

(4) Design of Perimeter Enclosures. A complete landscape plan for the required landscape buffer and a detail drawing of the perimeter enclosure must be submitted at the time of final approval: perimeter enclosure detail at a scale of one-half inch equals one foot.

(5) Landscape Buffer. On the outside of a perimeter enclosure adjacent to a right-of-way, a 14-foot-wide landscape buffer shall be provided between the perimeter enclosure and the right-of-way for major and minor arterial streets and major or minor collectors. A five-foot-wide landscape buffer for side and rear yard perimeters shall be provided on all other streets between the perimeter enclosure and the right-of-way.

(i) Vegetation in the sight triangle (see TEDS, GJMC Title 29) shall not exceed 30 inches in height at maturity;

(ii) In the landscape buffer, one tree per 40 linear feet of perimeter must be provided;

(iii) All perimeter enclosures and landscape buffers must be within a tract dedicated to and maintained by the homeowners' association. The perimeter enclosure and landscaping must be installed by the developer and made a part of the development improvements agreement;

(iv) A minimum of 75 percent of the landscape buffer area shall be covered by plant material at maturity. Turf may be allowed for up to 50 percent of the 14-foot-wide landscape strip, at the Director's discretion. Low water usage turf is encouraged;

(v) Where detached walks are provided, a minimum buffer of five feet shall be provided. In which case, the right-of-way parkway strip (area between the sidewalk and curb) will also be planted as a landscape buffer and maintained by the HOA.

(6) Construction of Perimeter Enclosures. The perimeter enclosure and required landscape buffer shall be installed by the developer and included in the development improvements agreement.

(7) Ownership and Maintenance. The developer shall refer to the perimeter enclosure in the covenants and restrictions and so that perpetual maintenance is provided for either that the perimeter enclosure be owned and maintained by the owners' association or by individual owners. The perimeter enclosure shall be identified on the plat.

(8) Alternative Construction and Ownership. If the decision-maker finds that a lot-by-lot construction, ownership and/or maintenance of a perimeter enclosure landscape strip would meet all applicable objectives of this section and the design standards of GJMC 21.06.060, the final approval shall specify the type and size of materials, placement of fence posts, length of sections, and the like.

(9) Overlay District Conflicts. Where in conflict, the perimeter enclosure requirements or guidelines of approved overlay districts shall supersede the requirements of this section.

(10) Variances. Variances to this section and appeals of administrative decisions (where this code gives the Director discretionary authority) shall be referred to the Planning Commission.

(h) I-1 and I-2 Zone Landscape.

(1) Parking Lot Perimeter Landscape. Landscaping for the parking lot perimeter shall be per subsection (c)(2) of this section with the following addition:

(i) Turf may be allowed for up to 50 percent of the parking lot perimeter, at the Director's discretion. Low water usage turf is encouraged.

(ii) A minimum of 75 percent of the parking lot perimeter landscape shall be covered by plant material at maturity.

(2) Street Frontage Landscape. Landscaping for the street frontage shall be per subsection (d) of this section with the following additions:

(i) Vegetation in the sight triangle in the street frontage must not exceed 30 inches in height at maturity.

(ii) One tree for every 40 linear feet of street frontage (excluding curb cuts) must be provided, 80 percent of which must be shade trees.

(3) Public Right-of-Way Landscape. Landscaping for the public right-of-way shall be per subsection (b)(16) of this section.

(4) Maintenance. Each owner or the owners' association shall maintain all landscaping.

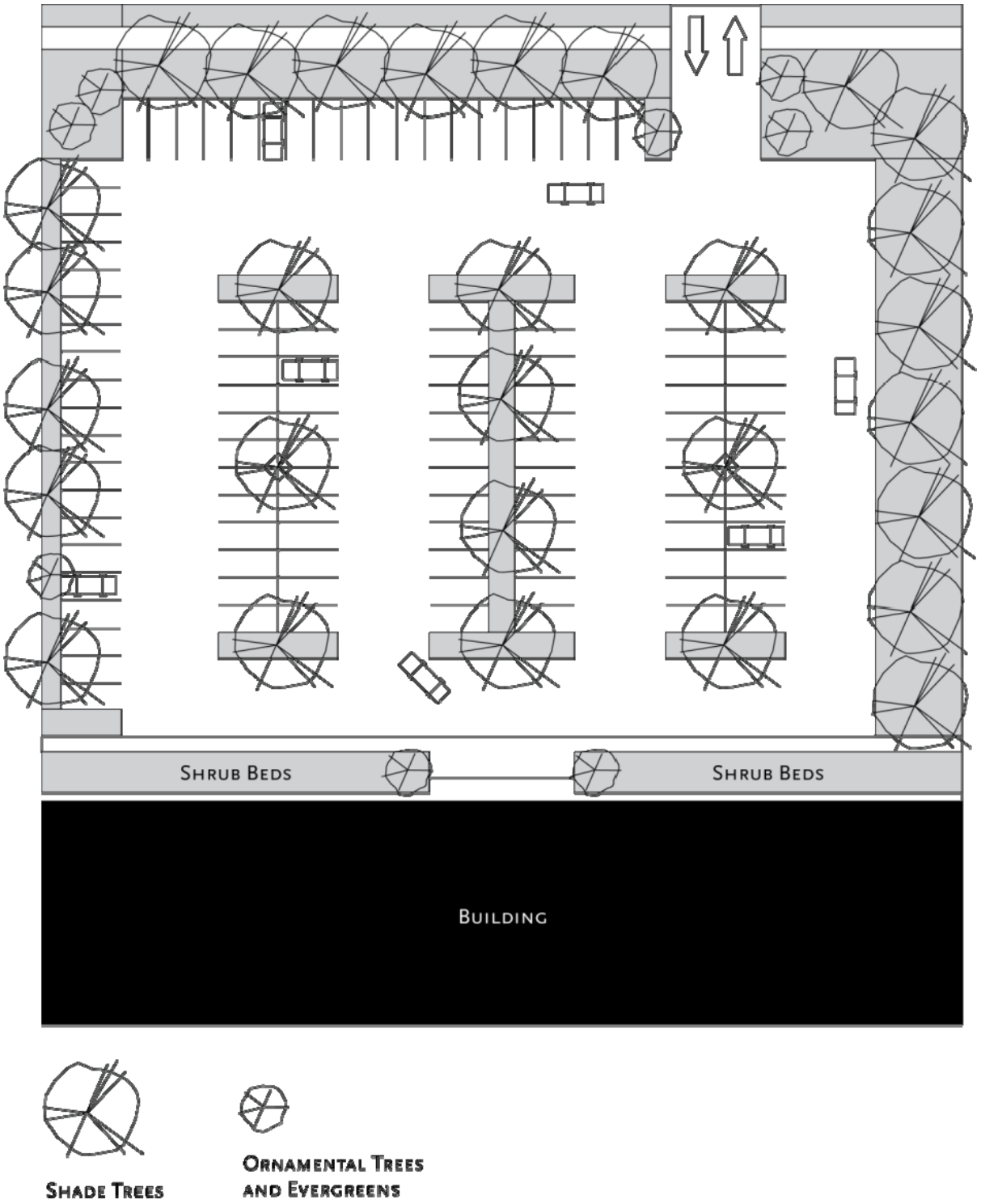
(5) Other Applicable Sections. The requirements of subsections (i), (j), (k) and (l) of this section shall also apply.

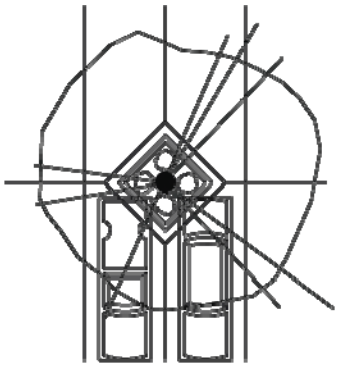
(i) Landscaping Requirements.

Zoning of Proposed Development	**Landscape Requirement**	**Location of Landscaping on Site**
Single-family residential (R zones)	As required for uses other than single-family residential; and as required in subsections (b)(16) and (g) of this section	As required for uses other than single-family residential; and landscape buffer and public right-of-way
R-5, R-8, R-12, R-16, R-24, R-0, B-1, C-1, C-2, I-O, CSR, MU	One tree per 2,500 square feet of improved area, with no more than 20 percent of the total being ornamental trees or evergreens. One five-gallon shrub per 300 square feet of improved area	Buffer, parking lot, street frontage perimeter, foundation plantings and public right-of-way
B-2	One tree per 2,500 square feet of improved area, with no more than 20 percent of the total being ornamental trees or evergreens. One five-gallon shrub per 300 square feet of improved area	Parking lot, park strip (in right-of-way)
I-1, I-2	As required in subsection (h) of this section and in other subsections of this section where applicable	Street frontage, parking lots, buffers and public right-of-way
MXR, MXG, MXS, MXOC	One tree per 3,000 square feet of improved area, with no more than 20 percent of the total being ornamental trees or evergreens. One five-gallon shrub per 300 square feet of improved area. Plantings must be evenly distributed throughout the development	Buffer, parking lot, street frontage perimeter, foundation plantings and public right-of-way

Zoning of Proposed Development	Landscape Requirement	Location of Landscaping on Site
Facilities: mining, dairy, vineyard, sand or gravel operations, confined animal feeding operation, feedlot, forestry commercial, aviation or surface passenger terminal, pasture	One tree per 5,000 square feet of improved area. One five-gallon shrub per 600 square feet of improved area	Perimeter, buffer and public right-of-way

(j) Example Tree Landscape Plan.





6' X 6' SQUARE SHOWN
7' X 7' ALSO POSSIBLE

ORCHARD-STYLE LANDSCAPE ISLAND

(k) Buffering Between Zoning Districts.

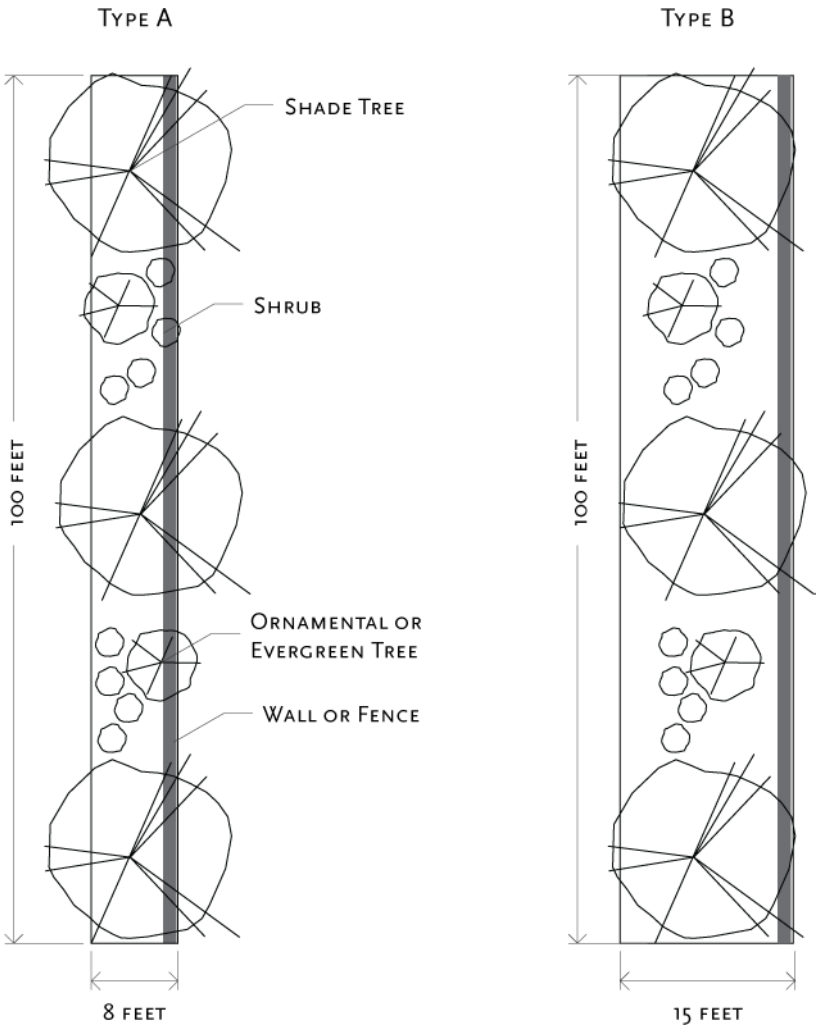
Zoning of Proposed Development	Zoning of Adjacent Property																	
	SF	R-5	R-8	R-12 R-16	R-24	R-O & MXOC	B-1	B-2	C-1	C-2 I-O	I-1	I-2	M-U	CSR	BP	MXR-	MXG-	MXS-
SF (Subdivisions)	-	-	-	-	-	-	F	-	F	W	W	W	F	-	F	-	-	-
R-5	-	-	-	-	-	-	F	-	F	W	W	W	-	-	F	-	-	-
R-8	-	-	-	-	-	F	F	-	F	W	W	W	F	-	F	A	-	-
R-12 & R-16	-	-	-	-	-	-	F	-	W	W	W	W	F	-	F	A	-	-
R-24	-	-	-	-	-	-	F	-	W	W	W	W	F	-	F	A	-	-
RO & MXOC	A	A	A	A	A	-	A or F	-	A or F	W	W	W	A or F	-	A or F	A	-	-
B-1	F	F	F	A or F	A or F	A or F	A or F	-	A or F	A or F	A or F	A or F	A or F	-	A or F	A	-	-
B-2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C-1	A&W	W	W	W	W	W	-	-	-	-	-	-	-	-	-	-	-	-
C-2 & I-O	W	W	W	W	W	W	F	-	-	-	-	-	A or F	A or F	A or F	A&W	-	-
I-1	W	W	W	W	W	W	F	-	-	-	-	-	A or F	B&W	A or F	B&W	A or F	A or F
I-2	B&W	W	W	W	W	W	F	-	-	-	-	-	A or F	B&W	A or F	B&W	A or F	A or F
M-U	A or F	A or F	A or F	A or F	A or F	A or F	A or F	-	A or F	A or F	A or F	A or F	-	-	-	-	-	-
CSR3 [1]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BP	A or F	A or F	A or F	A or F	A or F	A or F	A or F	-	-	-	-	-	-	-	-	A or F	A or F	A or F
MXR-	-	-	-	-	-	-	F	-	-	W	W	W	F	-	F	-	-	-
MXG-	-	-	-	-	-	-	F	-	-	W	W	W	F	-	F	-	-	-
MXS-	-	-	-	-	-	-	F	-	-	W	W	W	F	-	F	-	-	-

Notes
•A berm with landscaping is an alternative for a required fence or wall if the total height is a minimum of six feet.
•Where alleys or streets separate different zone districts, the Director may approve increased landscaping rather than requiring a wall or fence.
•The Director may modify this table based on the uses proposed in any zone district.
[1] Gravel operations subject to buffering adjacent to residential.

(l) Buffer Requirements.

Buffer Types	Landscaping Requirements	Location of Buffers on Site
Type A	Eight-foot-wide landscape strip with trees and shrubs	Between different uses
Type B	15-foot-wide landscape strip with trees and shrubs	Between different uses
Type F, W	Six-foot fence and wall (see subsection (f) of this section)	Between different uses

Note: Fences and walls are required for most buffers.



(Ord. 4646, 11-19-14; amended during 2010 codification; Ord. 4419, 4-5-10)

21.06.050 Off-street parking, loading and bicycle storage.

(a) Off-Street Parking Standards. New off-street parking (new construction and expansion of or changes to existing uses) standards follow. These are in addition to TEDS standards (GJMC Title 29).

(1) Uses Not Identified. The Director shall determine the parking requirement for a use which is not listed in subsection (c) of this section. The applicant shall provide adequate information so that the Director can make such decision by including:

(i) Type of uses;

(ii) Number of employees;

(iii) Building design capacity;

(iv) Square feet of sales area, service area, etc.;

(v) On-site parking spaces;

(vi) Proposed off-site parking spaces; and

(vii) Hours of operation.

(2) Multiple Uses. If there are accessory or multiple uses within one or more structures, these standards shall apply to each use and structure, resulting in a total parking requirement for the complex or property except as provided in subsection (e) of this section (Alternative Parking Plan).

(3) General.

(i) Each parking space must be accessible independently of others.

(ii) All square feet is gross floor area unless otherwise indicated.

(iii) Spaces for seats or persons is designed capacity.

(iv) A minimum of three spaces required for all uses requiring bicycle spaces.

(v) ADA requirements are listed in GJMC 21.06.090(b).

(b) Off-Street Parking Design.

(1) Location. Except as provided in an approved alternative parking plan (see subsection (e) of this section), all parking shall be provided on the same property as the principal structure, unless the Director deems it impracticable. In a business, commercial or industrial district, the off-site parking must either be in a zone that allows parking as a principal use or be in the same zone as the use creating the parking need. Parking spaces in residential zones shall not be in a front yard setback except for parking in driveways for detached single-family or two-family dwelling structures. In no case shall parking be allowed in parkway strips (the area between the sidewalk and curb or edge of pavement).

(2) Parking Lot Landscaping. Parking lots shall be landscaped (see GJMC 21.06.040(c)). In cases of hardship or to increase safety, the Director may permit a portion of the required landscaping to be relocated or allow other deviation from the parking landscaping requirements.

(3) Pedestrian Crossings. Pedestrian crossing areas shall be provided for each building egress or for every 125 feet of building which fronts a part of the parking area. Pedestrian crossing areas in parking lots shall be constructed of surface pavers, such as brick, stone blocks, interlocking brick pavers, stamped concrete or other materials as may be approved by the Director which form a smooth surface but contrast with asphalt. For parking lots of less than 50 cars, the Director may accept paint or similar markings.

(4) Parking Lot Lighting Requirements. Adequate shielded lighting shall be provided for all parking facilities used at night.

(5) Vehicular Traffic Areas. All driveways and parking areas, except for a single dwelling on one lot, shall comply with the following:

(i) All required parking and vehicular traffic surfaces shall drain and be surfaced with concrete or bituminous pavement in accordance with City standards. The City Engineer may permit a gravel surface in overflow parking areas, a low-traffic storage yard, or, as in subsection (b)(5)(ii) of this section, if the applicant establishes that very little dust will be generated. “Overflow parking” is defined as “parking in addition to the minimum required by ordinance which is designed not to be used more than 10 times per year.” A

"low-traffic storage yard" is defined as "a storage area generating less than 30 average daily trips." Industrial yards that accommodate large trucks and/or heavy equipment shall be surfaced and maintained with materials to prevent dust, mud and debris from leaving the site and being tracked onto the public right-of-way.

(ii) All surfaces shall be maintained in good condition free of weeds, dust, trash and debris. All vehicular traffic areas shall be built according to the construction standards established by the City.

(iii) A temporary parking lot shall be used after the owner has an approved site plan. Temporary parking lots are parking areas which serve during transition of a property during development and shall not be used for more than 24 months from issuance of a City site plan for such parking use.

(iv) A temporary parking lot:

(A) Is allowed only in R-0, B-1, B-2, C-1, C-2, I-O, I-1, or I-2 zones and only if a site plan has been approved by the Director;

(B) Shall be hard surfaced or gravel;

(C) Shall be graded for drainage;

(D) Shall be maintained in good condition free of weeds, dust, trash and debris;

(E) Shall be landscaped and screened;

(F) Parking spaces within a gravel lot shall be delineated with concrete "bumper blocks"; and

(G) Only used for a total of 24 months unless a site plan for a permanent lot usage is approved.

(v) Vehicular traffic areas shall be screened in the same manner as required for parking areas as per GJMC 21.06.040(c).

(c) Off-Street Required Parking. The table below shows the number of parking spaces required for the uses indicated. The number of spaces required may be modified through the alternative parking plan described.

USE CATEGORIES	SPECIFIC USES	MINIMUM NUMBER OF VEHICLE SPACES
RESIDENTIAL		
Group Living	Nursing Homes; Assisted Living Facility; Treatment Facility; Group Living Facilities	1 per 4 beds + 1 per each 3 employees
	Fraternities/Sororities	1.5 spaces for each sleeping room plus 1.5 spaces for every 4 active nonresident members of the fraternity/sorority plus 1 space for every 3 staff employed at the facility.
	Boarding and Rooming House	1 space for each room available for rent plus 2 spaces
	Other Group Living (e.g., dormitory style living)	0.8 parking spaces per bed

USE CATEGORIES	SPECIFIC USES	MINIMUM NUMBER OF VEHICLE SPACES
Household Living	Business Residence	1 per residence + business parking
	Accessory Dwelling Unit	1 per unit
	Single-Family, Two-Family	2 per unit
	Multifamily – 1 bedroom	1.25 per unit
	Multifamily – 2 bedroom	1.5 per unit
	Multifamily – 3+ bedroom	2 per unit
INSTITUTIONAL		
College, Vocational/ Technical Schools	College, Vocational/Technical Schools	1 per 2 students
Community Services	Community Center	1 per 250 square feet
Crematory	Crematory	1 per employee + 1 space per service vehicle
Cultural	Museums, Art Galleries, Opera Houses, Libraries	1 per 1,000 square feet
Day Care	Day Care	1.5 per employee
Detention Facilities	Jails, Honor Camps, Reformatories, Law Enforcement Rehabilitation Centers	1 per employee on maximum shift + 1 per service vehicle
Funeral Home/ Mortuary	Funeral Home/Mortuary	1 per 4 seats (one seat = 18")
Hospital/Clinic	Hospital/Clinic	1 per 2 beds + 1 per employee
Parks and Open Areas	Campground	1 space (10' x 30') per campsite
	Golf Course	4 per hole
	All Other	20 spaces per athletic field or ball diamond or 1 per 4 seats, whichever results in more spaces
Religious Assembly	Religious Assembly	1 per 4 seats (one seat = 18")
Safety Service	Fire or Police Station; Emergency Response Service	1 per employee + 1 per 300 square feet of office space
Schools	Elementary and Junior High	1 per classroom
	High Schools	6 per classroom
Utilities, Basic	Utilities, Basic	1 per employee
COMMERCIAL		
Office	General Offices; Governmental Offices	1 per 400 square feet
	Medical/Dental	1 per 250 square feet
Recreation and Entertainment, Outdoor	Driving Range	1 per 20 feet of driving area
	Miniature Golf	2 per hole
	All Other Outdoor Recreation	As determined by Director
Recreation and Entertainment, Indoor	Assembly/Auditorium	1 per 4 seats or 1 per 50 square feet if not permanent seat
	Bowling Alley	4 per lane
	Clubs/Lodges	1 per 500 square feet
	Health Club/Fitness Center	1 per 500 square feet

USE CATEGORIES	SPECIFIC USES	MINIMUM NUMBER OF VEHICLE SPACES
Drive-Through Uses (see TEDS manual (GJMC Title 29) for stacking or vehicle storage requirements)	Automated Tellers	N/A
	Bank, Drive-Through Facility	N/A
	Drive-Through Cleaners; Drive-Through Liquor	N/A
	Fuel: full service no repair/service facility; self-service	1 space per employee on largest shift + 1 space per 200 square feet
	Restaurant, Drive-In, no indoor seating	1 per employee on largest shift
	Restaurant, Fast-Food with Drive-In Facilities	1 space per 3 seats
Retail Sales and Services	Bars/Nightclubs	1 per 100 square feet
	Banks (Branch and Drive-In)	1 per 300 square feet
	Convenience Store	1 per 250 square feet
	Hotels/Motels; Inns	1 per room + 1 per 250 square feet of restaurants, bars, meeting areas
	Funeral Home/Mortuary/Crematorium	1 per 4 seats
	Restaurants	1.5 per 100 square feet
	Shopping Centers < 400,000 square feet 400,000 square feet + with Theater	 1 per 250 square feet 1 per 200 square feet 1 per 4 seats
	Theaters	1 per 4 seats
	New & Used Vehicle Sales, including Recreational Vehicles/Boats	1 space for each 5,000 feet of open sales lot area devoted to the sale, display, and rental of said vehicles and 1 space for each 300 square feet of gross floor area
	Other Retail Sales, High Volume, Stand Alone (e.g., supermarkets, clothing and department stores, shopping complexes, hardware building supplies, bookstores, big box stores and similar uses)	1 per 300 square feet
	Other Retail Sales/Services, Low Volume, Stand Alone (e.g., appliance and sales, repair shops, nurseries, greenhouses and similar uses)	1 per 500 square feet
	Other Service Businesses, Stand Alone (e.g., beauty/barber shops, frozen food lockers, laundries, and similar uses)	1 per 500 square feet
Self-Service Storage	Self-Service Storage	1 per 8 storage units + 1 per employee on maximum shift
Vehicle Repair	Vehicle Repair	2 per service bay + 1 per employee

USE CATEGORIES	SPECIFIC USES	MINIMUM NUMBER OF VEHICLE SPACES
Vehicle Service, Limited (see TEDS manual (GJMC Title 29) for stacking or vehicle storage requirements)	Car Wash, Self-Service	See TEDS (GJMC Title 29)
	Car Wash, Full-Service	1 space per employee
	Service Stations; Oil, Lube, Muffler Service	4 per service bay + required stacking spaces
	Other Limited Vehicle Service	2 per service bay + 1 per employee
	Tire, Batteries, Accessory Retailers	1 per 300 square feet
INDUSTRIAL		
Industrial Services and Operations	Industrial Services and Operations (e.g., Asphalt Plants, Concrete, Pipe and Culvert Storage)	1 per each 1,000 square feet of floor area
Manufacturing and Production	Manufacturing and Production	1 per 1,000 square feet
Warehouse and Freight Movement	Warehouse and Freight Movement	1 per 1,000 square feet
Waste-Related Use	Waste-Related Use, Salvage	1 per 1,000 square feet
Wholesale Sales	Wholesale Sales	1 space per 500 square feet of floor area
OTHER		
Agriculture	Feed Lots, Farming	None
Aviation, Surface Passenger Terminals	Airport Terminals, Charter Airplane Terminals, Bus Stations, Train Stations	1 per employee + 1 space per peak embarking passengers
Mining	Gravel Extraction or Storage, Oil or Gas Drilling or Production	1 per employee + 1 per facility vehicle
Telecommunications Facilities	Television Station, Radio Station, Cable TV Retailer, Internet Provider, Telephone Switching Station/Offices	1 per employee

(d) B-2 District. Parking regulations for uses in the B-2 district are:

(1) There is no parking requirement for the reuse, remodel, or reconstruction of an existing structure that does not increase the available square footage of leasable area.

(2) Parking shall be provided for any leasable square footage added after the effective date of the ordinance codified in this title.

(3) Permanent parking available to the public and within 500 feet (1,000 feet for employees) of the proposed construction counts towards the total parking requirement.

(e) Alternative Parking Plan. Unless an alternative parking plan is approved at the time of site plan approval, the parking ratios above shall apply.

(1) Applicant-Submitted Parking Data. The required parking ratios may be modified where applicant-submitted parking data illustrates that required parking ratios do not accurately apply to a specific development. The data submitted for an alternative parking plan shall include, at a minimum, the size and type of the proposed development, the mix of uses, the anticipated rate of parking turnover and the anticipated peak parking and traffic loads of all uses.

(2) Credit for On-Street Parking. Credit may be provided by the Director for any on-street parking spaces abutting the subject property. Such spaces must not be located within a clear sight triangle. No fractional spaces shall be credited.

(3) Off-Site Parking. Required off-street parking spaces may be permitted on a separate lot from the lot on which the principal use is located if the off-site parking complies with all of the following standards:

(i) Ineligible Activities. Off-site parking may not be used to satisfy the required parking ratios for residential uses (except for guest parking), as well as convenience stores or other convenience-oriented uses. Required parking spaces reserved for persons with disabilities may not be located off site.

(ii) Location.

(A) Off-site parking spaces shall be located within 500 feet (1,000 for employee spaces) from the primary entrance of the use served along the shortest available pedestrian route (measured from the nearest point of the parking area to the nearest point of the building or structure served by such parking lot). Off-site parking may not be separated from the use that it serves by a street right-of-way with a width of more than 80 feet unless a designated pedestrian crosswalk or walkway is provided.

(B) The off-site parking shall be located wholly within a district that allows commercial parking as principal use, except in the B-2 district.

(iii) Agreement.

(A) In the event that an off-site parking area is not under the same ownership as the principal use served, a written agreement between the record owners shall be required.

(B) An off-site parking agreement may be rescinded only if all required off-street parking spaces are provided in accordance with required ratios above.

(4) Shared Parking. Shared parking facilities may be permitted if the shared parking complies with all of the following standards:

(i) Ineligible Activities. Required parking spaces reserved for persons with disabilities may be located off-site with permission of the Director.

(ii) Location. Shared parking spaces shall be located within 500 feet of the primary entrance of all uses served along the shortest available pedestrian route (measured from the nearest point of the parking area to the nearest point of the building, structure or use served by such parking lot) unless shuttle bus service is provided to the parking area.

(iii) Shared Parking Study. Applicants wishing to use shared parking as a means of reducing the total number of required spaces shall submit a shared parking analysis using the latest edition of Urban Land Institute's Shared Parking. The study shall be provided in a form established by the Director and made available to the public. It shall address, at minimum, the size and type of the proposed development, the composition of tenants, the anticipated rate of parking turnover and the anticipated peak parking and traffic loads for all uses that will be sharing parking spaces.

(iv) Agreement.

(A) A shared parking plan shall be enforced through written agreement among all owners of record. An attested copy of the agreement between the owners of record shall be submitted to the Director on forms made available by the Director.

(B) A shared parking agreement may be rescinded only if all required off-street parking spaces are provided in accordance with an approved alternative parking plan. See subsection (e) of this section.

(5) Valet Parking. Valet parking may be permitted as a means of satisfying otherwise applicable parking requirements where all of the following standards have been met:

(i) Adequate assurance of the continued operation of the valet parking is provided, such as a contractual agreement for valet services or the tenant's affidavit agreeing to provide such services.

(ii) An equivalent number of valet spaces are available to replace the number of required on-site parking spaces. Such valet spaces do not require individual striping, and may take into account the tandem or mass parking of vehicles.

(iii) The design of the valet parking shall not cause customers who do not use the valet service to park off-premises or cause queuing in the right-of-way.

(iv) An accessible passenger loading and unloading area meeting ADA standards shall be provided.

(6) Recording of Approved Plans. An attested copy of an approved alternative parking plan shall be recorded in the deed records for Mesa County on forms made available by the Director. An alternative parking plan may be amended by following the same procedure required for the original approval. The applicant shall provide proof of recording prior to approval of the certificate of occupancy.

(7) Violations. Violations of an approved alternative parking plan constitute a violation of this code and shall be subject to all applicable enforcement and penalty provisions.

(f) Loading. A site plan for a proposed business, commercial or industrial use shall identify loading/unloading areas and shall be built and maintained in accordance with TEDS (GJMC Title 29).

(g) Bicycle Storage.

(1) Required Spaces. Bicycle spaces shall be provided at a rate of one space per 20 vehicle spaces.

(2) Alternative Bike Parking. The Director may allow bicycle parking for employees to be located within a structure for security reasons.

(Ord. 4813, 8-15-18; Ord. 4744, 4-5-17; Ord. 4710, 7-20-16; Ord. 4419, 4-5-10)

21.06.060 Subdivision standards.

(a) Applicability. Unless otherwise provided in a City Council approved development or annexation agreement, the provisions of this section shall apply to all residential, commercial, industrial and other subdivisions. See Chapter 21.02 GJMC for the process of subdivision review and approval.

(b) Intent.

(1) The design and layout must incorporate and emphasize unique features of the land. All subdivisions should be designed to:

(i) Complement neighborhood development and uses;

(ii) Reinforce the importance of public places such as boulevards, parks, and open spaces;

(iii) Protect existing natural resources and wildlife habitat;

(iv) Mitigate erosion from wind and water;

(v) Avoid development in riverine slide areas, geologically hazardous areas and in floodplains;

(vi) Preserve stands of existing mature trees and native vegetation;

(vii) Reduce fire hazards;

(viii) Promote pedestrian uses, bicycling, and transportation modes other than the private automobile;

(ix) Reduce long-term service and maintenance costs to the City, its residents and owners in the subdivision; and

(x) Avoid repetitive building and lot layouts.

(2) Open space should be integrated with the subdivision and adjacent property to create attractive areas for active and passive use. Open spaces should not be located on peripheral strips of land or isolated corners. Subdivision layout should interconnect streets, open spaces and existing and proposed pedestrian and bicycle trails.

(3) A subdivision for uses that differ significantly in size or type from contiguous uses and buildings should be organized to avoid or mitigate adverse effects on neighboring properties. Adjacent residential and mixed use projects should be connected, at least for nonvehicular transportation.

(c) Plans and Specification Standards. The design, construction and perpetual maintenance of all development, including subdivisions, shall be consistent with:

(1) Adopted plans and policies;

(2) Rules of the zoning district;

(3) Other requirements of this code;

(4) Any previous plans on which the subdivision is based;

(5) The City's technical and engineering, design, construction, and inspection criteria, standards, and specifications.

(d) Standards for Required Reports, Studies and Special Plans. The applicant shall submit to the Director those materials as listed in the SSID manual. All projects shall comply with the applicable requirements in SSID.

(e) Transportation Engineering Design Standards. All projects shall comply with applicable requirements for the Transportation Engineering Design Standards (GJMC Title 29).

(f) Lot Layout and Design.

(1) Access to Public Roads. All lots shall have direct or indirect access to a dedicated public road. If the plat provides for indirect access (i.e., over intervening private drives), access easements or tracts benefiting all lots with indirect access shall be provided on the recorded plat. Easements shall be used to access not more than one lot with no street frontage. All access to public roads shall meet the standards as set forth in TEDS (GJMC Title 29).

(i) Creation of lots having two parallel property lines abutting a right-of-way ("double frontage lot") or lots having a rear lot line which is adjacent to or across an alley from the side lot line of another lot ("reverse corner lot") is discouraged.

(ii) Double frontage lots shall comply with the subdivision perimeter enclosures provisions of GJMC 21.06.040(g).

(iii) A dwelling lot which abuts three public streets is discouraged.

(iv) The rear lot line of a dwelling lot should not abut a residential collector, local or cul-de-sac.

(v) The decision-maker may increase the required setback from a lot line bordering a collector or arterial street.

(vi) Single-family attached dwellings and/or multifamily dwellings with no street frontage or limited street frontage may be allowed by the Director provided access is reasonably

and readily available for each dwelling unit through the use of private streets, shared drives, parking lots, and/or other specifically identified limited common elements.

(2) Flag Lots.

(i) Each flag lot shall have at least 25 feet of street frontage; provided, that the Director may require an access easement 50 feet wide where public right-of-way may be needed to access future development. Said easement and irrevocable offer of dedication of right-of-way 50 feet wide shall run the full depth of the lot or lots.

(ii) The use of flag lots is discouraged. If no reasonable design alternative exists, the Director may allow one flag lot in a subdivision of four or fewer lots. If no reasonable design alternative exists, not more than 15 percent (round any fraction down to the next whole number) of the lots within a subdivision containing five or more lots are to be flag lots. If allowed, flag lots must be paired with the "poles" abutting to require the use of a common driveway. No more than two flag lots shall be contiguous.

(iii) The "flag" portion of a flag lot shall meet the minimum lot size of the applicable zone district. For purposes of this area calculation, the area of the "pole" is not counted. The decision-maker may increase the setbacks for the "flag portion" of a flag lot, to be noted on the plat.

(iv) Driveways shall be designed to allow vehicles to exit driving forward.

(v) As an alternative to paired flag lots, the Director may require a shared driveway if it meets the shared driveway standards.

(3) Rear Lot Lines. Each plat shall specifically identify all rear lot lines. Rear lot lines should not abut a residential collector or local street.

(4) Shared Driveways. No more than five dwelling units may share a single driveway access to a public street if technical requirements of TEDS (GJMC Title 29) are met. See GJMC 21.06.100(c).

(5) Loop Lane. Single-family lots may be located on a loop lane, subject to compliance with GJMC 21.06.100(d). Special setbacks and lot size reductions for properties located on loop lanes are required.

(6) Cul-de-Sacs and Dead End Streets. The design of cul-de-sacs and dead end streets shall meet TEDS (GJMC Title 29).

(7) Alleys.

(i) Alleys should be included in residential subdivisions, especially when they continue an existing pattern, or allow access to residential properties with garages or parking areas behind a principal structure served by a local or residential collector street.

(ii) Alleys should be provided in commercial and industrial areas unless alternate service access is provided.

(iii) TEDS (GJMC Title 29) applies to alleys.

(g) Circulation.

(1) General.

(i) Subdivisions shall be designed to continue or create an integrated system of lots, streets, trails, and infrastructure that provides for efficient movement of pedestrians, bicycles, and automobiles to and from adjacent development, while encouraging the use of mass transit.

(ii) Subdivisions shall allow for through movement of general traffic thus avoiding isolation of residential areas and overreliance on arterial streets on the edges of the subdivision for traffic movement, except as required by subsection (g) of this section.

(iii) Street layouts must help emergency providers find their way efficiently and quickly.

(iv) Residential subdivisions must provide efficient and relatively direct pedestrian and bicycle access to near commercial development.

(v) Bicycle paths shall connect to the City's on-street bikeway network and off-road trail system unless the Director determines it is not feasible.

(vi) The Street Naming and Addressing Manual controls the names of rights-of-way and property addressing.

(vii) Commercial subdivisions shall provide for vehicular circulation between adjacent lots and must dedicate or grant appropriate easements accordingly.

(2) Street Layouts.

(i) Street layouts shall continue streets in adjoining subdivisions or their anticipated locations when adjoining property is not yet developed.

(ii) Subdivisions shall accommodate a system of major collector, minor/residential collector, and local/residential streets providing multiple direct connections between local destinations such as parks, schools, and shopping, without requiring the use of arterial streets, unless unusual topographic features or existing development prohibits it.

(iii) Subdivisions containing or next to property designed for retail or commercial uses must be designed to integrate circulation systems among those lots and must avoid the erection of physical barriers between adjacent retail or commercial uses unless necessary for safety reasons.

(3) Street Widths. TEDS (GJMC Title 29) dictates street widths.

(4) Other Street Forms. The Director may approve different forms and types of streets if the functional and safety bases of TEDS (GJMC Title 29) are met. Any alternative street must be equal to or better than TEDS (GJMC Title 29) in terms of traffic safety, pedestrian circulation, impacts on adjacent uses, and appearance.

(5) Private Streets. Private streets are generally not permitted. Only the City Council may authorize any development to be served by a private street. See GJMC 21.06.100(a) and (b).

(6) Street Reserve Strips. No reserve strip shall be retained on the outer boundary or elsewhere of a development in order to control access to any public way.

(7) Bikeways, Walkways, and Sidewalks.

(i) All subdivisions shall provide an integrated system of bikeways, walkways, and sidewalks to allow residents, customers, and the public to safely and directly access all principal uses, public areas, streets, bus stops, parking areas, and trash, recreation, and mail pickup facilities on bicycle and on foot.

(ii) Unless the Director deems it impractical, pedestrian circulation shall be separated from vehicles and bicycles.

(iii) The adopted Grand Junction Circulation Plan and the standards in TEDS (GJMC Title 29) show how and where to build bicycle and pedestrian trails.

(iv) Walkways shall directly connect areas or points of pedestrian origin and destination. A walkway shall not be located or aligned solely based on the outline of a parking lot configuration that does not provide safe and convenient direct pedestrian access. Connecting walkways shall link street sidewalks with building entries, through the parking lots. To

provide direct pedestrian connections to these destinations, additional sidewalks or walkways not associated with a street, or the extension of a sidewalk from the end of a cul-de-sac to another street or walkway, may be required.

(v) Where a development abuts or includes an arterial or collector street, a bicycle and pedestrian access point shall be provided every 1,200 feet from the arterial and collector street or sidewalk into the development.

(8) Public Transit.

(i) Streets should be designed to facilitate the use of public bus transit where needed. The public transit authority may be a review agency.

(ii) The Director may require each subdivision to dedicate and/or construct adequate waiting areas for bus stops in the locations adjacent to arterial or major collector streets identified by a public transit authority; and direct walkways to each bus stop area from each nearby street, commercial, industrial use, and public area.

(iii) TEDS (GJMC Title 29) shows the design rules for a transit stop.

(9) Fire Lanes. Fire lanes shall be provided in accordance with the adopted fire code.

(h) Location and Use of Open and Undeveloped Space.

(1) The plat for each subdivision shall include and protect as much of the following open space as the Director deems reasonable:

(i) Natural, geologic or other hazard areas, such as potentially unstable slopes, faults, landslides, rockfalls, expansive soils, and floodplains.

(ii) Stream beds and corridors, bluffs, ridges, steep slopes, mature trees and/or stands of native vegetation, rock outcroppings, wetlands, native upland ecosystems, riparian areas, and wildlife corridors.

(iii) Water features such as drainages, waste ditches, washes, canals, ditches, lakes, natural ponds, and retention and detention ponds.

(2) Location. The open space in each subdivision shall be located to create or enhance:

(i) Community focal points;

(ii) Passive recreational opportunities;

(iii) Active recreational opportunities;

(iv) Landscaped buffers or visual transitions between different types or intensities of land uses; and/or

(v) Opportunities to accommodate multiple compatible uses (such as providing scenic vistas, passive recreation opportunities, wildlife habitat, and the prevention of construction on natural hazard areas) rather than a single use.

(3) Integration. The open space in each subdivision shall be integrated with schools, parks, and other open spaces or public property in or near the subdivision or on neighborhood property.

(4) Public Access and Visibility.

(i) Open spaces in each subdivision should be open, accessible, and visible to all residents of the subdivision and to the public using public streets, trails, and open spaces.

(ii) If the subdivision contains or abuts a publicly owned natural area, the Director may require the subdivision plat to include such easements and rights-of-way as are necessary to allow reasonable access for the public to such natural area. Conveyance to the public requirement or dedication to the City may be credited against any park or open space

dedication or fee in lieu of such land required by the City, upon approval of the City Council.

(5) Isolated Areas Discouraged. Open space should not be located in isolated areas or corners of the subdivision, in peripheral strips along the borders of right-of-way or the subdivision, or in unconnected patterns unless the Director finds such a location would further one of the other goals described above.

(6) Natural Hazard Areas. If natural or geologic hazards exist within the property, the applicant shall either:

(i) Identify the limits of development (as defined in subsection (h)(8) of this section) on the plat and include a plat note that those areas are not available for sale nor development;

(ii) Provide a report from a geotechnical engineer licensed in Colorado designating the specific mitigation measures or engineering precautions necessary to make such areas safe for development and occupancy, and include a plat note stating that development will be subject to those mitigation measures and engineering precautions although the specific design needed as a part of a building permit may occur as a part of the building permit; or

(iii) Some combination of subsections (h)(6)(i) and (ii) of this section.

(7) Significant Natural Features. All natural features (such as corridors, bluffs, ridges, steep slopes, stands of mature trees, rock outcroppings, wetlands, native upland ecosystems, riparian areas, and wildlife corridors) and water features (such as drainages, washes, canals, ditches, lakes, natural ponds, and retention and detention ponds) within the property limits shall be identified on the plat as the limits of development (as defined in subsection (h)(8) of this section). The plat shall clearly state that such areas are not available for sale nor development.

(8) Limits of Development. Each plat shall specify the limits of development (LOD) which are any specific areas of a subdivision within which the development and construction shall be limited or prohibited so that natural hazard areas are avoided and significant natural features are preserved. LODs shall be determined based on:

(i) Mapping hazard areas and significant natural features;

(ii) Site topography, including but not limited to steepness of slopes, existing drainage features, rock outcroppings, river and stream terraces, valley walls, ridgelines, and scenic topographic features; and

(iii) The practical needs to give access to heavy equipment for the developed project and reasonable staging and operational areas.

(9) Retention and Detention Ponds. Storm drainage, retention and detention ponds shall be located, designed, maintained, planted and managed to serve as visual amenities, entryway features, or opportunities for passive recreation within the subdivision.

(Ord. 4831, 2-6-19; Ord. 4419, 4-5-10)

21.06.070 Sign regulation.

This regulation governs exterior signs on real property. The proliferation and disrepair of signs can deter the effectiveness of signs, cause dangerous conflicts with traffic control signs and signals, and contribute to visual pollution to the detriment of the general public. No sign shall be displayed in any zone district without a sign permit, except where the provisions of this section expressly provide otherwise. Signs placed by a governmental entity are exempt from this section.

(a) Definitions. As used in this section, the following terms shall have the following meanings:

Digital sign or digital display or electronic sign: A display of a sign message or picture made of internally illuminated components that display an electronic image, which may or may not include text and is capable of changing the message periodically; including but not limited to television screens, holographic displays, programmable ink, LCD, LED or plasma displays.

Illuminated sign: A sign which is illuminated by a light source. *Internal illumination* or *internally illuminated* means a sign illuminated by a light source that is concealed or contained within the sign and becomes visible in darkness through a translucent surface. *Indirect illumination* or *indirectly illuminated* means a sign that is illuminated with an artificial light located away from the sign and directed onto the sign face so that the message is visible in darkness.

Interactive sign: A sign which contains QR codes or invites the viewer, as the sign is viewed from the street or roadway, to capture an image with a camera or other device or otherwise immediately and physically interact with the sign in order to obtain a benefit, prize or discount.

This section shall mean and refer to GJMC 21.06.070, Sign regulation.

(b) Prohibited Signs. Prohibited signs are signs which:

(1) Contain an obscene statement, word, or picture describing or depicting sexual activities or sexual anatomical areas;

(2) Contain, or are an imitation of, an official traffic sign or signal or contain the words: “STOP,” “GO SLOW,” “CAUTION,” “DANGER,” “WARNING,” or similar words;

(3) Are of a size, location, movement, content, coloring or manner of illumination which may be confused with, or construed as, a traffic control device or which hide from view any traffic or street sign or signal;

(4) Contain or consist of portable signs, tent signs, or strings of light bulbs not permanently mounted on a rigid background, except that one portable sign per business will be allowed next to the building in shopping areas where pedestrians circulate, so long as such portable sign is not placed in a parking lot or in any median, does not visually or physically obstruct vehicular or pedestrian circulation, and does not exceed 12 square feet in size and three feet in width;

(5) Are erected after adoption of this code and do not comply with the provisions of this regulation;

(6) Do not comply with the laws, rules and regulations of the State of Colorado as now or hereafter enacted and/or amended. See § 43-1-401, C.R.S. et seq.;

(7) Create a hazard for, or impede safe or efficient movement of, motorists or pedestrians;

(8) Are placed in whole or in part in, on or over any part of a public right-of-way, except where the sign is placed by a governmental entity. The Director has the authority to remove and dispose of any sign placed in or on or protruding into, onto or over any part of a public right-of-way without compensation to any person or entity; or

(9) Are interactive signs that are readable with normal vision from the public right-of-way. Interactive signs readable from the public right-of-way are prohibited because they distract drivers and pedestrians so as to constitute a significant safety risk.

(c) Signs That Do Not Require a Permit. The following signs are allowed on a lot/parcel in any zone district:

(1) One sign that is integral to or flush-mounted on a building or structure that is no greater than four square feet in area.

(2) A sign that is not illuminated, not digital or electronic, and not permanent in nature; for example, one that is planted into the ground or affixed to an object or structure by temporary means, does not have a foundation, is made of lightweight and thin materials such as a single sheet of plastic, thin metal, plywood or paper, except for wind driven signs and banners which are regulated separately in subsection (d) of this section, and except for prohibited signs discussed in subsection (b) this section, with the following limitation:

(i) On a parcel of less than one acre, up to six such signs are allowed, so long as each sign is not greater than six square feet in area, except in that one of these signs may be up to 32 square feet in area when construction is occurring on a parcel or a subdivision of land is being developed.

(ii) On a parcel of one acre or larger, up to six such signs per acre are allowed, so long as each sign is not greater than six square feet in area, except that one sign per acre can be up to 32 square feet in area.

(d) Wind Driven Signs and Banners.

(1) A banner permit shall be required prior to any use of wind driven signs or banners.

(2) Banners and wind driven signs may be displayed for a up to 30 consecutive days up to four times in a 12-month calendar year. Permit periods may run consecutively.

(3) All banners must be secured directly to the structure, fence, or post that is permanently affixed to the ground.

(4) All wind driven signs must be professionally made, must be in good repair and appearance, and must also be so located and installed so as not to pose a safety hazard for motorists or pedestrians. Such signs shall not be attached to any object located in the public right-of-way.

(5) In addition to other available penalties, failure to comply with the terms of a permit issued under this section shall result in the loss of a permit.

(e) Nonconforming Signs.

(1) All signage on site shall be brought into conformance with this code prior to approval of any new sign permit on the property.

(2) Any nonconforming sign that has been damaged in excess of 50 percent of its replacement cost by fire, wind or other cause except vandalism shall not be restored without conformance with the provisions of this regulation.

(3) Sign face changes are allowed without a permit, including converting from static display to digital/electronic display, if no other changes are made to the sign size, height or structure. Digital and electronic signs must comply with regulations governing such.

(f) Digital or Electronic Sign Standards.

(1) Purpose and Intent. Advancements in technology permit signs to change copy electronically, utilizing LED, LCD and other technologies. The impacts of these may disrupt the peace and quiet enjoyment of other properties in the area and create traffic hazards. Limitations on brightness is necessary in order to mitigate these impacts, protect public health and safety, and preserve the character of areas, especially residential neighborhoods.

(2) The maximum brightness levels for signs shall not exceed 0.3 (three tenths) footcandles over ambient light levels. Measurements of light are based on the area of the sign versus measure-

ment of the distance. Using a footcandle meter, brightness shall be in conformance with the following distance table:

AREA OF SIGN (sq. ft.)	MEASUREMENT DISTANCE (ft. from sign)
0 – 10	30
10 – 24	45
25 – 49	55
50 – 99	90
100 – 149	110
150 – 199	135
200 – 300	150

The measurement shall be conducted at least 30 minutes after sunset or 30 minutes before sunrise. Certification must be provided to the City upon installation that the sign has been preset to automatically adjust the brightness to these levels or lower. Re-inspection and recalibration may be periodically required by the City at the permitee's expense, to ensure that the specified brightness levels are maintained at all times.

(3) Interactive signs are prohibited.

(4) All new electronic display signs shall have photocell technology that will be used to dim the displays for appropriate nighttime viewing from dusk to dawn or when ambient light conditions warrant such changes.

(g) General Requirements.

(1) The following requirements shall apply to all signs in all zones unless otherwise indicated:

(i) A permit is required for placement or display of any new sign, except where otherwise stated or where specifically exempted by the provisions of this section.

(ii) Touching up, repainting or changing existing letters, text, symbols, graphics, or other content is considered maintenance and repair and does not require a permit.

(iii) Only a licensed sign contractor can obtain a sign permit.

(iv) All signs shall be permanent in nature except for those nonpermanent signs allowed under subsection (c) of this section.

(v) All exterior signs shall be engineered to withstand a minimum wind load of 30 pounds per square foot.

(vi) No sign shall be placed on any curb, sidewalk, post, pole, hydrant, bridge, tree or other surface located on public property including the posting of handbills except as expressly authorized by this section.

(vii) Regardless of sign allowances by zone district, no single sign shall exceed 300 square feet in area.

(2) The following shall apply to the measurement of signs:

(i) The total surface area of one sign face of freestanding signs and projecting wall signs shall be counted as part of the maximum total surface area allowance. Sign enhancement features such as bases, pillars, and other decorative elements as part of monument signs shall not be counted as part of the maximum square footage of the sign, provided such features do not exceed the size of the sign face.

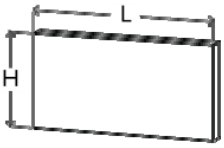
(ii) The total surface area of all sign faces of roof signs shall be counted as part of the maximum total surface area allowance.

(iii) For measurement of different shapes of signs, see the graphics below.

(iv) The total surface area of three-dimensional figures shall be counted as part of the maximum sign allowance.

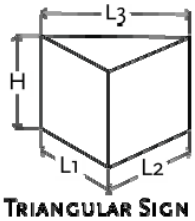
(v) The area of flush wall signs with backing or a background that is part of the overall sign display or when backed by a surface which is architecturally a part of the building shall be measured by determining the sum of the area of each square, rectangle, triangle, portion of a circle or any combination thereof which creates the smallest single continuous perimeter enclosing the extreme limits of each word, written representation (including any series of letters), logo or figure including all frames, face plates, nonstructural trim or other component parts not otherwise used for support.

(vi) The area of a facade sign shall be determined to be the sum of the area of each of the smallest perimeter enclosing the limits of each work and written or graphic representation, including letter, number, character, and/or logo used for advertising, offering or merchandising a product, or for service identification. The area of a mural painted on a wall shall not be included in the sign area calculation.



DOUBLEFACE SIGN
H x L

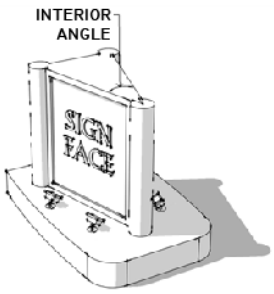
Blade Sign



TRIANGULAR SIGN
[(HxL1)+(HxL2)+(HxL3)]/2

Double Face Sign

(vii) Only one display face is measured if the sign faces are parallel or form an interior angle of less than or equal to 60 degrees; provided, that the signs are mounted on the same structure. If the faces are of unequal area, then sign area is equal to the area of the larger face.



(3) No illumination of a sign is permitted unless the following criteria are met:

(i) The light from any illuminated sign shall be so shaded, shielded and directed that the light intensity or brightness shall not be objectionable to surrounding areas.

(ii) Neither the direct or reflected light from a light source shall create a traffic hazard to operators of motor vehicles on public thoroughfares or approaches to public thoroughfares.

(iii) No exposed reflective type bulb or incandescent lamp, which exceeds 40 watts, shall be used on the exterior surface of a sign to expose the face of the bulb, light or lamp to any public street or adjacent property.

(iv) Electrical service provided to illuminated signs may require an electrical permit from the Building Department.

(4) Identification and Marking. Each sign requiring a permit shall bear an identification plate stating the following information:

(i) Date the sign was erected; and

(ii) Name of person, firm or entity responsible for its construction and erection.

(5) Sign(s) placed in connection with a temporary use that requires a temporary use permit shall conform to the requirements, conditions and terms of the temporary use permit.

(h) Sign Standards by Zone. The following restrictions and requirements apply to permanent signs in the given zone districts. Regardless of the zone district, property containing a nonresidential use that abuts an arterial street may be permitted to have one monument style sign on one such frontage that meets the requirements of subsection (h)(3) of this section (business, commercial and industrial zones).

(1) Residential Zones.

(i) One permanent sign per residential lot not exceeding six square feet in area is allowed, subject to the standards below.

(ii) One permanent monument sign up to 32 square feet in area is allowed at a multifamily apartment/condominium building/complex and on each common area parcel that abuts a public right-of-way; for purposes of this subsection, "common area parcel" means a parcel that is owned by a homeowners' association for the benefit of all lot owners in a planned community, common interest community or condominium.

(iii) For a nonresidential use in a residential zone, one sign not to exceed 24 square feet in area is allowed per street frontage.

(iv) Location. Permitted signs may be anywhere on the property. If freestanding, the top shall not be over eight feet above the ground. If building-mounted, the sign shall be flush-mounted and shall not be mounted on a roof of the building or project above the roof line.

(v) Illumination. Indirect or internal illumination only shall be utilized for letter faces and/or logos.

(2) Residential Office Zone.

(i) General. The residential office zone provides a transition from residential to commercial development and consequently requires more restrictive sign regulations to maintain compatibility.

(ii) Types Allowed. Flush wall signs and monument signs shall be the only sign types allowed.

(iii) Location and Size. Signs shall be located at least 10 feet behind the front property line. Total sign area shall not exceed 25 square feet per street frontage. The sign allowance for one street frontage may be transferred to a side of a building that has no street frontage, but cannot be transferred to another street frontage. Monument signs shall not exceed eight feet in height.

(iv) Illumination. Signs may be externally illuminated; no other illumination of signs is allowed. All lights used for illumination of signs shall be arranged so as to confine direct light beams to the lighted sign and away from adjacent residential properties and out of the direct vision of motorists passing on adjacent streets. Illumination of signs shall comply with GJMC 21.06.080, Outdoor lighting, and shall be limited to authorized business hours.

(v) Sign Area. The area of flush wall signs and monument signs shall be calculated as per the graphics shown under subsection (g)(2) of this section.

(3) Business, Commercial, Industrial Zones (B-1, B-2, C-1, C-2, I-O, BP, M-U, I-1, I-2, and AE (Formerly PAD)).

(i) General. This subsection shall apply to all zones designated in Chapter 21.03 GJMC as business, commercial, industrial or any variety of these types.

(ii) Types Allowed. Signs in the business, commercial, and industrial zones may include facade signs, flush wall signs, freestanding signs, projecting signs and roof signs. All signs allowed in residential zones are also allowed in business, commercial or industrial zones.

(iii) Location and Size. Permitted signs may be anywhere on the premises except as specifically restricted in this subsection (see specific sign type and pertinent zoning regulation). The total amount of signage to be allowed on any property shall not exceed the sign allowance as calculated in accordance with subsection (h)(3)(v)(B) or (h)(3)(vii)(B) of this section, whichever is greater. No single sign may be larger than 300 square feet. No projecting sign may exceed the allowances in subsection (h)(3)(vi) of this section.

(iv) Illumination. Unless specifically prohibited, all of the following signs may be illuminated within the limits allowed under subsection (g)(3) of this section and GJMC 21.06.080:

(v) Facade Signs, Flush Wall Signs and Roof Signs.

(A) The sign allowance shall be calculated on the basis of the area of the one building facade that is most nearly parallel to the street that it faces. Each building facade which faces a dedicated public street shall have its own separate and distinct sign allowance. The sign allowance for facade signs and flush wall signs on buildings located on interior lots (lots not on a corner) which are oriented perpendicular to the street shall be based on the longer building facade. The total sign allowance, or any percentage thereof, of one frontage may be transferred to a building facade that has no frontage on a dedicated public street, provided the transferred amount does not exceed two square feet of sign area per linear foot of the facade on which it is being placed.

(B) Two square feet of sign area shall be allowed for each linear foot of building facade for facade signs, flush wall signs and roof signs. The measurement of a roof sign shall be based on the square footage of each sign face. Flush wall signs may extend up to 12 inches from the face of the building if the base of the sign is at least eight feet above ground level. (Show window signs in a window display of merchandise when incorporated with such display will not be considered part of the total sign allowance.)

(C) On any building which allows facade signs, flush wall signs, roof signs, or projecting signs, a maximum of two of these types may be used. If a flush wall sign and roof sign are used, the sign allowance of two square feet per linear foot of building may be divided between the two types of signs. If either a flush wall sign or roof sign and a projecting sign are used, the allowance for the projecting sign shall be subtracted from the flush wall sign or roof sign allowance.

(D) Roof signs shall be manufactured such that no guy wires, braces, or secondary supports shall be visible. Maximum height for roof signs shall be such that height of the structure and the sign together do not exceed the maximum height for the zone district.

(E) One sign that is flush-mounted on the rear facade of a structure that is no more than 16 square feet in area is allowed, which sign does not count toward the total sign allowance for the parcel or building (if there is more than one such sign, the other(s) shall count toward the total sign allowance).

(vi) Projecting Signs. Signs may project up to 72 inches from the face of the building if located eight feet or more above grade. They shall not project beyond the back of curb, nor within two feet of the edge of the roadway if there is no curb. Total area per sign face shall not exceed one-half square foot per linear foot of building facade. If the projecting sign is the only sign mounted on the building, the minimum sign allowance shall be 12 square feet.

(vii) Freestanding Signs. Freestanding signs shall comply with the following requirements:

(A) No more than one freestanding sign shall be permitted for any parcel for each street frontage. The sign allowance per frontage can only be used on that frontage and shall not be transferred to any other frontage, except where otherwise provided.

(B) Maximum sign allowance shall be calculated by the linear front foot of property on a public street right-of-way in conformance with the following:

a. Two traffic lanes: Maximum area of sign per face per front foot of property, three-quarters square foot; maximum height, 25 feet.

b. Four or more traffic lanes: Maximum area of sign per face per front foot of property, one and one-half square feet; maximum height, 40 feet.

(C) Signs may be installed at street right-of-way line. The sign face may project up to 72 inches into the right-of-way, if located 14 feet or more above grade, but shall not project closer than 24 inches to the back of the curb. If the existing street right-of-way width is less than that required in this code, the distance shall be measured from the line of such right-of-way as required by this code rather than from the existing right-of-way line. Ute and Pitkin Avenues shall be calculated using four lanes.

(D) On a corner lot, a freestanding sign shall not be placed within the sight distance triangle, as defined in TEDS (GJMC Title 29), unless free air space is maintained as provided in TEDS (GJMC Title 29). A single pipe support with no sign structure or copy shall not be considered a violation of the free air space requirement.

(E) In addition to freestanding signs as allowed above, up to two additional freestanding signs per street frontage, not greater than three square feet in area and no more than 30 inches in height, are allowed.

(F) When electrical service is provided to freestanding signs, all such electrical service shall be underground.

(G) All freestanding signs shall require a building permit in addition to a sign clearance.

(viii) Flush wall or freestanding sign(s) with text so small as to not be readable with normal eyesight from a public right-of-way are allowed, so long as such sign does not exceed 32 square feet in area. Such signs shall not count toward the total sign allowance or the maximum freestanding sign allowance.

(4) Outdoor advertising signs erected on ground or wall locations (and roof locations done within the regulations and limitations of roof signs) shall only be permitted in the C-2 (general commercial) and I-1 and I-2 (industrial) zones, subject to the following conditions, limitations and restrictions:

(i) Height Limitations. No outdoor advertising sign shall be erected higher than 40 feet above the level of the street or road upon which the sign faces, or above the adjoining ground level if such ground level is above the street or road level. No outdoor advertising sign shall have a surface or face area exceeding 300 square feet in area or containing less than 15 square feet in area.

(ii) Distance. For each square foot of surface or facing of the sign, two feet of space from adjacent outdoor advertising signs shall be maintained. Such distances shall be determined by using the largest sign as criterion. For example, no sign can be erected closer than 600 feet to an existing 300-square-foot sign. A maximum of one outdoor advertising sign shall be allowed per lot or parcel of land.

(iii) Location. A sketch, drawn to scale, depicting the size and location of the proposed billboard shall be provided. The sketch shall be prepared by a licensed surveyor and shall indicate dimensions from the proposed billboard to the closest adjacent aliquot section line and shall include coordinates. The sketch shall also include the location of the proposed billboard to the nearest adjacent right-of-way line, if applicable. The sketch shall be signed and sealed by the surveyor.

(iv) Outdoor advertising signs shall not be located within 600 feet from the centerline of the Riverside Parkway as depicted in Figure A.

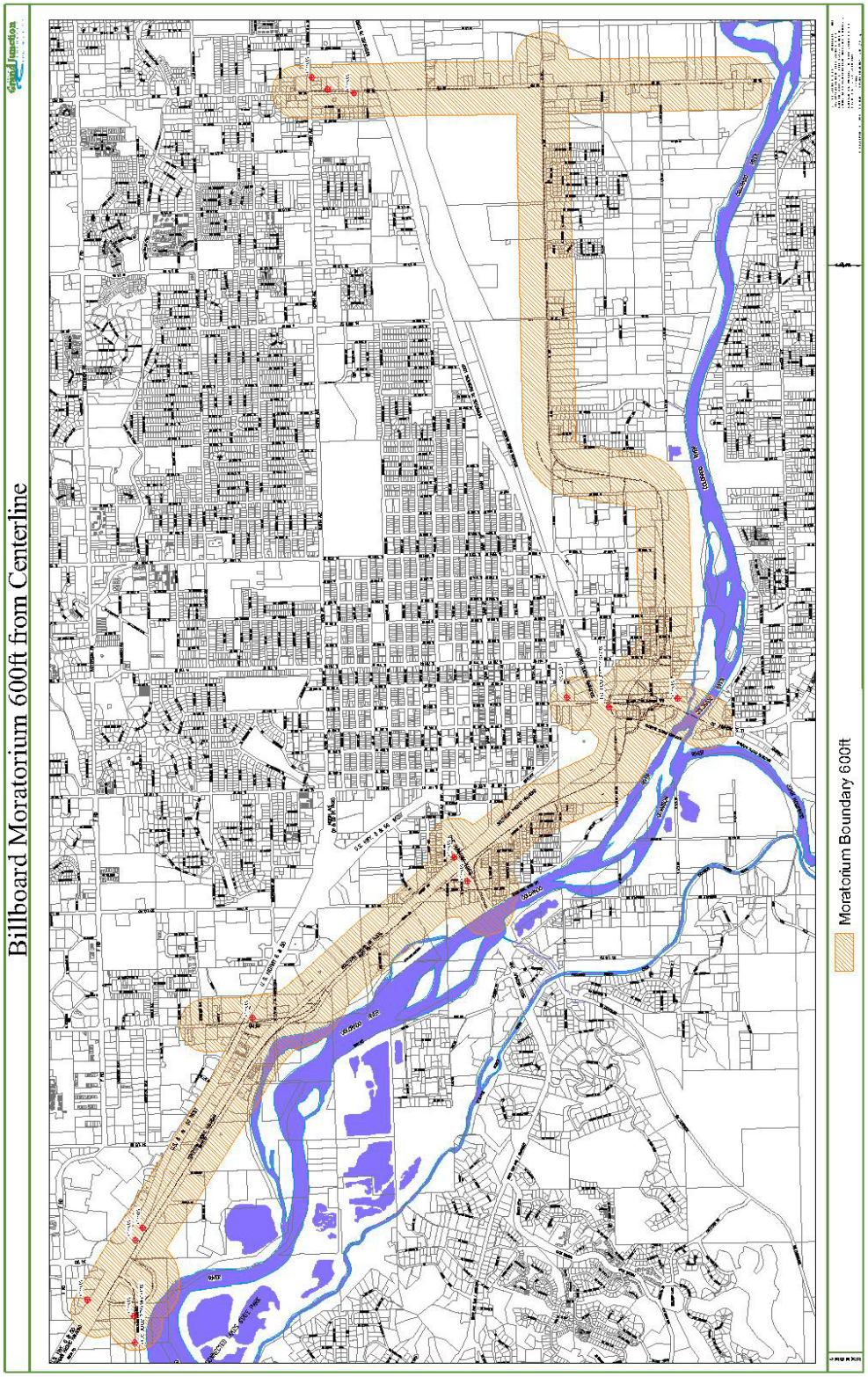

Billboard Moratorium 600ft from Centerline
Moratorium Boundary 600ft

Figure A

(v) Illumination. Outdoor advertising signs that are illuminated by indirect or external illumination shall use only downward facing, downcast light to confine direct light beams to the sign and out of the direct vision.

(vi) Prohibited signs are signs that do not comply with the laws, rules and regulations of the State of Colorado as now or hereafter enacted or amended. See § 43-1-401, C.R.S. et seq.

(5) CSR. Signage on a property zoned CSR shall be limited to signage allowed in the surrounding zone districts.

(6) Form Districts. Signage shall conform to subsection (h)(3) of this section except that all freestanding signs shall be monument style signs with a maximum height of 15 feet.

(7) Planned Developments. No sign other than those permitted in any zone district in subsection (c) of this section (Signs That Do Not Require a Permit) shall be allowed on properties in a planned development zone unless the sign has been approved as part of the development plan. Variance of the maximum total surface area of signs shall not be permitted, but the maximum sign allowance for the entire development or use may be aggregated and the total allowance redistributed.

(8) Sign Packages. A site or sites that consist of more than one developed parcel of land that are abutting and function as one through the sharing of vehicular access through, across, over, entrance onto, and/or exit from the site and/or parking (such as a shopping center) may be considered for a sign package through a sign package permit. Variance of the maximum total sign allowance shall not be permitted, but the maximum sign allowance for the entire site or sites may be aggregated and the total allowance redistributed for the same type of sign. For example, freestanding sign allowance may be redistributed among freestanding signs, but a freestanding sign allowance may not be redistributed for a facade sign. See GJMC 21.02.070(n).

(i) Removal and Disposition of Signs.

(1) Maintenance and Repair.

(i) No person shall allow, on any premises owned or controlled by him, any sign that is in a dangerous or defective condition.

(ii) The Director shall require the owner of the sign and/or the owner of the premises upon which it is located to remove or repair any such sign. In cases of immediate danger to the public due to the defective nature of a sign, the Director may have the sign removed and assess the costs of the removal against the property. Such assessment shall constitute a first and prior lien on the property, equivalent to ad valorem taxes, and shall be collected in the same manner as the real estate taxes on the property.

(iii) All signs shall be safe and maintained in good appearance as well as safety including the replacement of defective parts, painting, repainting, cleaning and other acts required for proper maintenance. Failure to properly maintain a sign shall be a violation of this code.

(2) Abandoned Signs. Signs are allowed on otherwise vacant property so long as a permit is obtained (unless a permit is otherwise expressly not required) and so long as the sign allowance for the zone district is adhered to. However, a sign structure that has no content or is "blank" and has fallen into disrepair and which is located on property which is unoccupied for a period of 12 consecutive months or more shall be deemed abandoned.

An abandoned sign is prohibited; the owner of the sign or the owner of the premises shall remove the sign and supporting structure. An abandoned sign which is not removed in a timely manner may be removed by the Director under the provisions of this section.

(Ord. 4831, 2-6-19; Ord. 4745, 4-19-17; Ord. 4741, 3-15-17; Ord. 4737, 2-1-17; Ord. 4691, 2-17-16; amended during 2010 codification; Ord. 4420, 4-5-10; Ord. 4419, 4-5-10)

21.06.080 Outdoor lighting.

(a) Purpose.

(1) To minimize light pollution, light trespass and glare;

(2) To conserve energy and resources;

(3) To provide safe roadways for motorists, cyclists and pedestrians;

(4) To ensure sufficient lighting can be provided where needed to promote safety and security; and

(5) To protect and reclaim the ability to view the night sky.

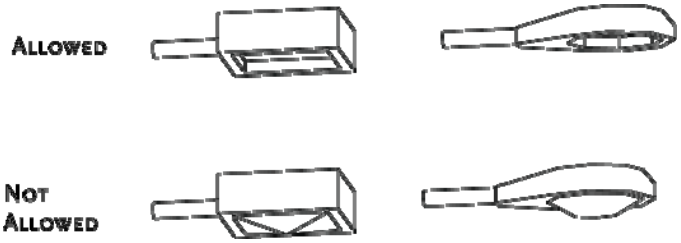
(b) Applicability. All new land uses, structures or building additions shall meet the requirements of this section for the entire property.

(c) Outdoor Lighting Standards. All outside light sources shall conform to the standards set forth below.

(1) Floodlights shall not be used to light all or any portion of any building facade between the hours of 10:00 p.m. and 6:00 a.m.

(2) No outdoor lights shall be mounted more than 35 feet above the ground unless as a part of an approved outdoor recreational facility.

(3) All outdoor lights mounted on poles, buildings or trees that are lit between the hours of 10:00 p.m. and 6:00 a.m. shall use full cutoff light fixtures (see graphic).



(4) All lights used for illumination of signs, parking areas, security or for any other purpose shall be arranged so as to confine direct light beams to the lighted property and away from adjacent residential properties and out of the direct vision of motorists passing on adjacent streets.

(5) Outdoor lighting for commercial areas is encouraged to be turned off after business hours. Lights on a timer are encouraged.

(6) Sensor activated lights are encouraged to replace existing lighting necessary for security purposes.

(7) Canopy lights, such as service station lighting, shall be fully recessed or fully shielded so as to ensure that no light source is visible from or causes glare on public rights-of-way or adjacent properties. Canopy lighting shall have a maximum of 30 foot-candles, with a light loss factor of 1.0. Light loss factor (LLF) is a correction factor used to account for the difference between laboratory test results and real world degradation of the lighting system aging over time resulting in reduced lumen output.

(8) The operation of searchlights for advertising purposes is prohibited.

(9) The installation of sodium vapor fixtures that are not color corrected or mercury vapor fixtures is prohibited.

(d) Parking Lot Lighting.

(1) Adequate lighting shall be provided for all parking facilities used at night. Lighting sources shall not be directly visible from adjacent roadways or residential uses and shall not interfere with the safe operation of vehicles moving on or near the site. Parking area lighting shall,

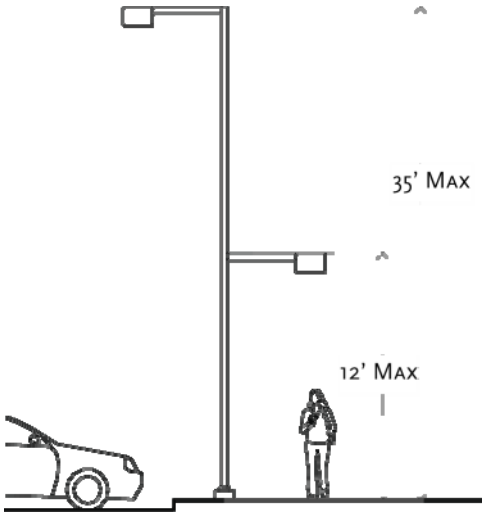
where possible, be located in landscaped areas. Parking facility lighting shall not exceed an average of three footcandles and a maximum of 10 footcandles.

(2) The minimum required lighting intensity to be provided in all parking areas is 0.6 footcandle. High activity areas such as near building entrances and pedestrian corridors shall be provided with a greater lighting intensity.

(3) The maximum height of required lighting is 35 feet, measured from the parking surface to the top of the lighting standard. Lighting located near buildings and adjacent to sidewalks shall not exceed 12 feet in height.

(4) A lighting plan shall be submitted for all parking lots that contain 30 spaces or more. The lighting plan shall detail the location and specifications of all lighting to be provided on site. An ISO footcandle diagram shall also be provided to indicate the level and extent of proposed lighting.

(5) Where nonresidential or multifamily parking lots abut a residential zone or use, the Director may require a lighting plan for lots that contain fewer than 30 parking spaces.



(Ord. 4648, 12-3-14; Ord. 4419, 4-5-10)

21.06.090 Site circulation.

On-site circulation shall be given the same attention as is given to the design of public street systems. Poor site design and circulation is detrimental to both the public investment in the street system and the private investment in the property. Access locations, building location, site circulation, and parking are highly interrelated as each one has a dramatic effect on the others. The design of the on-site circulation system shall be an integral part of the overall site and access design process.

(a) On-Site Roads. On-site vehicular circulation shall occur completely within the limits of the developed property. On-site roads shall be designed with geometric features such as curves, grades, sight distance, turning radii, design vehicle characteristics, drainage, and vehicle storage to the same standards as public streets.

(b) Parking. Parking facilities shall provide internal vehicular circulation and storage. The use of raised landscaped planting strips in large parking areas is required in this code. All fixed objects within the parking area shall be highly visible by using the appropriate lighting and/or landscaping features.

(1) Parking Stall and Aisle Design.

(i) Parking stalls shall be located outside the sight zone at access locations. All parking stalls shall be oriented such that any vehicle exiting a parking stall is not required to back into any public street. Wheel or bumper blocks shall be provided, located, and arranged so that no part of any parked vehicle extends beyond the boundaries of the parking area and to ensure that the vehicle overhang does not obstruct sidewalks or other pedestrian walking areas.

(ii) Parking stalls may be oriented at zero, 30, 45, 60, 75 or 90 degrees to the parking aisle. Both stall and aisle dimensions and layout will vary depending on the stall orientation. The use of parking stalls oriented 90 degrees to the building face with two-way aisles is

generally preferred as this permits the most direct route between the parking stall and the building and minimizes auto/pedestrian conflicts adjacent to buildings.

(iii) Where larger vehicles may be frequent users of the parking facilities, it is appropriate to increase the parking stall dimensions according to the dimensions and turning characteristics of the vehicle.

(iv) Parking aisles shall be designed to accommodate the turning characteristics of the vehicles that will most commonly use the parking facilities. Dead-end parking aisles are prohibited without provision of an adequate turn around. Aisles should not exceed 300 to 350 feet in length without a break in circulation.

Parking Stall Dimensions and Layout

Parking Angle	A	B	C
	Stall Width in Feet	Stall Length in Feet	Aisle Width in Feet
0	22.0 22.0 22.0	9.0 9.5 10.0	12.0 12.0 12.0
30	9.0 9.5 10.0	18.0 18.0 20.0	11.0 11.0 11.0
45	8.5 9.0 9.5	21.0 21.0 21.0	13.0 12.0 11.0
60	8.5 9.0 9.5	21.1 21.0 21.0	18.0 16.0 15.0
75	8.5 9.0 9.5	19.5 19.5 19.5	25.0 23.0 22.0
90	8.5 9.0 9.5	18.5 18.5 18.5	28.0 25.0 24.0

(2) Accessible Parking for Physically Handicapped Persons.

(i) A portion of the required off-street parking spaces shall be specifically designated, located and reserved for use by persons with physical disabilities in accordance with Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities.

(ii) Requirements for accessible parking spaces for physically handicapped persons are detailed in the City Standard Street Details and are also in the Federal Register found at http://www.accessboard.gov/.

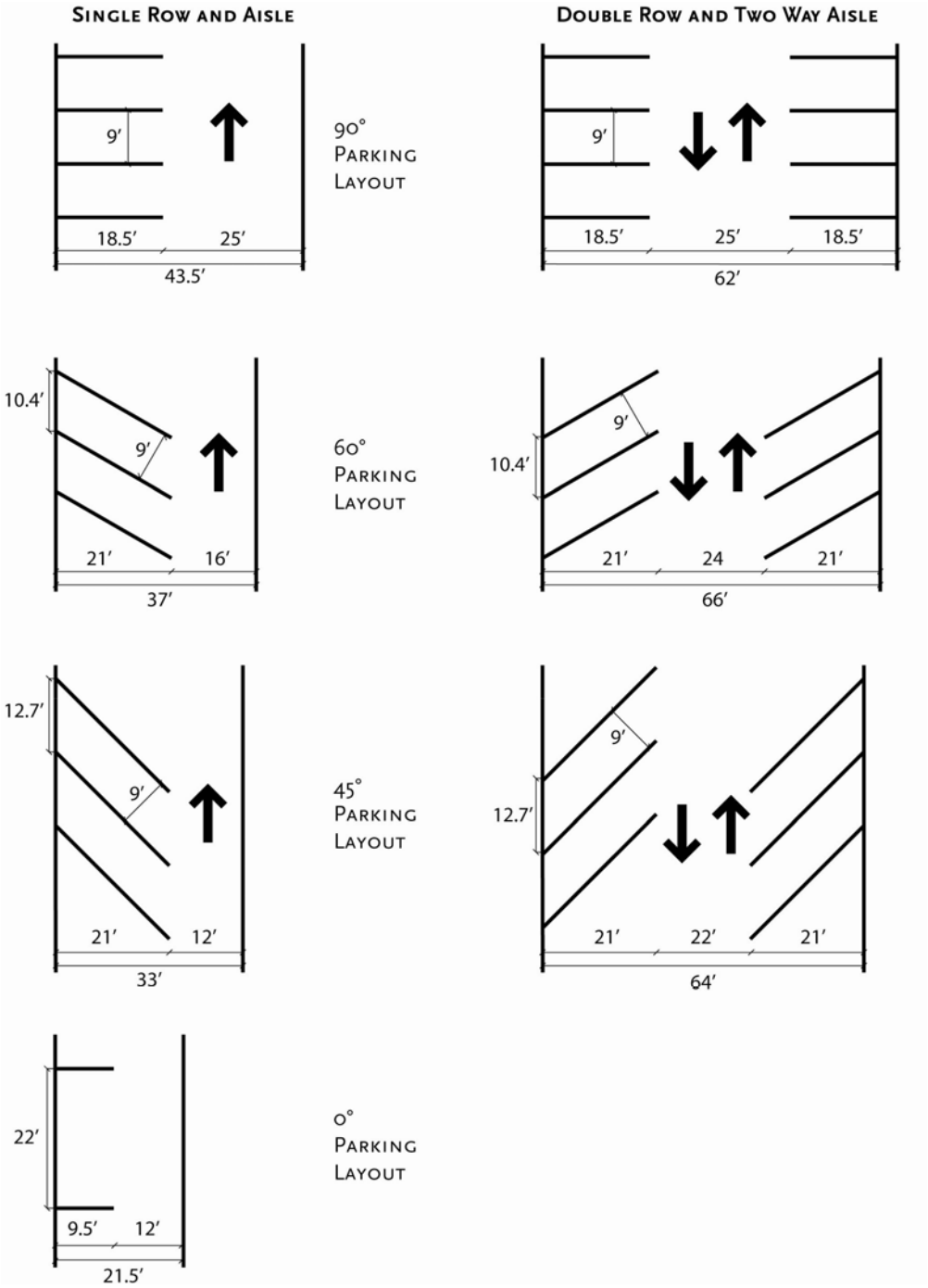
(iii) The additional width required for an accessible parking space may be created by reducing the width of an adjacent sidewalk area, provided the clear portion of the sidewalk width is not reduced below five feet, when providing accessible parking spaces in public right-of-way.

(iv) The required parking spaces are detailed in the table below:

Total Spaces in Lot	**Required Accessible Spaces**
1 to 25	1
26 to 50	2
51 to 75	3
76 to 100	4
101 to 150	5
151 to 200	6
201 to 300	7
301 to 400	8
401 to 500	9
501 to 1,000	2% of Total
1,001 and over	20 + 1 for each 100 over 1,000

(3) Maximum Allowable Grades in Parking Lots. Maximum grades allowed in parking lots shall be eight percent.

Typical Parking Layouts
(Alternate dimensions may be approved by Director)



(Ord. 4419, 4-5-10)

21.06.100 Private streets, shared driveways and loop lanes.

Private streets may be considered as an alternative to residential public streets without a specific design exception if the standards in this section are met. Private streets have historically posed problems over time as they deteriorate and property owners do not realize the burden of maintenance is theirs. Applica-

tion of the criteria established in this section should avoid problems encountered in the past with private streets and provide property owners some protection through a maintenance agreement and funding. The shared driveway (also called an "autocourt") is a private street. The loop lane is intended as an alternative public street.

(a) Private Streets. The developer must conclusively demonstrate that a proposed private street:

(1) Provides flexibility in residential street access due to design or topographic conditions; and

(2) Encourages more creative design including but not necessarily limited to the clustering of units in residential development; and

(3) Provides an immediate and continuing public benefit, e.g., by reducing public street maintenance costs; and

(4) Provides a safe residential environment; and

(5) Promotes attractive streetscapes that give neighborhoods character and identity, e.g., by allowing alternative street surfaces, finishes and designs.

(b) Then private residential streets shall be allowed for residential development under the following conditions:

(1) The maximum annual average daily traffic (AADT) of the proposed private street shall not exceed 250 trips per day as determined by the ITE – Trip Generation publication.

(2) All traffic, including vehicular and pedestrian, exiting from private streets shall not adversely impact the existing and proposed transportation network. Pedestrian connections accessible by the general public shall be required within the proposed development. Pedestrian facilities shown on the Grand Junction Circulation Plan shall be provided by the developer.

(3) A turnaround (i.e., cul-de-sac or other applicable and acceptable improvement) shall be required per the City's or County's adopted street standard in effect at the time of the development. A "Y" or "T" turnaround may be acceptable if designed according to Fire Department access requirements.

(4) Street cross sections shall conform to the adopted street standards. Streets with a minimum 20-foot-wide pavement section may be allowed, if on-street parking is prohibited and adequate off-street parking is provided. Streets with no on-street parking shall be signed in accordance with the MUTCD. The developer shall execute and record an irrevocable covenant running with the land granting the City or County the right and power to enter the street for the purpose of enforcing the parking restriction.

(5) If off-street parking is utilized, it shall conform to the following:

(i) It shall be provided at a rate of one space per two units plus at least four on-site parking spaces per dwelling. Two of these spaces may be in a garage or carport.

(ii) Off-street parking shall be located within 200 feet of any unit the private street serves.

(iii) Off-street parking shall be included within the same tract as the private street and shall be maintained by the homeowners' association.

(6) The finished surface of the private street may be composed of variable surfaces such as brick, interlocking pavers, cobblestones or other similar finishes, designed by a professional engineer and as approved by the City or County Engineer.

(7) Any and all private streets shall include concrete curb and gutter constructed to the City Standard Details.

(8) A pedestrian trail system may be substituted for an attached sidewalk if adjacent properties could easily access the trail and the trail system links to other transportation and recreational trails or facilities within and outside of the immediate development. Trail width shall be no

less than equal to the standard for a two-way off-street bicycle path and shall be designed to the City Standard Details.

(9) All entrances to garages shall be set back from the private street or pedestrian trail a minimum distance of 20 feet.

(10) Utility and/or multipurpose easements may be required for a portion of, or the full width adjacent to, the street section when necessary.

(11) Private streets shall be platted in a tract dedicated to the homeowners' association.

(12) A single homeowners' association for all phases of the development shall be formed and established with the Secretary of State's Office prior to the recordation of a final plat that contains a private street.

(13) The homeowners' association shall establish an annual maintenance fund for the private street in accordance with the attached document titled "Maintenance Agreement." The agreement shall be recorded by the petitioner, with review and approval by the Public Works Department, prior to the recordation of the final plat.

(14) The homeowners' association shall be responsible to maintain a vegetation-free zone along the private street that is 20 feet in width (10 feet each side from the center of the street) and 13 feet, six inches in height as measured from the paved surface of the street.

(15) Each residential structure accessed from a private street shall have landscaped areas of at least 10 feet in width between the street and the structure except for the driveway to the garage.

(16) An entrance design feature such as decorative paving, special signage or other conspicuous improvement shall be incorporated into the final design of the private street such that the design clearly distinguishes the private street from the public street.

(c) Shared Driveway Standards. The shared driveway or autocourt is designed to provide access to lots where a full public street is not practical or economical. The number of shared driveways used in a subdivision is limited due to the undesirable lot layouts they often create, potential conflicts over shared common space, and private versus public maintenance cost issues. Shared driveways shall comply with the following standards.

(1) A shared driveway shall be owned and maintained by the owners of the parcels or lots that abut the shared driveway. The shared driveway shall be platted in a tract dedicated to the property owners of the parcels that abut the shared driveway.

(2) Not more than five single-family lots shall abut or touch any portion of the shared driveway and no more than five single-family units may access a shared driveway.

(3) Shared driveways shall be a minimum of 16 feet wide flowline to flowline and a maximum of 150 feet long.

(4) Parking on a shared driveway shall be prohibited.

(5) A shared driveway may be used only where it intersects a street with on-street parking.

(6) Each lot abutting a shared driveway shall provide four on-site parking spaces. For homes on shared driveways that access a cul-de-sac, five on-site parking spaces shall be provided. These additional spaces may be provided on the shared driveway if it is widened to accommodate such parking.

(7) Each lot abutting a shared driveway shall access off of the shared driveway unless approved otherwise at the time of subdivision.

(8) Shared driveways shall be designed to permit the ASHTO "P" design vehicle to back out of an individual driveway and turn 90 degrees in either direction on the shared driveway without any portion of the vehicle:

(i) Leaving the individual driveway from which the vehicle is exiting or the shared driveway; or

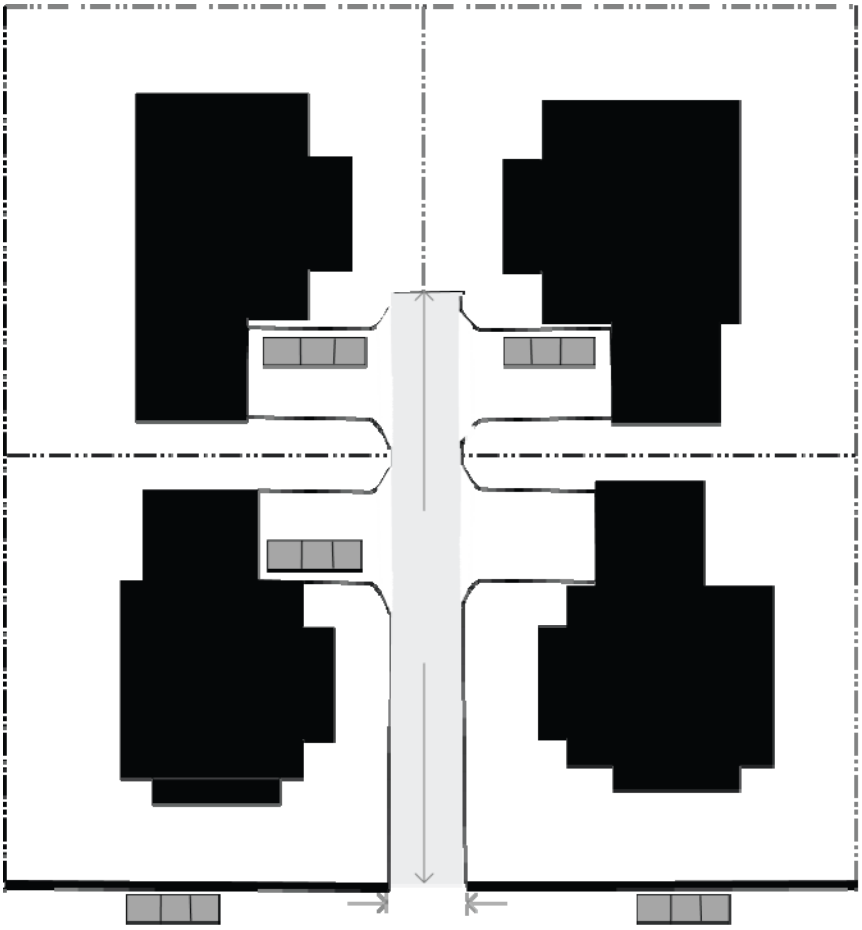
(ii) Entering on or over the individual driveways of any other residence.

(9) The building setback adjacent to a shared driveway shall be the minimum setback required for that side of the property by the underlying zoning district or 15 feet, whichever is greater. All entrances to garages shall be set back a minimum distance of 20 feet from the shared driveway.

(10) No fences or hedging taller than 30 inches shall be located within the setback adjacent to the shared driveway. Open fences are acceptable.

(11) No gateways, locked entries or other restrictive access constraints are allowed across a shared driveway.

(12) Finished surface may be composed of variable hard surfaces such as brick, interlocking pavers, cobblestones or similar finishes, designed by a professional engineer and as approved by the City or County Engineer.



SHARED DRIVEWAYS

(d) Loop Lane Standards. A loop lane is an alternate street design that provides a turnaround in place of a cul-de-sac. The loop lane is desirable because it allows for additional open space/park area instead of an expanse of asphalt paving found in a standard cul-de-sac. Loop lanes shall comply with the following standards. Any variation from these specifications shall require a design exception as described in Chapter 29.64 GJMC, Design Exceptions.

(1) A maximum of seven homes may access off the loop.

(2) The minimum loop lane is 16 feet from flowline to flowline and shall consist of a paved surface with roll-over curb and gutter on at least one side and a roll-over curb or vertical curb on the other side.

(3) No curve on any portion of the flowline of the loop lane shall have an inside radius of less than 33 feet and an outside radius of less than 48 feet.

(4) No portion of the loop lane shall extend more than 250 feet from the abutting street right-of-way.

(5) A minimum separation of 66 feet is required between the right-of-way on each side of the loop.

(6) Four guest-parking spaces, located in the public right-of-way, are required at the end of the loop. The parking area is reserved for guest parking and shall not be used for the parking of residents' vehicles and/or recreation vehicles for more than a 24-hour period.

(7) The loop lane and parking shall be dedicated to and maintained by the City. The right-of-way shall extend one foot beyond the curb on the park side of the lane and one foot beyond curb on outside edge of the lane.

(8) A 14-foot multipurpose easement shall be dedicated on the outside edge of the lane. The park may be used for stormwater detention.

(9) The loop shall provide for two-way traffic.

(10) "No parking" signs shall be installed and maintained so that no parking is allowed between the curbs on any traveled portion of the loop lane, except the guest parking area.

(11) Corner lots with frontage on the loop lane and the abutting street shall be required to access from the loop lane only.

(12) Each residence shall provide and maintain four off-street parking spaces, two of which may be within a garage or carport. No front loading garage or carport may be closer than 20 feet to the front lot line. Individual driveways must have a five-foot radius fillet on driveway corners.

(13) The front yard setback for the house is 15 feet from the right-of-way (16 feet from the curb).

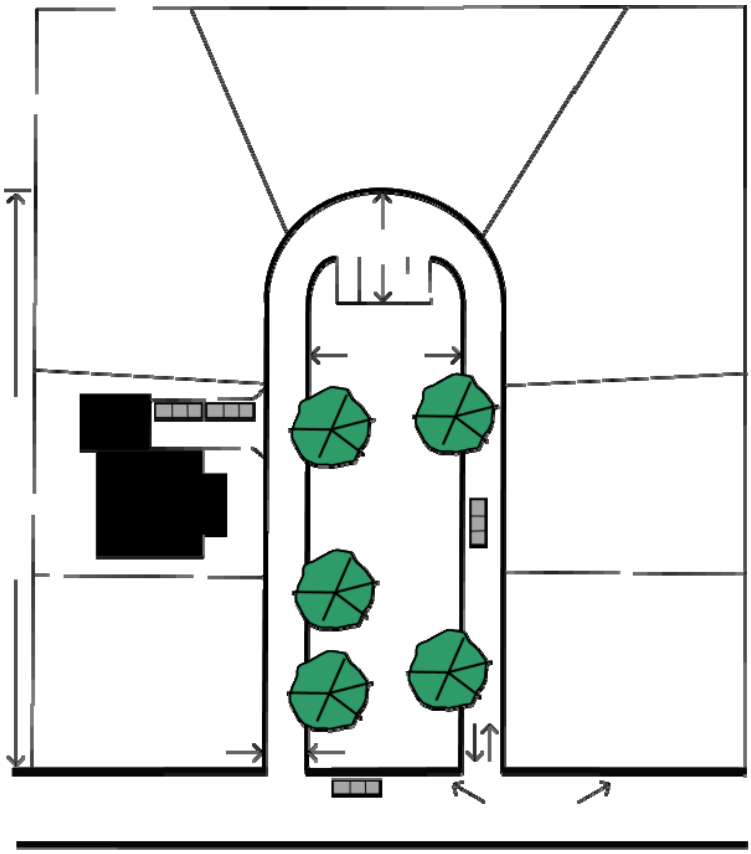
(14) Lots on the loop lane may be 20 percent smaller and the rear setback can be 10 feet less (10 feet minimum) than as required by the zone district.

(15) The park shall be owned and maintained by the homeowners' association, subject to any easements.

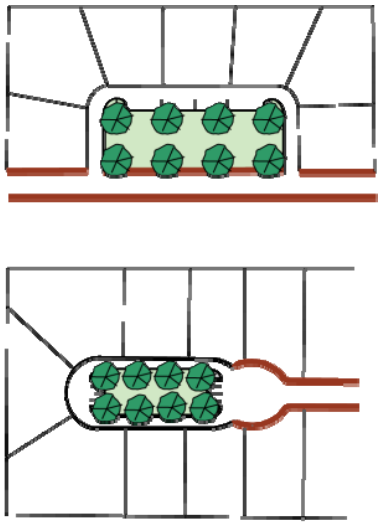
(16) No gateways, locked entries or other access constraints are allowed across the loop lane.

(17) A sidewalk is required only where the park abuts a street other than the loop.

(18) The developer shall landscape the park and provide an irrigation system in accordance with the Zoning and Development Code.



LOOP LANE



ALTERNATIVE CONFIGURATIONS

(Ord. 4831, 2-6-19; Ord. 4419, 4-5-10)

Chapter 21.07

SPECIAL REGULATIONS

Sections:
21.07.010 Flood damage prevention.
21.07.020 Environmental/sensitive lands regulations.
21.07.030 Airport environs overlay zoning district (AE).
21.07.040 Historic preservation.

21.07.010 Flood damage prevention.

(a) Purpose. Flood damage prevention regulations promote the public health, safety and general welfare and minimize public and private losses due to flooding. The regulations are designed to:

(1) Protect human life and health;

(2) Minimize expenditure of public money for costly flood control projects;

(3) Minimize the need for rescue and relief efforts associated with flooding;

(4) Minimize prolonged business interruptions;

(5) Minimize damage to critical facilities, infrastructure and other public facilities and utilities such as water and gas mains, electric, telephone and sewer lines, streets and bridges;

(6) Help maintain a stable tax base by providing for the sound use and development of areas of special flood hazard so as to minimize future flood blight areas;

(7) Ensure that potential buyers are notified that property is in an area of special flood hazard; and

(8) Ensure that those who occupy the areas of special flood hazard assume responsibility for their actions.

(b) Methods and Provisions for Flood Damage Prevention. In order to accomplish its purposes, this section includes methods and provisions for:

(1) Restricting or prohibiting uses which are dangerous to health, safety and property because of water or erosion hazard;

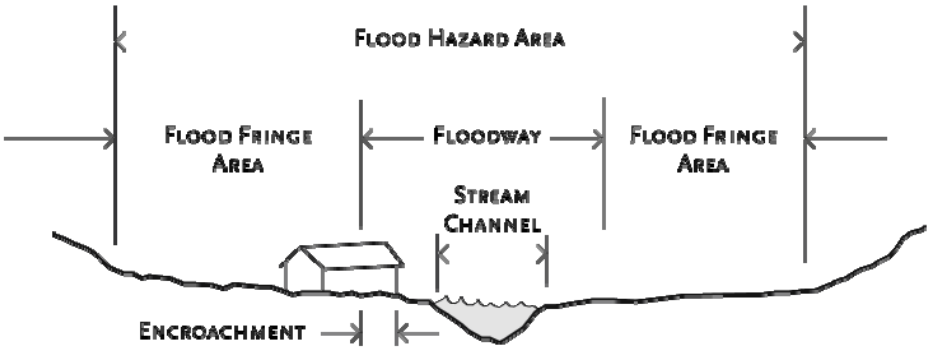
(2) Restricting or prohibiting uses which result in damaging increases in erosion or in flood heights or velocities;

(3) Requiring that uses vulnerable to floods, including facilities which serve such uses, be protected against flood damage at the time of initial construction;

(4) Controlling the alteration of natural floodplains, stream channels and natural protective barriers which help accommodate or channel flood waters;

(5) Controlling filling, grading, dredging and other practices which may increase flood damage; and

(6) Preventing or regulating the construction of flood barriers which will unnaturally divert floodwaters or which may increase flood hazards in other areas.



(c) General Provisions.

(1) This chapter applies to all areas of special flood hazard and areas removed from the floodplain by the issuance of a Federal Emergency Management Agency (FEMA) Letter of Map Revision Based on Fill (LOMR-F) within the City.

(2) Basis for Establishing the Areas of Special Flood Hazard. FEMA has identified areas of special flood hazard in a scientific and engineering report entitled, "The Flood Insurance Study for Mesa County and Incorporated Areas," dated October 16, 2012. The study together with the Flood Insurance Rate Maps (FIRMs) are hereby adopted by reference and declared to be a part of this code. The FIRMs may be superseded by local engineering studies approved by the Director, provided such studies fully describe and analyze, based on the FIRMs and generally accepted engineering practice, design floodwater build-out conditions.

(3) Compliance. No structure shall be constructed, located, extended, converted or altered without full compliance with the terms of this section and other applicable regulations. No land shall be developed without full compliance with the terms of this section and other applicable regulations. For waterways with base flood elevations (BFEs) for which a regulatory floodway has not been designated, no new construction, substantial improvements, or other development (including fill) shall be permitted within Zones A1-30 and AE on the City's FIRMs, unless it is demonstrated that the cumulative effect of the proposed development, when combined with all other existing and anticipated development, will not increase the water surface elevation of the base flood more than one-half foot at any point within the City. Under the provisions of 44 CFR Chapter 1, Section 65.12, of the NFIP regulations, the City may approve certain development in Zones A1-30, AE, AH, on the City's FIRM which increases the water surface elevation of the base flood by more than one-half foot; provided, that a conditional FIRM revision through FEMA (Conditional Letter of Map Revision), fulfills the requirements for such revisions as established under the provisions of Section 65.12 and receives FEMA approval.

(4) This section does not and it is not intended to repeal, abrogate or impair any existing easements, covenants or deed restrictions. If this section and another ordinance, easement, covenant or deed restriction conflict or overlap, whichever imposes the more stringent restrictions on use and development shall prevail and be applied.

(5) All terms and provisions of this section shall be:

(i) Considered as minimum requirements;

(ii) Liberally construed in favor of the City; and

(iii) Deemed neither to limit nor repeal any other powers granted or reasonably construed or interpreted under law, charter, rule or regulation.

(6) Warning and Disclaimer of Liability. The degree of flood protection required by this section is considered reasonable for regulatory purposes and is based on scientific and engineering considerations. Larger floods can and will occur. Flood heights may be increased because of manmade or natural causes. This section does not imply that land outside the areas of special flood hazard or uses permitted within such areas will be free from flooding or flood damages. This section shall not create liability on the part of the City, or any officer or employee thereof, or FEMA for any flood damage that results from reliance on this section or any administrative decision lawfully made hereunder.

(7) The flood carrying capacity within an altered or relocated portion of any watercourse shall be maintained.

(8) The Director shall maintain records obtained as part of a floodplain development permit, including but not limited to the lowest floor and floodproofing elevations for new and substantially improved construction.

(9) In riverine situations, notice shall be given by the Director to an adjacent community(ies) prior to any alteration or relocation of a watercourse.

(d) Provisions for Flood Hazard Reduction.

(1) General Standards. The following standards shall apply to all property located in special flood hazard areas:

(i) Anchoring.

(A) All new construction and substantial improvement shall be anchored to prevent flotation, collapse or lateral movement of the structure and as anchored must be capable of resisting the hydrostatic and hydrodynamic loads.

(B) All manufactured homes shall be elevated and anchored to resist flotation, collapse or lateral movement and as anchored is capable of resisting the hydrostatic and hydrodynamic loads. Methods of anchoring may include, but are not limited to, over the top or frame ties to ground anchors. This requirement is in addition to applicable State and local anchoring requirements for resisting wind forces. Specific requirements may be:

a. Over the top ties provided at each of the four corners of the manufactured home, with two additional ties per side at intermediate locations, with manufactured homes less than 50 feet long requiring one additional tie per side;

b. Frame ties provided at each corner of the home with five additional ties per side at intermediate points, with manufactured homes less than 50 feet long requiring four additional ties per side;

c. Each component of the anchoring system shall be capable of carrying a force of 4,800 pounds; and

d. Any addition to the manufactured home shall be similarly anchored.

(ii) Construction Materials and Methods.

(A) All new construction and substantial improvements shall be constructed with materials and utility equipment resistant to flood damage.

(B) All new construction and substantial improvements shall be constructed using methods and practices that minimize flood damage.

(C) All new construction and substantial improvements shall be constructed with electrical, heating, ventilation, plumbing and air conditioning equipment and other service facilities that are designed and/or located so as to prevent water from entering or accumulating within the components during flooding.

(iii) Utilities.

(A) All new and replacement water supply systems shall be designed to minimize or eliminate infiltration of floodwaters into the system;

(B) New and replacement sanitary sewage systems shall be designed to minimize or eliminate infiltration of floodwaters into the systems and discharge from the systems into floodwaters; and

(C) On-site waste disposal systems shall be located to avoid impairment to them or contamination from them during flooding.

(iv) Subdivision Proposals.

(A) All subdivision proposals shall be consistent with the need to minimize flood damage;

(B) All subdivision proposals shall have public utilities and facilities such as sewer, gas, electrical, and water systems located and constructed to minimize flood damage;

(C) All subdivision proposals shall have adequate drainage provided to reduce exposure to flood damage; and

(D) BFE data shall be provided for subdivision proposals and other proposed development which contain at least 50 lots or five acres (whichever is less).

(2) Specific Standards. The following provisions, as determined from BFE data, are required for all special flood hazard areas:

(i) New construction and substantial improvement of any residential structure shall have the lowest floor (including basement) elevated at least one foot above the BFE.

(ii) New construction and substantial improvement of any commercial, industrial or other nonresidential structure shall either have the lowest floor (including basement) elevated at least one foot above the level of the BFE; or, together with attendant utility and sanitary facilities, shall:

(A) Be flood-proofed so that below the BFE the structure is watertight with walls being substantially impermeable to the passage of water;

(B) Have structural components capable of resisting hydrostatic and hydrodynamic loads and effects of buoyancy; and

(C) Be certified by a Colorado registered professional engineer. The certification shall state that the design and methods of construction are in accordance with accepted standards of practice and meet the minimum provisions of this code. Such certifications shall be provided to and reviewed by the Director.

(iii) Openings in Enclosures Below the Lowest Floor. For all new construction and substantial improvements, fully enclosed areas below the lowest floor that are subject to flooding shall be designed to automatically equalize hydrostatic flood forces on exterior walls by allowing for the entry and exit of floodwaters. Designs for meeting this requirement shall be certified by either a Colorado registered professional engineer or architect and must meet or exceed the following minimum criteria:

(A) A minimum of two openings having a total net area of not less than one square inch for every square foot of enclosed area subject to flooding shall be provided;

(B) The bottom of all openings shall be no higher than one foot above grade;

(C) Openings may be equipped with screens, louvers, or other coverings or devices; provided that they permit the automatic entry and exit of floodwaters.

(iv) Manufactured Homes.

(A) All manufactured homes that are placed and/or substantially improved on a site:

a. Outside of a manufactured home subdivision;

b. In a new manufactured home park or manufactured home subdivision;

c. In an expansion to an existing manufactured home park or manufactured home subdivision; or

d. On an existing manufactured home park or manufactured home subdivision on which a manufactured home has incurred substantial damage as a result of a flood;

(B) Shall be anchored and elevated on a permanent foundation such that the lowest floor of the manufactured home is at least one foot above the BFE;

(C) The manufactured home shall be securely anchored to an anchored foundation system in order to resist flotation, collapse and lateral movement; and

(D) Manufactured homes that are placed or substantially improved on sites in existing manufactured home parks or manufactured home subdivisions that are not subject to the provisions of this subsection shall be elevated so that either:

a. The lowest floor of the manufactured home is at least one foot above the BFE; or

b. The manufactured home frame or chassis is supported by reinforced piers or other foundation elements that are no less than 36 inches in height above grade and securely anchored to an anchored foundation system in order to resist flotation, collapse and lateral movement.

(v) Recreational Vehicles. Recreational vehicles occupied as a temporary dwelling in a special flood hazard area shall meet all of the following requirements or meet permit requirements, elevation and anchoring requirements for manufactured homes:

(A) Be on the site for fewer than 180 consecutive days;

(B) Be fully licensed and ready for highway use;

(C) Be attached to the site only by quick disconnect type utilities and security devices; and

(D) Include no permanently attached additions.

(3) Specific Standards for Areas of Shallow Flooding. Specific standards are required for special flood hazard areas associated with base flood depths of one to three feet where a clearly defined channel does not exist and where the path of flooding is unpredictable and where velocity flow may be evident. Such flooding is characterized by ponding or sheet flow; therefore, the following provisions apply:

(i) Residential Construction. All new construction and substantial improvements of residential structures must have the lowest floor (including basement) elevated above the highest adjacent grade at least one foot above the depth number specified in feet on the City's FIRM (at least three feet if no depth number is specified). Upon completion of the structure, the elevation of the lowest floor, including basement, shall be certified by a registered Colorado professional engineer.

(ii) Nonresidential Construction. With the exception of critical facilities, all new construction and substantial improvements of nonresidential structures must have the lowest floor (including basement) elevated above the highest adjacent grade at least one foot above the depth number specified in feet on the City's FIRM (at least three feet if no

depth number is specified), or together with attendant utility and sanitary facilities be designed so that the structure is watertight to at least one foot above the base flood level with walls substantially impermeable to the passage of water and with structural components having the capability of resisting hydrostatic and hydrodynamic loads of effects of buoyancy. A registered Colorado professional engineer or architect shall submit a certification which shall state that the design and methods of construction are in accordance with accepted standards of practice and meet the minimum provisions of this code.

Within Zones AH or AO, adequate drainage paths around structures on slopes are required to guide floodwaters around and away from proposed structures.

(4) Specific Standards for Floodways. A floodway is an area within a special flood hazard area. The floodway is extremely hazardous due to the velocity of floodwaters, debris and erosion potential. To mitigate those hazards the following provisions apply:

(i) Encroachments, including fill, new construction, substantial improvements and other development are prohibited unless a Colorado registered professional engineer certifies in writing with a no-rise certificate that encroachments will not result in any increase in flood levels during the occurrence of the base flood discharge. The supporting technical date for the no-rise certificate shall be based on the standard step-backwater computer model used to develop the 100-year floodway shown on the FIRM or Flood Boundary and Floodway Map (FBFM), unless otherwise approved by the Director.

(ii) All new construction and substantial improvements shall comply with all applicable flood hazard reduction provisions of this section.

(5) Specific Standards for Alteration of a Watercourse. For all proposed developments that alter a watercourse within a special flood hazard area, the following standards apply:

(i) Channelization and flow diversion projects shall appropriately consider issues of sediment transport, erosion, deposition, and channel migration and properly mitigate potential problems through the project as well as upstream and downstream of any improvement activity. A detailed analysis of sediment transport and overall channel stability should be considered, when appropriate, to assist in determining the most appropriate design.

(ii) Channelization and flow diversion projects shall evaluate the residual 100-year floodplain.

(iii) Any channelization or other stream alteration activity proposed by a project proponent must be evaluated for its impact on the regulatory floodplain and be in compliance with all applicable Federal, State and local floodplain rules, regulations and ordinances.

(iv) Any stream alteration activity shall be designed and sealed by a registered Colorado professional engineer or certified professional hydrologist.

(v) All activities within the regulatory floodplain shall meet all applicable Federal, State and City floodplain requirements and regulations.

(vi) Within the regulatory floodway, stream alteration activities shall not be constructed unless the project proponent demonstrates through a floodway analysis and report, sealed by a registered Colorado professional engineer, that there is not more than a 0.00-foot rise in the proposed conditions compared to existing conditions floodway resulting from the project, otherwise known as a no-rise certification.

(vii) Maintenance shall be required for any altered or relocated portions of watercourses so that the flood-carrying capacity is not diminished.

(6) Specific Standards for Properties Removed From the Floodplain by Fill. A floodplain development permit shall not be issued for the construction of a new structure or addition to an

existing structure on a property removed from the floodplain by the issuance of a FEMA Letter of Map Revision Based on Fill (LOMR-F), with a lowest floor elevation placed below the base flood elevation with one foot of freeboard that existed prior to the placement of fill.

(7) Specific Standards for Critical Facilities. A critical facility is a structure or related infrastructure, but not the land on which it is situated, as classified below, that if flooded may result in significant hazards to public health and safety or interrupt essential services and operations for the City at any time before, during and after a flood.

(i) Classification of Critical Facilities. Critical facilities are classified under the following categories: (a) essential services; (b) hazardous materials; (c) at-risk populations; and (d) vital to restoring normal services.

(A) Essential services facilities include public safety, emergency response, emergency medical, designated emergency shelters, communications, public utility plant facilities, and transportation lifelines.

These facilities consist of:

a. Public safety (police stations, fire and rescue stations, emergency vehicle and equipment storage, and, emergency operation centers);

b. Emergency medical (hospitals, ambulance service centers, urgent care centers having emergency treatment functions, and nonambulatory surgical structures but excluding clinics, doctors offices, and nonurgent care medical structures that do not provide these functions);

c. Designated emergency shelters;

d. Communications (main hubs for telephone, broadcasting equipment for cable systems, satellite dish systems, cellular systems, television, radio, and other emergency warning systems, but excluding towers, poles, lines, cables, and conduits);

e. Public utility plant facilities for generation and distribution (hubs, treatment plants, substations and pumping stations for water, power and gas, but not including towers, poles, power lines, buried pipelines, transmission lines, distribution lines, and service lines); and

f. Air transportation lifelines [airports (municipal and larger)], helicopter pads and structures serving emergency functions, and associated infrastructure (aviation control towers, air traffic control centers, and emergency equipment aircraft hangars).

Specific exemptions to this category include wastewater treatment plants (WWTP), nonpotable water treatment and distribution systems, and hydroelectric power generating plants and related appurtenances.

Public utility plant facilities may be exempted if it is demonstrated to the satisfaction of the Director that the facility is an element of a redundant system for which service will not be interrupted during a flood. At a minimum, it shall be demonstrated that redundant facilities are available (either owned by the same utility or available through an intergovernmental agreement or other contract) and connected, the alternative facilities are either located outside of the 100-year floodplain or are otherwise compliant with all floodplain regulations, and an operations plan is in effect that states how redundant systems will provide service to the affected area in the event of a flood. A development approval includes the condition that evidence of ongoing redundancy be provided to the Director upon the Director's request.

(B) Hazardous materials facilities include facilities that produce or store highly volatile, flammable, explosive, toxic and/or water-reactive materials.

These facilities include:

a. Chemical and pharmaceutical plants (chemical plant, pharmaceutical manufacturing);

b. Laboratories containing highly volatile, flammable, explosive, toxic and/or water-reactive materials;

c. Refineries;

d. Hazardous waste storage and disposal sites; and

e. Above ground gasoline or propane storage or sales centers.

(C) At-risk population facilities include medical care, congregate care, and schools.

These facilities consist of:

a. Elder care (nursing homes);

b. Congregate care serving 12 or more individuals (day care and assisted living);

c. Public and private schools (pre-schools, K-12 schools, before-school and after-school care serving 12 or more children);

(D) Facilities vital to restoring normal services including government operations.

These facilities consist of:

a. Essential government operations (public records, courts, jails, building permitting and inspection services, community administration and management, maintenance and equipment centers);

b. Essential structures for public colleges and universities (dormitories, offices, and classrooms only).

These facilities may be exempted if it is demonstrated to the Director that the facility is an element of a redundant system for which service will not be interrupted during a flood. At a minimum, it shall be demonstrated that redundant facilities are available (either owned by the same entity or available through an intergovernmental agreement or other contract), the alternative facilities are either located outside of the 100-year floodplain or are otherwise compliant with all floodplain regulations and an operations plan is in effect that states how redundant facilities will provide service to the affected area in the event of a flood. Evidence of ongoing redundancy shall be provided to the Director on an as-needed basis as determined by the Director upon request.

(ii) Protection for Critical Facilities. All new and substantially improved critical facilities and new additions to critical facilities located within the special flood hazard area shall be regulated to a higher standard than structures not determined to be critical facilities. For the purposes of critical facilities, protection shall include one of the following:

(A) Location outside the special flood hazard area; or

(B) Elevation or floodproofing of the structure to at least two feet above the BFE.

(iii) Ingress and Egress for New Critical Facilities. New critical facilities shall, when practicable as determined by the Director, have continuous noninundated access (ingress and egress for evacuation and emergency services) during a 100-year flood event.

(e) Data, Information and Interpretation. The Director shall obtain and maintain the following information:

(1) The actual elevation, relative to mean sea level, of the lowest floor, including basement, of each structure;

(2) For each new or substantially improved floodproofed structure, the actual elevation, relative to mean sea level, to which the structure has been floodproofed and the required floodproofing certifications;

(3) Proof that an applicant has, prior to altering or relocating any watercourse or part thereof, notified adjacent communities and the Colorado Water Conservation Board of such alteration and demonstrated that there is adequate maintenance within the altered or relocated portion of the watercourse so that the flood-carrying capacity is not diminished. The Director shall also submit evidence of such notification to the Federal Emergency Management Agency.

The Director shall interpret the Flood Insurance Rate Maps (FIRM) to decide location of the boundaries of the areas of special flood hazard.

(Ord. 4815, 9-5-18; Ord. 4778, 1-3-18; Ord. 4583, 4-17-13; Ord. 4551, 9-5-12; Ord. 4419, 4-5-10)

21.07.020 Environmental/sensitive lands regulations.

(a) Purpose. Environmental and sensitive lands (ESL) regulations shall apply to identified hazard areas and/or lands, which have or may have specific environmental conditions. The intent of this regulation is to:

(1) Guide development and land use within these areas;

(2) Protect the public from avoidable financial expenditures for hazard control projects, hazard relief measures and damages to public utilities, streets and bridges;

(3) Protect people and property and minimize damage from possible hazards; and

(4) Provide a mechanism by which people owning/purchasing land can gain information about the land and whether the land is suitable for development.

(b) Applicability. The provisions of this chapter, in addition to any other applicable regulation, shall apply to a planned development outline development plan, preliminary subdivision plat or simple subdivision for environmental and sensitive lands. This chapter shall not apply to the following:

(1) Development of a single-family home on any lot or parcel in existence as of the effective date of this code;

(2) State, County or City highway personnel engaged in constructing or effecting repair of bridges and/or roads;

(3) Colorado Division of Wildlife and/or U.S. Fish and Wildlife Service engaged in habitat improvement; and

(4) Railroad personnel engaged in constructing or effecting repair of bridges and track.

(c) General Requirements.

(1) The Director shall administer this code making any necessary interpretations of maps and other documents or information necessary or required, to determine among other things the boundaries of geologic and wildfire hazard areas.

(2) Any development application involving a property with a known or suspected geologic hazard shall be submitted by the Director for review by the Colorado Geological Survey.

(3) Any development application involving a property with a known or suspected wildfire hazard shall be submitted by the Director for review by the State Forestry Service.

(4) Protection from or against hazard or loss by the application of this regulation is not guaranteed. The analysis and recommendations are based on engineering and scientific studies, which are reasonably believed to be accurate and complete. A review consistent with this regulation does not guarantee, either expressly or impliedly that areas outside of established hazard boundaries or uses permitted within hazard boundaries will be free from damage or that people will be free from death or injury caused by known or unknown hazards. Application of this regulation to any development shall not create any liability on the part of, or create a cause of action against, the City or any officer or employee thereof.

(d) Wildfire Standards.

(1) Defensible Space. Any new residential development on or adjacent to land that is predominantly woods, brush or grasslands, shall be developed to minimize the potential for the buildings to be ignited by wildfire and for a building fire to ignite surrounding woods, brush or grasslands. In addition to all other applicable regulations woods, brush or grassland development shall be developed with the area surrounding each dwelling unit modified and managed using a two-area system as follows:

(i) Area 1. Area 1 shall consist of a 30-foot area immediately surrounding the dwelling unit, not to extend beyond the property line. No dead trees or other dead vegetation may remain in Area 1 at the time of initial sale or initial construction, whichever is first. Area 1 shall be further subdivided into two segments:

(A) Segment A shall consist of the five feet immediately surrounding all sides of the dwelling unit. All vegetation shall be removed from this area at the time of initial sale or construction, whichever is first. No new vegetation shall be planted in Segment A if the structure is sided with combustible materials such as wood or logs. If noncombustible siding is used, however, low-growing shrubs may remain or be installed. In no case shall shrubs be planted so as to be continuous with grass. No propane tanks may be installed in Segment A and no firewood or other combustible materials may be stored there.

(B) Segment B shall consist of the 25 feet immediately beyond Segment A. At the time of initial sale or initial construction, whichever occurs first, all installed trees within Area 1 shall be located, and all existing vegetation shall be thinned, as follows to break up the horizontal and vertical continuity of fuels:

a. Spacing between clumps of brush or trees, as measured between the crown of each clump, shall be no closer than two times the height of the taller clump. The maximum width of any clump of brush or trees shall be no greater than two times the height of the clump. Thinned material shall be removed from the site.

b. All branches of trees or brush shall be pruned to a minimum height of 10 feet above the ground or one-half the total height of the tree or bush, whichever is less. Pruned material shall be removed from the site.

c. Propane tanks and firewood may be located in Segment B, but in no case shall such tanks be located within 20 feet of the primary structure. Propane tanks shall be located on gravel pads and shall not be located immediately adjacent to grass-covered areas.

(ii) Area 2. Area 2 shall consist of the area immediately beyond Area 1 and extending to 75 feet from the principal structure, not to extend beyond the property line. Trees shall be initially thinned in this area to maintain a minimum of five feet between tree crowns at maturity. All dead trees must be removed from Area 2 prior to initial sale or initial construction, and subsequent dead trees shall be removed annually, except that two dead trees per acre may remain to serve as wildlife habitat.

(2) Maintenance. Persons owning, leasing or otherwise maintaining new dwelling units covered by provisions of this code are responsible for proper maintenance of the defensible space. Maintenance of the defensible space shall include modifying or removing flammable vegetation and keeping leaves, needles and other dead vegetative material from accumulating on roofs of structures.

(e) Wildlife Habitat Protection.

(1) Prior to development of a moderate, high or very high potential for impact category parcel, as shown on the 1999 Wildlife Composite Map for the urban area or an amended map approved by the City, the developer shall consult with the Colorado Division of Wildlife to substantiate the basis for the potential impact and to address various specific measures to avoid, minimize, or mitigate negative impacts to wildlife and/or habitat.

(2) New structures shall not be located within 100 feet of the floodways of the Colorado or Gunnison Rivers or as recommended by the Colorado Division of Wildlife. Roads, trails, recreation access sites, bridges, fences, irrigation and water diversion facilities, erosion and flood control devices, underground utilities, and similarly necessary structures may be located within this setback, if necessary. The installation of these structures shall comply with all other applicable federal, State, and local regulations.

(f) Hillside Development.

(1) Hillside development standards are applicable to hillside development and excavation of hillside so that:

(i) Soil and slope instability and erosion is minimized;

(ii) The adverse effects of grading, cut and fill operations are minimized;

(iii) The character of the City's hillsides is preserved; and

(iv) The public's interest is protected.

(2) The provisions hereof are designed to accomplish the following:

(i) Prohibit development or uses which would likely result in a hazardous situation due to slope instability, rock falls, or stormwater runoff and excessive soil erosion;

(ii) Minimize the threat and consequent damages resulting from hillside area fires by establishing fire protection measures and adequate emergency vehicle access;

(iii) Preserve natural features, wildlife habitats, natural vegetation, trees and other natural plant formations;

(iv) Provide for safe vehicular circulation and access to recreation areas, natural drainage channels, paths and trails;

(v) Encourage the location, design and development of building sites in a manner that will provide for greater aesthetic appeal, blend with the slopes and hillside terrain, minimize the scarring and erosion effects of cutting, filling and grading of hillsides and prohibit development of ridge lines as defined; and

(vi) Encourage preservation of open space by encouraging clustering or other design techniques to preserve natural terrain, views and vistas.

(3) Hillside Development Standards. In furtherance of the purposes set forth, any hillside development shall comply with the tables below. Any portion of a development having a slope greater than 30 percent with an elevation change of 20 feet or greater shall not be included in

calculation of the area of such parcel for the purposes of determining conformity with the minimum lot parcel size and density requirements below.

SINGLE-FAMILY, PLANNED AND CLUSTER SUBDIVISION DEVELOPMENT		
Average Slope of Development Area	**Minimum Lot Size[1]**	**Minimum Lot Width**
0% – 10%	See Existing Zone	See Existing Zone
10.01% – 20%	10,000 sq. ft.	At least 100 ft. at front setback line
20.01% – 30%	15,000 sq. ft.	At least 200 ft. at front setback line
30.01% +	Development Not Permitted[2]	Development Not Permitted[2]

[1] Minimum lot size as finally approved.

[2] Development on slopes of greater than 30 percent is not permitted unless, after review and recommendation by the Planning Commission and approval by the City Council, it is determined that:

a. Appropriate engineering measures will be taken to minimize the impact of cuts, fills, erosion and stormwater runoff consistent with the purpose of this section; and

b. The developer has taken reasonable steps to minimize the amount of hillside cuts and also has taken measures to mitigate the aesthetic impact of cuts through landscaping or other steps.

Note: Maximum setback for single-family dwelling structures – 150 feet from public or private street.

MULTIPLE DWELLING UNITS		
Average Slope of Development Area	**Minimum Lot Width**	**Maximum Density**
0% – 10%	See Existing Zone	See Existing Zone
10.01% – 20%	100 feet	Maximum density of underlying zone x 0.80 unless clustered
20.01% – 30%	100 feet	Maximum density of underlying zone x 0.60 unless clustered
30.01% +	Development Not Permitted[1]	Development Not Permitted[1]

[1] Development on slopes of greater than 30 percent is not permitted unless, after review and recommendation by the Planning Commission and approval by the City Council, it is determined that:

a. Appropriate engineering measures will be taken to minimize the impact of cuts, fills, erosion and stormwater runoff consistent with the purpose of this section; and

b. The developer has taken reasonable steps to minimize the amount of hillside cuts and also has taken measures to mitigate the aesthetic impact of cuts through landscaping or other steps.

(4) Unless otherwise approved by the Planning Commission, for property with slopes in excess of 20 percent, development may, as determined by the Director, be clustered on the portion of the site with slopes less than 20 percent. Clustering may be achieved by concentrating the number of units or by concentrating the amount of square footage allowed for the entire site on that portion of the property with less than 20 percent slope. See also GJMC 21.03.060, Cluster developments.

(5) Determination of Slope and Slope Areas. Slope shall be determined on a parcel by parcel basis if the slope is not generally uniform. The Director may allow some incursion hillside disturbance between slopes. Such incursions shall not exceed 20 feet unless, upon recommendation of the Planning Commission, the City Council finds that a greater incursion is consistent with the purposes of this section. All property with a slope greater than 30 percent shall be excluded from the calculation of development area for purposes of determining hillside disturbance and

density/intensity limitations. Natural slope delineation for the purposes of this section shall be determined as follows:

(i) Contour intervals, maps and calculations required to determine the natural slope shall be prepared by the applicant and shall be submitted with the development application.

(ii) Contour maps shall be prepared and certified by a licensed professional engineer or licensed surveyor showing contours at intervals no greater than two feet (the contour map).

(iii) A qualified professional shall prepare all reports, documents, maps, reports and calculations. The basis of the information used/analyzed shall be conspicuously disclosed thereon. Each report shall include a current statement of the professionals' certifications, credentials and qualifications to prepare the report.

(iv) The Director may require that the applicant perform a field survey to verify the accuracy of the contour lines shown on the contour map.

(v) The contour map shall identify profile lines, which shall be used for performing the field survey. Profile lines shall be perpendicular to contour lines and in no case occur at intervals greater than 150 feet apart or 75 feet from a property line.

(6) Determination of Slope Areas/Density Calculation. Using the field survey, slopes shall be calculated in horizontal intervals no greater than 40 feet. Points identified as slopes, as listed above, shall be located on the contour map and connected by a continuous line. The area bounded by the lines and intersecting property lines shall be used for determining dwelling unit density.

(7) Street Design. The TEDS manual (GJMC Title 29) shall apply to all hillside development except that:

(i) Streets, roads, driveways and other vehicular routes shall not traverse property having a slope greater than 30 percent unless, after review by the Planning Commission and approval by the City Council, it is determined that:

(A) Appropriate engineering measures will be taken to minimize the impact of cuts, fills, erosion and stormwater runoff consistent with the purposes of this section; and

(B) The developer has taken reasonable steps to minimize the amount of hillside cuts and taken measures to mitigate the aesthetic impact of cuts through the use of landscaping and other mitigation measures acceptable to the Director.

a. Existing vegetation, where streets are to be located, shall be preserved to the greatest extent possible. As much as possible street alignment should follow the natural terrain.

b. Upon the favorable recommendation of the Director sidewalk construction may be waived by the Planning Commission when the Planning Commission finds that sidewalk construction would result in excessive grading and/or cut/fill of slopes.

c. Vertical or drive-over, curb and gutter, as determined by the Director, shall be installed along all public streets.

(8) Joint Development Applications. Multiple owners of hillside property, whether or not such property is contiguous, may file a joint development application for all such property or the City Council may direct the Director to file such an application on behalf of the City.

(9) For all purposes of this chapter, such property shall be treated as a single development parcel.

(10) Development permitted on such property, pursuant to this chapter, may be clustered on any one or more of the parcels under such joint application subject to the requirements and limitations of this chapter. The provisions of this section shall not allow variance in the use requirements of the underlying and existing zoning category for the receiving parcel and may not result in a violation of the purposes of these regulations.

(g) Ridgeline Development. The City recognizes the value of its visual resources and amenities. The purpose of the ridgeline development standards is to preserve the character of the identified ridgelines and to minimize soil and slope instability and erosion. Ridgeline development standards include the following:

(1) For all lots platted within the mapped ridgeline protection area shown on Exhibits 7.2.C1, 7.2.C2 and 7.2.C3, buildings, fences and walls shall be set back a minimum of 200 feet from the ridgeline.

(2) This setback shall not apply if the applicant produces adequate visual representation that a proposed new structure will not be visible on the skyline as viewed from the centerline of the mapped roads or that mitigation will be provided. Mitigation techniques might include:

(i) Earth tone colors to blend with the surrounding area;

(ii) The use of nonreflective materials;

(iii) Vegetation to screen and soften the visual impact of the structure; and/or

(iv) A reduction of building height or the “stepping” of the building height; or

(v) Other means that minimize the appearance from the road corridor.

(3) In no case shall the setback be less than 30 feet from the ridgeline. This regulation shall not apply to existing structures or lots platted prior to the effective date of this code or to fences constructed primarily of wire.

(4) The required setback shall be measured to the building envelope, to be established at the time of platting.

(5) Line of sight shall be measured from the centerline of the road most parallel to the ridgeline at the point most perpendicular to the center of the lot.

(6) Ridgeline shall be determined on a site-specific basis and shall be that point at which the line of sight is tangent with the slope profile.

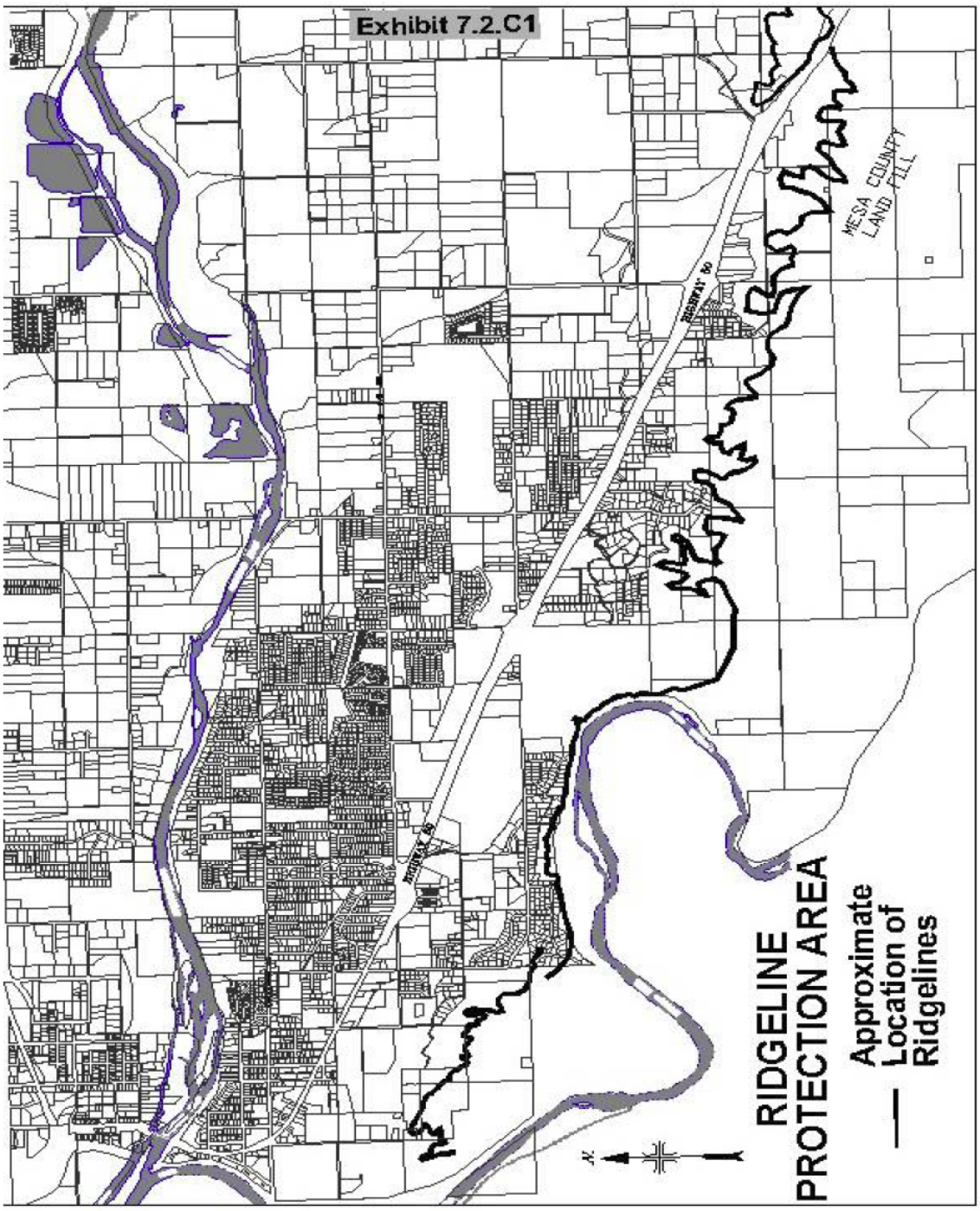


Exhibit 7.2.C1
MESA COUNTY LAND FILL
RIDGELINE PROTECTION AREA
Approximate Location of Ridgelines
N

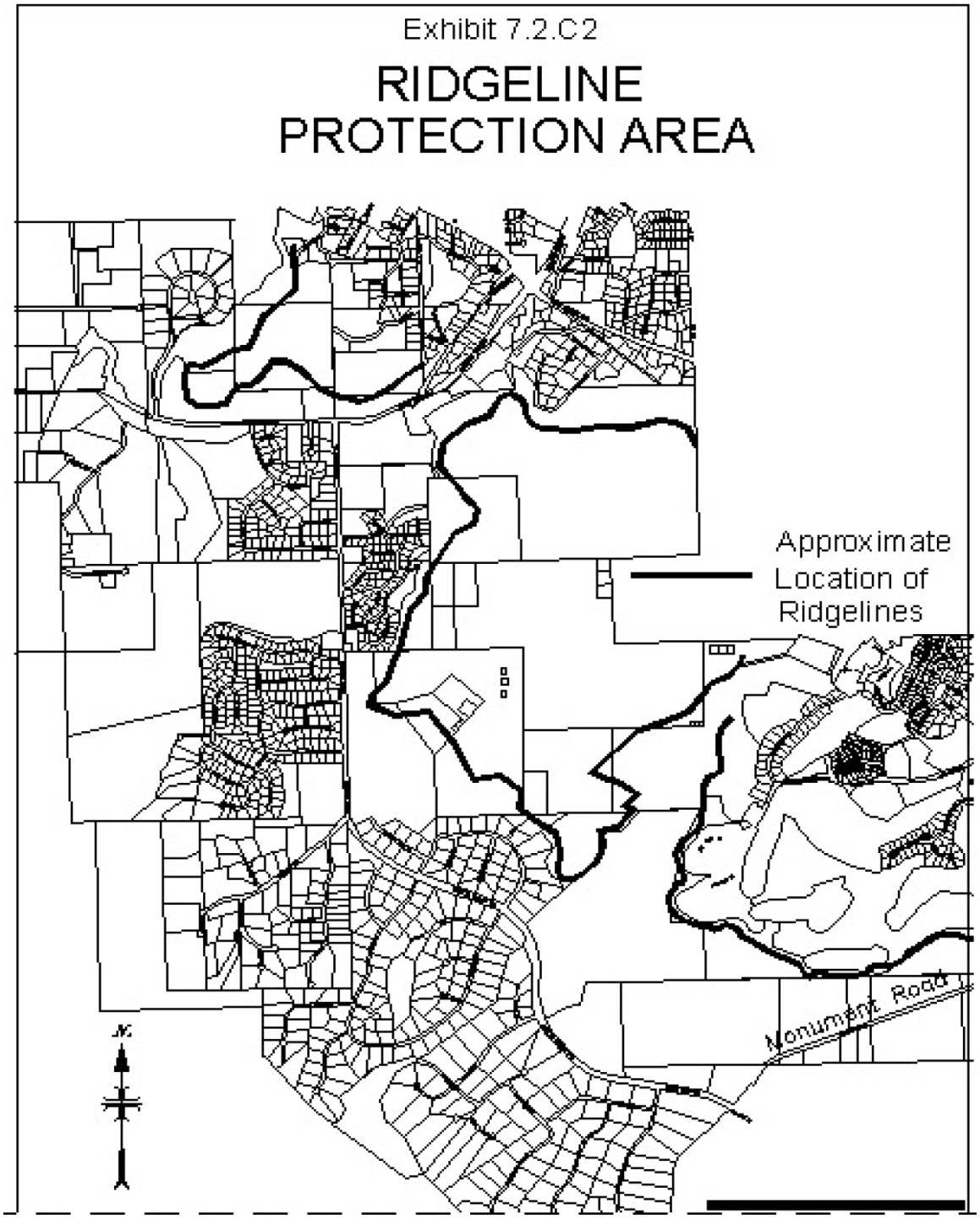
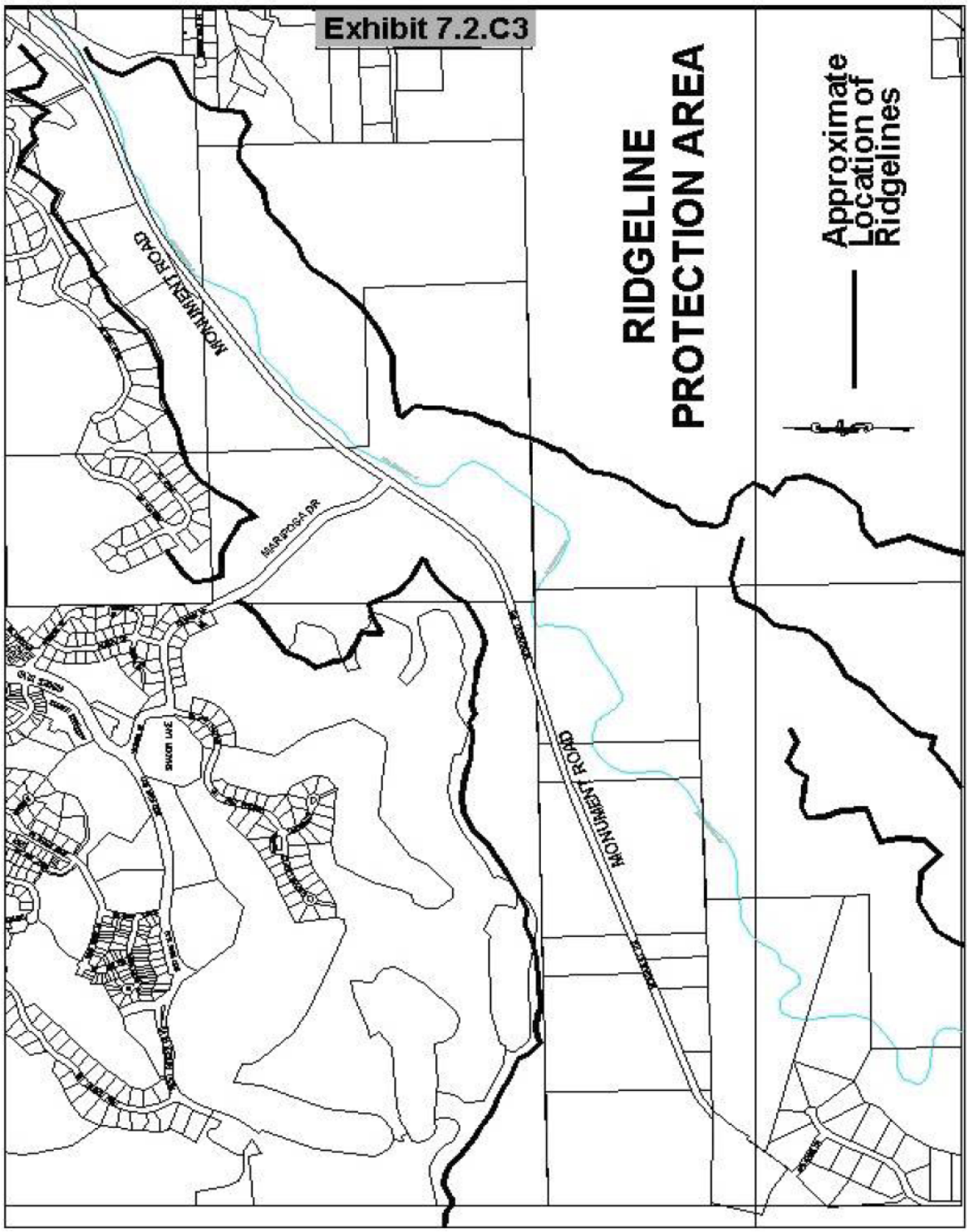


Exhibit 7.2.C2
RIDGELINE
PROTECTION AREA
Approximate
Location of
Ridgelines
Monument Road
N



(h) Natural Resources. Natural resources, especially mineral resources, shall be protected. In the event that development is proposed in an area of known mineral deposits, the applicant shall provide an estimate of the economic value of the on-site mineral resources. This estimate shall be prepared by a registered engineer and submitted prior to approval of development. The City Council shall make an evaluation of the value of both the resource and the cost of extraction prior to development of

the property. The City Council may delay development approval until extraction has been accomplished or protection provided within the design of the development.

(i) Geologic Hazard Maps.

(1) The Colorado Geological Survey (CGS) has identified geologic hazard areas. The CGS maps, together with explanatory text, references and supporting and supplemental studies, results and findings delineating the boundaries of geologic hazard areas are incorporated into this code by reference.

(2) The CGS maps approximate the boundaries of hazard areas. The maps shall primarily provide notice to the Director, Planning Commission, City Council and the applicant, that geologic hazards may exist and if so require consideration prior to and if approved, during development. Precise boundaries and determination of hazard require on-site evaluation by qualified professionals. The Director may require a detailed engineering analysis, study and/or report if a hazard is known or reasonably believed to exist. The engineering analysis, study and/or report, if required, may, as determined by the Director, be required to include a map of the extent of the hazard, a definition of its degree of severity, a determination of the frequency of occurrence/reoccurrence, an evaluation of the compatibility of the proposed land use and consideration of the means and methods of hazard mitigation.

(3) Hazard mitigation is not intended to categorically preempt development but development may occur only if mitigation is appropriate and proportionate to the severity and frequency of the hazard.

(4) Mitigation techniques, which may be acceptable, are:

(i) Avoidance of the hazard area;

(ii) Retaining walls, fill, rock bolting, pilings;

(iii) Diversion, channeling, damming, barriers;

(iv) Excavation of unstable areas, bridging of weak zones, proper distribution of loading;

(v) Improvement of surface and subsurface drainage.

(5) Mitigation plans shall be prepared and stamped by a Colorado registered, professional engineer.

(j) Environmental Audit. A Phase I environmental audit shall be required for any property dedicated or deeded to the City. The City may require additional investigation.

(Ord. 4419, 4-5-10)

21.07.030 Airport environs overlay zoning district (AE).

(a) Purpose. The airport environs overlay zoning district (AE) is hereby created with the following purposes:

(1) To protect the public health, safety and welfare by regulating development and land use within noise sensitive areas and airport hazard areas;

(2) To ensure compatibility between Grand Junction Regional Airport and surrounding land uses; and

(3) To protect the airport from incompatible encroachment.

(b) Overlay District. The airport environs overlay zoning district (AE) shall serve as an overlay zoning that applies additional standards and requirements to properties located within an underlying zoning district. In case of conflicting standards and requirements, the more stringent standards and requirements shall apply.

(c) Airport Environs Overlay Maps. Airport environs overlay maps referred to in this code are on file at the Public Works and Planning Department. The maps are incorporated by this reference as if fully set forth.

(d) Airport Environs Subdistricts. The airport environs overlay zoning district (AE) is comprised of four subdistricts. The subdistricts represent a determination by the Federal Aviation Administration (FAA) of differing levels of expected noise impact and hazard from aircraft overflight. If any parcel is within more than one subdistrict, the more restrictive subdistrict determination shall apply. The subdistricts are as follows:

(1) Area of Influence (Subdistrict A). An area surrounding the airport impacted or influenced by proximity of the airport, either by aircraft overflight, noise and/or vibrations.

(2) Noise Zone (Subdistrict B). Includes the area within the 65 Ldn to 70 Ldn noise-exposure area as shown in the Grand Junction Regional Airport Master Plan.

(3) Critical Zone (Subdistrict C). A rectangular-shaped zone located directly off the end of a runway's primary surface, beginning 200 feet from the end of the pavement, which is critical to aircraft operations (i.e., more apt to have accidents within it because of the takeoff and landing mode in that particular area) as shown in the Grand Junction Regional Airport Master Plan.

(4) Clear Zone (Subdistrict D). A triangular-shaped zone located directly off the end of a runway's primary surface, beginning 200 feet from the end of the pavement, which is clear of all above-ground obstruction or construction. The width is the same as the primary surface. The length is determined by the use of the runway, in accordance with FAA regulations.

(5) The boundaries of the AE zoning and its subdistricts shall be reviewed whenever the Grand Junction Regional Airport Authority updates and/or amends the noise contour maps and/or master plan. The Grand Junction Regional Airport Authority shall notify the City of any such update and/or amendment and provide a copy of it to the City.

(e) Exemptions. The terms, provisions, conditions and restrictions of 5-11 et seq. of the former code pertaining to land use for land around airports shall control development in existence prior to the effective date of this code. This chapter shall apply to development, structures and/or lots platted after the effective date of this code.

(f) Land Use Compatibility.

(1) Airport Environs Matrix. The airport environs land use compatibility matrix below, also known as the airport matrix, establishes requirements and limitations in addition to those provided in Chapter 21.03 GJMC. In the case of conflict the more restrictive requirements shall control.

(2) The airport matrix below identifies development standards that apply to development within the AE zone. Any proposed use and/or development shall comply with the requirements of this section, in addition to all other applicable standards.

(3) All structures shall be constructed to comply with the noise level reduction (NLR) standards of the airport matrix. National Technical Information Service (NTIS) report Guidelines for the Sound Insulation of Residences Exposed to Aircraft Operations (AD-A258 O32), latest edition, shall be used for noise reduction methods for new development.

(4) Use Restriction. Notwithstanding any other provision of this code, no use may be made of land or water within any zone or subdistrict that creates or may create:

(i) Interference with navigational signals or radio communication between the airport and aircraft;

(ii) Difficulty for pilots to distinguish between airport lights and other lighting;

(iii) Glare in the eyes of pilots using the airport;

(iv) Impaired visibility in the vicinity of the airport;

(v) A hazard or endanger landing, takeoff or maneuvering of aircraft.

(g) Avigation Easement. New development located within the AE zone shall convey an avigation easement to the Grand Junction Regional Airport Authority in a form and with terms and conditions approved by the Director. Such conveyance shall not be required for repair or maintenance of existing structures.

(h) Record Notice of Critical and Noise Zone Subdistricts. A written notice, in a form approved by the Director, shall be affixed to and recorded with each final plat/plan when the development is located in a noise zone. The notice shall also be required when the development is located within a critical zone. The notice shall minimally provide that:

(1) All or part of the development is potentially subject to aircraft noise levels high enough to annoy users of the property and interfere with its unrestricted use.

(2) If in the critical zone add: All or part of this property is also located in the approach and departure path of the airport in an area more apt to have accidents because of the takeoff and landing of aircraft.

(i) Height Limitations. Nothing, including structures and trees, shall be erected, altered, allowed to grow or be maintained so that it crosses or enters into the applicable runway approach zones as defined in Federal Aviation Regulations (FAR) Part 77, as amended.

Airport Land Use Compatibility Standards Matrix

LAND USE	SUBDISTRICTS			
	A	B	C	D
Residential (≤ 1 unit per 5 acres)	Y	30[1]	30[1]	N
Residential (≥ 1 unit per 5 acres)	Y	C30[1]	N	N
Hotels/Motels	Y	C25	N	N
Schools, Hospitals, Libraries	Y	C25	N	N
Churches	Y	C25	N	N
Auditoriums, Outdoor Amphitheaters, Concert Halls	Y	C25	N	N
Sports Arenas	Y	C25	N	N
Playgrounds, Parks, Open Space, Golf Courses, Cemeteries, Riding Stables	Y	Y	C	N
Office Buildings, Personal, Business, and Professional Services	Y	C	C	N
Commercial Establishments: Retail	Y	C	C	N
Commercial Establishments: Wholesale, Manufacturing, Transportation, Communications, and Utilities	Y	C	C	N
Manufacturing – Noise-Sensitive	C	C	C	N
Communications – Noise-Sensitive	C	C	C	N
Farming (Livestock)	Y	Y	Y	N
Agriculture, Mining, Fishing (Except Livestock Farming)	Y	Y	Y	C
Poultry Production	Y	Y	Y	N

Airport Land Use Compatibility Standards Matrix					
LAND USE		SUBDISTRICTS			
		A	B	C	D
LEGEND					
Y:	Yes				
C:	Requires conditional use permit				
N:	No				
25:	Measures to achieve noise level reduction (NLR) of 25 dB must be incorporated into the design and construction of structures.				
30:	Measures to achieve noise level reduction (NLR) of 30 dB must be incorporated into the design and construction of structures.				
Footnote 1: Where possible, no residential development shall be permitted within Subdistricts B and C; however, for properties substantially or wholly burdened by Subdistrict C, residential development may be permitted at a density not to exceed one unit per five acres. Clustering of homes outside of Subdistricts B and C shall, where possible, be used.					

(Ord. 4419, 4-5-10)

21.07.040 Historic preservation.

(a) Purpose. This section enhances the community's local resources and promotes the public health, safety, prosperity and welfare through the protection and preservation of the City's architectural, historic and cultural heritage, as embodied in designated historic structures, sites and districts, by application of appropriate regulations and incentives. Those regulations and incentives include:

(1) The establishment of a City Register listing designated structures, sites and districts; and

(2) The provision of educational opportunities to increase public appreciation of Grand Junction's unique heritage.

(b) Board Established. The City Council hereby creates a Historic Preservation Board, which may be referred to as the Historic Board or Preservation Board. The Historic Board shall have principal responsibility for matters of historic preservation, and shall have such membership, authority, duties, and responsibilities as further provided in Chapter 21.01 GJMC.

(c) City Registry Established.

(1) The City Council hereby establishes the City Register of historic sites, structures and districts. Historic sites, structures or districts may be listed on said register only if said site, structure or district has been designated by the City Council following recommendation by the Historic Board.

(2) All properties listed on the National or State Register are eligible for the City Register but are not designated until approval, pursuant to this code, is obtained.

(d) Designation of Historic Structures, Sites and Districts.

(1) The City Council pursuant to this code:

(i) May by resolution designate as historic an individual structure, site or other feature or an integrated group of structures or features on a lot or site. Designation shall be for a special historical or architectural value; or

(ii) May by resolution designate as an historic district an area containing a number of structures or sites having a special historical or architectural value.

(2) Each such designation shall include a description of the characteristics of the structure, site or historic district which justify its designation and a description of the particular features that

should be preserved and shall include a legal description of the location and boundaries of the historic structure, site or district.

(3) No individual structure or site shall be designated without the consent of all owners of record. Historic districts may be designated in accordance with State law and the provisions in this section.

(4) The purpose and effect of designation is:

(i) To assist local interests in preservation of physical structures, sites or districts and to recognize locally significant structures, sites or districts;

(ii) To provide a mechanism to educate the public on local history, development of the community, architectural styles and housing and business development;

(iii) To enable the owners of the property in the City to take advantage of historic preservation programs and opportunities; and

(iv) To make all properties listed on the City Registry eligible for such incentive programs as may be developed.

(e) A Procedure for Designating Historic Structures, Sites and Districts for Preservation.

(1) A nomination for designation to the City Register may be made by the Historic Board or by any citizen by filing an application with the Community Development Department. The applicant shall pay all public notice expenses, recording fees and any other fees established by resolution of the City Council.

(2) Historic Board Review.

(i) The Historic Board shall hold a public meeting on the designation application no more than 30 days after the filing of the application.

(ii) The Historic Board shall review the application for conformance with the established criteria for designation and with the purposes of this section.

(iii) Within 10 days after the conclusion of the public meeting, but in no event more than 30 days after the meeting, unless mutually agreed to by the Historic Board, the applicant, and the owner or owners other than the applicant, the Historic Board shall recommend either approval, modification and approval or disapproval of the application.

(iv) The Historic Board may recommend approval conditional upon the execution of certain easements, covenants or licenses.

(v) The Historic Board shall forward to the City Council written recommendations concerning a designation and further state any recommendations as to easements, covenants or licenses that must be met by the property owner in order to receive and/or maintain the designation.

(3) City Council Review.

(i) The City Council shall hold a public hearing on the designation application no more than 30 days after receipt of the Board's recommendation.

(ii) The City Council shall review the application for conformance with the established criteria for designation and with the purposes of this section.

(4) When a structure, site or historic district has been designated as provided herein, the Director shall promptly notify the record owners of the property, as shown in the County Assessor's records or other available information, and record the designation in the land records of the Mesa County Clerk and Recorder.

(5) Limitation on Resubmission and Reconsideration of Proposed Designation. If the City Council disapproves a proposed designation, no person shall submit an application that is the same or substantially the same for at least one year from the effective date of the denial of the application.

(f) Criteria for Designation. The Historic Board and City Council shall consider the following criteria in reviewing nominations/applications for designation.

(1) Structures. Structures must be at least 50 years old and meet one or more of the architectural, cultural or geographic/environmental significance criteria. A structure can be exempted from the age requirement if the Council finds it to be exceptionally important in other criteria.

(i) Historic structures or sites shall meet one or more of the following in order to be considered for designation.

(A) Architectural.

a. Exemplifies specific elements of an architectural style or period;

b. Is an example of the work of an architect or builder who is recognized for expertise nationally, statewide, regionally, or locally;

c. Demonstrates superior craftsmanship or high artistic value;

d. Represents an innovation in construction, materials or design;

e. Represents a built environment of a group of people in an era of history;

f. Exhibits a pattern or grouping of elements representing at least one of the above criteria; or

g. Is a significant historic remodel.

(B) Cultural.

a. Is a site of an historic event that had an effect upon society;

b. Exemplifies the cultural, political, economic or ethnic heritage of the City; or

c. Is associated with a notable person or the work of a notable person.

(C) Geographic/Environmental.

a. Enhances the sense of identity of the City; or

b. Is an established and familiar natural setting or visual feature of the City.

(ii) Prehistoric and historic archaeological structures or sites shall meet one or more of the following:

(A) Architectural.

a. Exhibits distinctive characteristics of a type, period or manner of construction; or

b. Is a unique example of structure.

(B) Cultural.

a. Has the potential to make an important contribution to the knowledge of the area's history or prehistory;

b. Is associated with an important event in the area's development;

c. Is associated with a notable person or the work of a notable person;

d. Is a typical example or is associated with a particular ethnic or other community group; or

e. Is a unique example of an event in local history.

(C) Geographic/Environmental. Is geographically or regionally important.

(iii) Each property shall also be evaluated based on physical integrity using the following criteria (a property need not meet all the following criteria):

(A) Shows character, interest or value as part of the development, heritage or cultural characteristics of the community, region, State, or nation;

(B) Retains original design features, materials and/or character;

(C) Is in the original location or same historic context if it has been moved; or

(D) Has been accurately reconstructed or restored.

(2) Historic Districts.

(i) For the purposes of this section, a historic district is a geographically definable area including a concentration, linkage or continuity of sites, buildings, structures and/or objects. A historic district is related by a pattern of either physical elements or social activities.

(ii) Significance is determined by applying criteria to the pattern and unifying elements.

(iii) Nominations/applications for historic district designation shall not be approved unless the application contains written approval from owners of at least 60 percent of the properties within the proposed district boundaries.

(iv) Properties that do not contribute to the significance of the historic district may be included within the boundaries so long as the noncontributing elements do not noticeably detract from the district's sense of time, place and historical development. Noncontributing elements shall be evaluated for their magnitude of impact by considering their size, scale, design, location and/or information potential.

(v) Historic district boundaries shall be defined by visual changes, historical documentation of different associations or patterns of development, or evidence of changes in site type or site density as established through testing or survey.

(vi) When districts are designated, applicable design guidelines and other appropriate restrictions may be included as part of the designation.

(vii) In addition to meeting at least one of the criteria as outlined in subsection (f)(2)(viii) of this section, the designated contributing sites and structures within the district must be at least 50 years old. The district could be exempt from the age standard if the resources are found to be exceptionally important in other significant criteria.

(viii) Historic districts shall meet one or more of the following:

(A) Architectural.

a. Exemplifies specific elements of an architectural period or style;

b. Is an example of the work of an architect or builder who is recognized for expertise nationally, Statewide, regionally or locally;

c. Demonstrates superior craftsmanship or high artistic value;

d. Represents an innovation in construction, materials, or design;

e. Represents a built environment of a group of people in an era of history;

f. Is a pattern or a group of elements representing at least one of the above criteria; or

g. Is a significant historic remodel.

(B) Cultural.

a. Is the site of an historic event that had an effect upon society;

b. Exemplifies cultural, political, economic or social heritage of the community; or

c. Is associated with a notable person or the work of a notable person.

(C) Geographic/Environmental.

a. Enhances the sense of identity of the community; or

b. Is an established and familiar natural setting or visual feature of the community.

(D) Archaeology/Subsurface.

a. Has the potential to make an important contribution to the area's history or prehistory;

b. Is associated with an important event in the area's development;

c. Is associated with a notable person or the work of a notable person;

d. Has distinctive characteristics of a type, period or manner of construction;

e. Is of geographical importance;

f. Is a typical example/association with a particular ethnic group;

g. Is a typical example/association with a local cultural or economic activity; or

h. Is a unique example of an event or structure.

(g) Review of Alterations.

(1) City Registry. The owner of any historic structure or site on the City Registry designated pursuant to subsection (e) of this section is requested to consult with the Historic Board before making any alteration. The Historic Board shall determine if the alteration is compatible with the designation. In reviewing a proposed alteration, the Historic Board shall consider design, finish, material, scale, mass and height. When the subject site is in an historic district, the Historic Board must also find that the proposed development is visually compatible with development on adjacent properties, as well as any guidelines adopted as part of the given historic district designation. For the purposes of this section, the term "compatible" shall mean consistent with, harmonious with and/or enhances the mixture of complementary architectural styles either of the architecture of an individual structure or the character of the surrounding structures. The Historic Board shall use the following criteria to determine compatibility of a proposed alteration:

(i) The effect upon the general historical and architectural character of the structure and property;

(ii) The architectural style, arrangement, texture and material used on the existing and proposed structures and their relation and compatibility with other structures;

(iii) The size of the structure, its setbacks, its site, location, and the appropriateness thereof, when compared to existing structure and the site;

(iv) The compatibility of accessory structures and fences with the main structure on the site, and with other structures;

(v) The effects of the proposed work in creating, changing, destroying, or otherwise impacting the exterior architectural features of the structure upon which such work is done;

(vi) The condition of existing improvements and whether they are a hazard to public health and safety; or

(vii) The effects of the proposed work upon the protection, enhancement, perpetuation and use of the property.

(2) North Seventh Street Historic Residential District. The owner of any property within the North Seventh Street Historic Residential District shall comply with the North Seventh Street Historic Residential District Guidelines and Standards.

(i) Before making any construction or alteration to a site or structure, such owner shall make application to the City for a Certificate of Appropriateness. The Director shall make review such application for compliance with the Guidelines and Standards and make an initial determination and recommendation to the Board. The Director may include in that recommendation any conditions deemed appropriate to comply with the Guidelines and Standards and with the Zoning and Development Code.

(ii) The Board shall have jurisdiction to review City staff recommendations and to decide applications for Certificates of Appropriateness at a public hearing. The Board may include any conditions of approval deemed appropriate for compliance with the Guidelines and Standards. No owner shall construct or alter a structure or site in the District without first obtaining a Certificate of Appropriateness from the Board.

(iii) A decision of the Board may be appealed to City Council within 30 days of the issuance of the decision. Appeals to City Council shall be de novo.

(iv) All reviews pursuant to this subsection (2) shall determine if the new construction or alteration is compatible with the historic designation as provided in the North Seventh Street Historic Residential District Guidelines and Standards. In reviewing an application, consideration shall be given to design, siting, form, texture, setbacks, orientation, alignment, finish, material, scale, mass, height and overall visual compatibility, according to and with reference to the applicable Guidelines and Standards of the North Seventh Street Historic Residential District. For purposes of this section, the term "compatible" shall mean consistent with, harmonious with and/or enhancing the mixture of complementary architectural styles either of the architecture of an individual structure or the character of the surrounding structures.

(h) Revocation of Designation.

(1) If a building or special feature on a designated site has been altered in such a way so as to negate the features necessary to retain designation, the owner may apply to the Historic Board for a revocation of the designation or the Historic Board shall recommend revocation of the designation to the City Council in the absence of the owner's application to do so.

(2) If a designated structure is moved or demolished, the designation shall, without notice and without Historic Board recommendation, automatically terminate. If moved, a new application for designation at the new location must be made in order for designation to be considered.

(3) Upon the City Council's decision to revoke a designation, the Director shall cause a revocation notice to be sent to the property owner.

(Ord. 4815, 9-5-18; Ord. 4509, 3-21-12; Ord. 4419, 4-5-10)

Chapter 21.08

NONCONFORMITIES

Sections:
21.08.010 Nonconformities in general.
21.08.020 Nonconforming uses.
21.08.030 Nonconforming structures.
21.08.040 Nonconforming sites.
21.08.050 Nonconforming lots/parcels.

21.08.010 Nonconformities in general.

(a) Continuation. A nonconformity may be continued in accordance with the appropriate provisions in GJMC 21.08.020 through 21.08.050.

(b) Types of Nonconformity. There are several types of nonconformities that may exist, as follows:

(1) Nonconforming uses (see GJMC 21.08.020).

(2) Nonconforming structures (see GJMC 21.08.030).

(3) Nonconforming sites, including parking, landscaping and screening/buffering (see GJMC 21.08.040).

(4) Nonconforming lots (see GJMC 21.08.050).

(5) Nonconforming signs (see GJMC 21.06.070).

(c) Evidence of Status. Evidence of the status of a nonconforming use shall be supplied by the owner of the property upon request of the Director.

(d) Time Extensions. The Zoning Board of Appeals may permit one extension of up to 12 additional months to the time periods for abandonment, obtaining a building permit or completing construction, provided the applicant can demonstrate circumstances out of his or her control have prevented a good faith attempt to reestablish or rebuild the nonconforming use and/or structure. Such circumstances may include the health of the applicant, court proceedings, failure to reach an insurance settlement, acts of God, or similar hardships.

(e) Variance. The Zoning Board of Appeals may vary the provisions of GJMC 21.08.020 through 21.08.050. Application and processing shall be in accordance with the provisions of GJMC 21.02.200.

(Ord. 4419, 4-5-10)

21.08.020 Nonconforming uses.

(a) Continuation. A lawful use made nonconforming by the adoption of this code or other City ordinances may continue only for so long as such use is not abandoned, expanded, increased or changed, except as provided in this section.

(b) Nonresidential Uses.

(1) Expansion. In a nonresidential zone, on a parcel of land on which there exists an otherwise lawful nonconforming use, an existing structure and/or an outdoor operations/storage/display area may be expanded provided all other provisions of this code are met. Nonconforming use shall not be expanded in any residential zoning district.

(2) Change of Use. No use shall be changed to a conforming use until the Director has determined that the requirements of the zone district will be met. The Director may approve a different use, provided such use is deemed by the Director to be less intense than the existing use. Prior

to approval, the Director shall determine that traffic generation and parking requirements for the new nonconforming use are less than what was required for the existing use. No change to a more intense nonconforming use is allowed.

(3) Abandonment. A nonconforming use that has been discontinued for any 12-month period for whatever reason shall be considered to be abandoned and shall not be reestablished. Any use on the property after that time shall conform to all provisions of this code. Evidence of intent to abandon is not required.

(4) Destruction. A nonconforming nonresidential use that is damaged may be reestablished following approval by the Director in accordance with the following:

(i) A use may only be reestablished within a conforming structure.

(ii) All restorative and other work must conform to adopted building codes.

(iii) A building permit must be issued within two years from the date of the damage.

(iv) The certificate of occupancy (or other final inspection) must be issued as provided by adopted codes.

(c) Residential Uses. A "nonconforming residential use" is a structure which contains more dwellings than allowed by the zone or is a dwelling located in a nonresidential zone that does not permit residential uses.

(1) Expansion. In all zones, a residential use may be expanded by up to 20 percent of the gross floor area as it existed on April 5, 2010, if no additional dwelling units are created and all other provisions of this code are met. Accessory structures for a nonconforming residential use such as a garage or storage shed shall be allowed if the provisions of GJMC 21.04.040 are met. Accessory dwelling units shall not be permitted.

(2) Abandonment.

(i) A nonconforming residential use, other than a single-family dwelling, that has not been occupied for a continuous period of 12 months, for whatever reason, shall be considered to be abandoned and shall not be reoccupied except in conformance with all applicable provisions of this code. Evidence of intent to abandon the nonconforming use is not required.

(ii) A nonconforming single-family dwelling that has not been occupied for a continuous period of 12 months or longer shall not be considered to be abandoned and may be reoccupied at any time provided the structure has not been changed, legally or illegally, to a nonresidential use or multiple-unit residential use.

(iii) Removal of a nonconforming mobile home or manufactured home, not in a mobile home park, from its foundation or pad for a continuous period of 12 months shall constitute abandonment of the use and placement of a new unit must comply with the provisions of this code. Evidence of intent to abandon the nonconforming mobile home or manufactured home use is not required.

(3) Destruction. Nonconforming residential uses that are damaged may be reestablished in accordance with the following:

(i) All portions of the structure being restored are not and were not on or over a property line;

(ii) The number of dwelling units does not increase;

(iii) All construction is in compliance with current construction codes, such as the fire and building codes;

(iv) A building permit is obtained within one year from the date of the damage; and

(v) The certificate of occupancy (or other final inspection) is issued within two years of the issuance of the building permit.

(Ord. 4497, 2-1-12; Ord. 4419, 4-5-10)

21.08.030 Nonconforming structures.

(a) Continuation. A lawful structure as of April 5, 2010, that is nonconforming due solely to failure to meet the dimensional standards or performance standards pertaining to a structure and criteria of the underlying zone may be used for any purposes permitted in the zone so long as the use is in conformance with the provisions of this section.

(b) Maintenance and Restoration. A nonconforming structure may be maintained or restored provided no expansion of the nonconformity occurs. The cost of the maintenance, restoration or remodeling shall be as shown on the approved building permit application and the current fair market value of the existing structure shall be based on improvement value as determined by the Mesa County Assessor or an appraisal performed by a certified general appraiser licensed to do business in the State of Colorado utilizing the "cost" approach. This appraisal shall be performed at the applicant's expense. The Mesa County Assessor's appraisal may be used if not more than 12 months old.

(1) Maintenance, restoration or remodeling projects that cost 25 percent or less of the current fair market value of the structure shall not require any correction to existing nonconforming parking, landscaping or screening/buffering other than what may be required by fire and building codes.

(2) Maintenance, restoration or remodeling projects that cost more than 25 percent, but less than 75 percent, of the current fair market value of the structure shall require a corresponding percentage increase in compliance with the landscaping requirements of this code until the site achieves 100 percent compliance. For example, if a site has only 20 percent of the required landscaping and the cost of the remodeling is 30 percent of the value of the building, then 30 percent of the required landscaping shall be provided.

(3) Maintenance, restoration or remodeling projects that cost 76 percent or greater of the current fair market value of the structure shall require 100 percent compliance with the landscaping requirements of this code.

(4) Maintenance, restoration or remodeling projects that require an increase in landscaping shall have up to 24 months after the issuance of a certificate of occupancy (or other final inspection) to install the required landscaping and related improvements. A development improvements agreement (DIA) with financial security shall be required for the cost of all landscaping materials and improvements, including the irrigation system. See GJMC 21.02.070(m).

(5) Properties that are physically constrained from complying with these provisions shall comply to the maximum extent practical as determined by the Director using the following criteria:

(i) Is the general intent of the requirement being met by the applicant, such as landscaping along the site frontage, even if some of it is in the right-of-way?

(ii) Are there other upgrades, amenities, or public benefits being provided, such as upgrades to building facade, relocating landscaping on site, increasing plant sizes and/or planting density, public art, etc.?

(iii) Will the proposed deviation result in a safe, efficient condition?

(iv) What other alternatives have been considered that would meet the current standards?

(c) Expansion. A nonconforming structure may be expanded; provided, that no increase in the structural nonconformity occurs. For example, an addition may be constructed, provided it meets the dimensional requirements for the zone. If the expansion results in an expansion of the nonconforming use, then see GJMC 21.08.020.

(d) Destruction.

(1) A nonconforming residential structure which is damaged may be restored within the existing footprint; provided, that:

(i) All portions of the structure being restored are not on or over a property line;

(ii) All construction is in compliance with current construction codes, such as fire and building codes;

(iii) A building permit is obtained within 12 months from the date of the damage;

(iv) The certificate of occupancy (or other final inspection) is issued within one year of the issuance of the building permit.

(v) If damage exceeds 50 percent or more, restoration or improvement shall not be permitted unless the restoration results in a structure and site conforming to all applicable requirements of this code.

(2) A nonconforming nonresidential structure which is damaged to 50 percent or less of its fair market value, based on a market appraisal performed by a certified appraiser, may be restored within the existing footprint; provided, that:

(i) All portions of the structure being restored are not on or over a property line;

(ii) All construction is in compliance with current construction codes, such as fire and building codes;

(iii) A building permit is obtained within 12 months from the date of the damage;

(iv) The certificate of occupancy (or other final inspection) is issued within one year of the issuance of the building permit.

(v) If damage exceeds 50 percent or more, restoration or improvement shall not be permitted unless the restoration results in a structure and site conforming to all applicable requirements of this code.

(e) Signs. This section shall not apply to nonconforming signs (see sign regulations, GJMC 21.06.070).

(Ord. 4419, 4-5-10)

21.08.040 Nonconforming sites.

(a) Continuation. A parcel of land existing as of April 5, 2010, that is nonconforming due solely to failure to meet the parking, landscaping or screening/buffering standards may be used for any purposes permitted in the zone so long as the use is in conformance with the provisions of this section.

(b) Maintenance and Restoration. A nonconforming site may be maintained or restored provided no expansion of the nonconformity occurs, unless the expansion occurs in conformance with this section.

(c) Expansion. Additions to structures or additional paving, parking or outdoor storage on nonconforming sites shall require correction of existing nonconforming parking, landscaping and screening/buffering.

(1) Redevelopment or expansion which results in a 65 percent or greater increase of the gross square footage of the existing structure, outdoor operations/storage/display, paving or parking areas requires the entire property to meet all of the landscaping and screening/buffering

requirements of this code. The increase may be to only one of the gross square footage areas or a combination of increases of the gross square footage areas which result in an overall increase of 65 percent or greater. (For example, if the gross square footage area of the structure increases by 50 percent and the outdoor storage gross square footage area increases by 20 percent, then the overall increase is 70 percent and the entire property shall be required to meet all landscaping and screening/buffering requirements of this code.)

(2) Redevelopment or expansion which would result in less than a 65 percent increase of the gross square footage of the existing structure, outdoor operations/storage/display, paving or parking areas shall require a corresponding percentage increase in compliance for landscaping and screening/buffering requirements of this code until the site achieves 100 percent compliance. (For example, if the gross square footage area of the structure increases by 10 percent and the outdoor storage gross square footage area increases by 15 percent, then the overall increase is 25 percent and the site contains only 50 percent of the required landscaping, 25 percent of the required landscaping for the entire site must be provided, thereby bringing the site to 75 percent of the total required.) Existing landscaping on the site shall be retained or replaced but shall not count toward the required percentage of new landscaping.

(3) Redevelopment or expansion that necessitates an increase in the number of parking spaces shall be required to provide 50 percent of the required parking spaces for the additional floor area in accordance with this code. The additional parking area shall comply with all associated landscaping and drainage requirements of this code.

(4) The conversion of nonconforming commercial and/or residential structures and sites to condominiums shall not require that the site be brought into compliance with parking, lighting, and landscaping requirements of this code.

(5) Properties that are physically constrained from complying with these provisions shall comply to the maximum extent practicable as determined by the Director using the following criteria:

(i) Is the general intent of the requirement being met by the applicant, such as landscaping along the site frontage, even if some of it is in the right-of-way?

(ii) Are there other upgrades, amenities, or public benefits being provided, such as upgrades to building facade, relocating landscaping on site, increasing plant sizes and/or planting density, public art, etc.?

(iii) Will the proposed deviation result in a safe, efficient condition?

(iv) What other alternatives have been considered that would meet the current standards?

(d) Change of Use.

(1) Changes of use that necessitate an increase in the number of parking spaces shall be required to provide the difference between the required parking for the prior use and that required for the proposed use in accordance with this code. Where this calculation results in the addition of less than five spaces, no additional spaces shall be required. Any additional parking area shall comply with all associated landscaping and drainage requirements of this code.

(2) New outdoor operations/storage/display uses require that the entire lot or parcel meet all requirements of this code.

(e) Destruction.

(1) A nonconforming residential structure which is damaged may be restored within the existing footprint; provided, that: all portions of the structure being restored are not and were not on or over a property line; all construction is in compliance with current construction codes, such as the fire and building codes; a building permit is obtained within six months from the date of the damage; and the certificate of occupancy (or other final inspection) is issued within one year of the issuance of the building permit. If damage exceeds 50 percent or more, restoration

or improvement shall not be permitted unless the restoration results in a structure and site conforming to all applicable requirements of this code.

(2) A nonconforming nonresidential structure which is damaged to 50 percent or less of its fair market value, based on a market appraisal performed by a certified appraiser, may be restored within the existing footprint; provided, that: all portions of the structure being restored are not and were not on or over a property line; all construction is in compliance with current construction codes, such as the fire and building codes; a building permit is obtained within six months from the date of the damage; and the certificate of occupancy (or other final inspection) is issued within one year of the issuance of the building permit. If damage exceeds 50 percent or more, restoration or improvement shall not be permitted unless the restoration results in a structure and site conforming to all applicable requirements of this code.

(Ord. 4419, 4-5-10)

21.08.050 Nonconforming lots/parcels.

A lot or parcel of land with an area less than prescribed in the applicable zone may be used for any purpose permitted in the zone if:

(a) The owner is able to demonstrate to the satisfaction of the Director that the parcel was lawful at the time it was created; and

(b) The use meets all other regulations prescribed for the zone prior to occupancy or use.

(Ord. 4419, 4-5-10)

Chapter 21.09

ENFORCEMENT

Sections:
21.09.010 Director.
21.09.020 Inspection.
21.09.030 Code violations and enforcement.
21.09.040 Continuing violations.
21.09.050 Civil remedies and enforcement powers.
21.09.060 Criminal penalty.
21.09.070 Enforcement procedures.
21.09.080 Continued compliance.
21.09.090 Enforcement and revocation.

21.09.010 Director.

The Director may delegate the authority, duties and powers pursuant to this code.

(Ord. 4419, 4-5-10)

21.09.020 Inspection.

The Director may enter or inspect any building, structure, lot, parcel or property to ensure compliance with the provisions of this code. Such inspection shall be carried out during business hours unless the Director determines that an emergency exists. Entry onto those portions of private property which are not open to the public, business invites and others for the purpose of conducting the owner's business shall be made only after contact with the owner of the premises, whose permission for the inspection should be obtained. Application for any approval, development, or project constitutes permission to inspect all of the property including structures relating to the application. Failing permission from the owner, no inspection of private portions of property shall be undertaken without an order from the Municipal Court or another court of competent jurisdiction.

(Ord. 4419, 4-5-10)

21.09.030 Code violations and enforcement.

The remedies provided for violation of any provision of this code, City regulation or the code of ordinances, whether civil or criminal, shall be cumulative and be in addition to any other legal or equitable remedy. Except as otherwise provided, any development or use which is initiated or maintained or is not in compliance with the provisions of this code is prohibited and shall be an "unlawful" development or use.

(Ord. 4419, 4-5-10)

21.09.040 Continuing violations.

Each day that a violation of any provision of this code exists, occurs or remains uncorrected shall constitute a separate violation.

(Ord. 4419, 4-5-10)

21.09.050 Civil remedies and enforcement powers.

(a) Withhold Permit. The Director, for any unlawful use or development, may:

(1) Deny or withhold any permit, certificate or other form of authorization to use or develop any land, structure or improvements thereon. This provision shall apply regardless of whether the current owner or applicant is responsible for the violation.

(2) Revoke any development permit or other authorization when the Director determines:

(i) That there is departure from the plans, specifications or conditions as required under terms of the permit or other authorization;

(ii) That the development permit was procured by false representation or was issued by mistake; or

(iii) That any of the terms, conditions or provisions are being violated or reasonably believed to be violated. Written notice of revocation shall be served upon the owner, the owner's agent or contractor that such permit was issued to or notice may be posted in a conspicuous or prominent location at the place of violation.

(3) With or without revoking permits, stop work on a property where there is a violation of a provision of this code or of a permit or other form of authorization issued hereunder.

(4) Upon notice to the applicant the Director may petition the Planning Commission to, at public hearing, revoke the plan or other approval or condition its continuance on strict compliance with this code, the provision of a financial guarantee or other security to ensure that construction is completed in compliance with approved plans or such other conditions as the Planning Commission may reasonably impose.

(5) Initiate injunctive relief or abatement proceedings or other appropriate legal action in Municipal Court or another court of competent jurisdiction against any person who fails to comply with any provision of this code or any requirement or condition imposed pursuant to this code. The Director shall act to prevent, enjoin, abate or terminate violations.

(6) Seek a court order in the nature of mandamus, abatement, injunction prohibition or other action or proceeding to abate or remove a violation or to otherwise restore the premises in question to the condition in which they existed prior to the violation.

(b) Civil Penalty.

(1) Any person who fails to comply with any provision of this code shall be subject to a civil penalty of not less than $100.00 or more than $1,000 for each offense.

(2) Each day that a violation exists shall constitute a separate offense; however, the maximum civil penalty that may be imposed, even in circumstances where there are multiple and continuing offenses, shall be $10,000.

(3) Every such action shall be brought before the Municipal Court of the City. The Municipal Court shall have original jurisdiction to hear and decide such cases.

(4) The City is entitled to recover judgment against any person failing to comply with any provision of this code for reasonable attorney's fees in an amount determined by the Municipal Court.

(5) The City, its officers and employees may initiate an action under this section, but neither the City nor its officers or employees shall be liable for any claim or cause of action.

(c) Other Remedies. The City shall have such other powers and remedies as are and as may be provided by Colorado law for the violation of this or any duly and lawfully enacted code.

(d) Continuation. Nothing in this code shall prohibit the continuation of enforcement actions undertaken by the City pursuant to previous lawful and valid ordinances, laws, rules or regulations.

(Ord. 4419, 4-5-10)

21.09.060 Criminal penalty.

A violation of any provision of this code or any requirement or condition imposed pursuant to this code, including violations of standards and requirements adopted by reference, shall be a misdemeanor. Upon

conviction, any person found in violation shall be punished by a fine of not more than $1,000 or by imprisonment for not more than one year or by both fine and/or imprisonment, for each violation. Each person violating this code or any requirement or condition imposed pursuant to this code, whether the person directly commits the act or aids or abets the same, whether present or absent, may be prosecuted and punished as a principal.

(Ord. 4419, 4-5-10)

21.09.070 Enforcement procedures.

(a) Nonemergency Matters.

(1) For violations of this code that do not constitute an emergency, the Director shall give notice of the general nature of the violation to the property owner, agent, occupant or any applicant for any relevant permit in a manner reasonably calculated to afford notice.

(2) Enforcement action shall be stayed for a period of 10 days after notice, as provided in this section, has been posted on the property, mailed to the last known owner of the property or been hand delivered. Lack of personal notice shall not defeat any enforcement action.

(3) Notice may be given in person, by United States mail, or by posting notice on the premises.

(4) Notice of violation shall state the nature of the violation and the time period for compliance and may state the corrective steps necessary and the nature of subsequent penalties and enforcement actions should the situation not be corrected.

(5) Notices are deemed to run with the land and may be recorded by the Director in the Mesa County land records.

(6) Notices of violation are effective for 12 months from the date of issue.

(b) Emergency Matters. For violations of this code, actual or alleged, that constitute an emergency as determined by the Director, City Council, City Manager or declaration of the County, State or federal government, the City may use the enforcement powers available under this chapter without prior notice.

(Ord. 4419, 4-5-10)

21.09.080 Continued compliance.

Once constructed, the owner and developer shall be treated as an association (unless otherwise formed) and shall be liable for and responsible to maintain the development in substantial compliance with City regulations, approved plans and conditions. Failure to achieve substantial compliance including, but not limited to, the replacement of required plant materials that have died or are diseased, shall constitute a violation of this code and may be enforceable by the City in Municipal Court subject to the provisions of this chapter.

(Ord. 4419, 4-5-10)

21.09.090 Enforcement and revocation.

In accordance with the provisions of this chapter, the Director may revoke any permit for failure to comply with the conditions of the permit or failure to comply with any provision of this code, or if any information, statement or documents supplied by or on behalf of an applicant are false, misleading or omit any material fact or information.

(a) Revocation of Permit or Approval.

(1) Director Duties. If the Director determines there are one or more reasons to revoke a development permit or approval, he/she shall revoke such permit or approval. Any appeal of the

Director's decision shall be heard by the Zoning Board of Appeals in accordance with GJMC 21.02.210(b).

(2) Notice and Hearing. Notice and hearings for a revocation are the same as for the original application.

(3) Decision and Appeals. A decision to revoke a development permit shall become effective immediately. After revocation of any permit or approval, any activities continuing pursuant to such permit or approval shall be deemed to be in violation of the code.

(4) Right Cumulative. The Director's right to revoke any approval, development permit, or other privilege or right shall be cumulative to any other remedy.

(Ord. 4419, 4-5-10)

Chapter 21.10

DEFINITIONS

Sections:
21.10.010 Rules of construction.
21.10.020 Terms defined.

21.10.010 Rules of construction.

To help interpret and apply this code, the following rules shall apply:

(a) The particular controls the general;

(b) The text shall control if there is a difference of meaning or implication between the text and any caption or title;

(c) The words "shall" and "must" are always mandatory. The words "may" and "should" are permissive and are at the discretion of the decision-maker;

(d) Words used in the present tense include the future;

(e) Words in the singular include the plural;

(f) Words of one gender include all other genders, unless the context clearly indicates otherwise;

(g) Any term not herein defined shall be as defined elsewhere in the City code or, if not defined elsewhere in the City code, as defined in Webster's New International Dictionary, most recent edition;

(h) Unless otherwise indicated, the term "days" means calendar days, if the period of time referred to is more than 30 days. If the period of time referred to is less than 30 days, "days" means days when the City is open for business;

(i) If the last day of a submission date, period or other deadline is a Saturday, Sunday or a holiday recognized by the City, the period shall end on the last business day; and

(j) Use of words like "City Council," "Planning Commission," "Director," and "Engineer" includes City officials and staff.

(Ord. 4419, 4-5-10)

21.10.020 Terms defined.

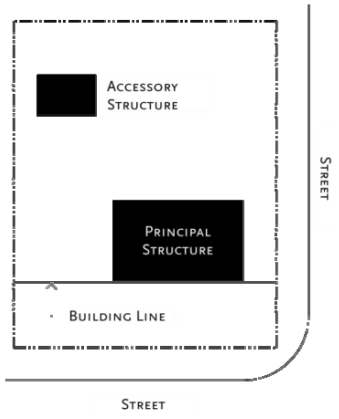
Abandonment means the relinquishment of property, or a cessation of the use of the property, by the owner or lessee without any intention of transferring rights to the property to another owner or of resuming the use of the property.

Abut/abutting means uses or parcels which directly touch. (Parcels across a public right-of-way would not be abutting, but would be adjacent.)

Access means a way or means of approach to provide vehicular or pedestrian physical entrance to a property.

Accessory dwelling unit means a dwelling unit which is secondary to a principal dwelling unit which may be attached to the principal structure or freestanding.

Accessory structure means a detached subordinate structure, the use of which is customarily incidental to, and supportive of, the principal structure or the principal use of land, and which is located on the same parcel of ground with the principal structure or use. (See graphic.)



Accessory use means the use of land or of a building customarily incidental to, subordinate to, and supportive of the principal use of the parcel.

Addition means:

(1) A structure added to the original structure at some time after certificate of occupancy has been issued for the original structure;

(2) An extension or increase in floor area or height of a building or structure.

Adjacent means property or use, any portion of which is within a 100-foot radius. Public right-of-way, easements, canals or waste ditches, and waterways are not counted when deciding if one property or use is adjacent to another.

Adjoin means a lot or parcel of land that shares all or part of a common lot line with another lot or parcel of land.

Administrative decision means any decision on a development application made by an authorized City employee pursuant to this code.

Adult day treatment center means a facility for the care of adults who require nursing or physical assistance and/or supervision during the day by licensed caregivers and staff.

Adult entertainment establishments. See GJMC 21.04.030(b)(5)(i).

Adult foster home means a residence for the care of persons who are unable to live alone in safety.

Adult material. See GJMC 21.04.030(b)(5)(ii).

Adverse impact means a condition that creates, imposes, aggravates, or leads to inadequate, impractical, unsafe, or unhealthy conditions on a site proposed for development or on off-tract property or facilities.

Aggrieved person means a person having suffered actual loss or injury or being exposed to potential loss or injury to legitimate interests including, but not limited to, business, economic, aesthetic, governmental, recreational, or conservation interests.

Agri-business means a business and/or commercial use operated primarily for the support of agricultural needs. Such use may consist of products, materials, and equipment servicing and sales; storage and/or processing of agricultural products and/or animals; medical and/or technical support services.

Agricultural animals. The following animals are considered agricultural animals to an agricultural use, whether used for personal enjoyment or for commercial purposes: horses, mules, burros, sheep, cattle, rabbits, chickens, ducks and geese.

Agricultural produce means fruit, vegetables, eggs and honey prior to processing of any kind other than washing. Canned fruits or vegetables, preserves, wine, meat and dairy products shall not be considered agricultural produce for the purposes of this code.

Airport environs. See GJMC 21.07.030.

Alley means a service road providing a secondary means of public access to abutting property and not intended for general traffic circulation.

Alterations means any proposed modification to a designated historic site, structure or district which could have an effect on the character of the historic resource relative to the criteria by which it was designated. Examples of alterations for structures may include additions, any exterior modifications, including signage to be affixed to the facade, and any interior modifications that may affect the characteristics for which the structure was designated.

Amateur radio means radio communications, which are licensed or regulated as such by the Federal Communications Commission, and are not subject to provisions of this code.

Amortization means a method of eliminating nonconforming uses by requiring the termination of the nonconforming use after a specified period of time.

Animal care, boarding, sales means a facility in which four or more animals of the same species are housed, groomed, bred, boarded, trained in return for compensation, or sold. Such facility may offer incidental medical treatment.

Animal clinic means a facility for the medical care and treatment of animals under the supervision of a licensed veterinarian with no outdoor accommodations for the temporary boarding of animals.

Animal hospital means a facility for the medical care and treatment of animals under the supervision of a licensed veterinarian with outdoor accommodations for the temporary boarding of animals.

Annexation means the incorporation of a land area into an existing community with a resulting change in the boundaries of that community.

Antenna means any device designed and intended for transmitting or receiving television, radio, microwave signals, or other electromagnetic waves. An antenna includes all mounting and stabilizing items such as a tower, a pole, a bracket, guy wires, hardware, connection equipment and related items.

Appeal means a request for a review of the Grand Junction Community Development Department's interpretation of any provisions of this code or a request for a variance therefrom.

Applicant means any person, firm, partnership, joint venture, association, corporation, group or organization applying for any permit, approval or decision governed or required by this code. "Developer" or "subdivider" may be used interchangeably.

Application means a written request for any approval, permit, or action required by this code. "Proposals" and "requests" are used interchangeably. An application is not complete until each requirement in this code is met and all fees are paid.

Appurtenances means the visible, functional, or ornamental objects accessory to and part of buildings.

Area of influence (airport) means an area surrounding an airport which is impacted or influenced by its proximity to the airport, either by aircraft overflight, noise, vibrations, or by vehicular traffic associated with airport operations.

Area of shallow flooding means a designated Zone AO or AH on the City's Flood Insurance Rate Map (FIRM) with a one percent chance or greater annual chance of flooding to an average depth of one to three feet where a clearly defined channel does not exist, where the path of flooding is unpredictable and where velocity flow may be evident. Such flooding is characterized by ponding or sheet flow.

Area of special flood hazard (also *floodplain*) means the land in the floodplain subject to a one percent or greater chance of flooding in any given year.

Automobile sales establishment and lots means an open area used for the display, sale or rental of new and/or used motor vehicles.

Average means, unless specified otherwise, the arithmetic mean.

Avigation easements limit construction and heights of vegetation, and grant the right of flight over the surface together with the right, subject to the applicable local, State, and federal laws (such as noise pollution laws), to cause noise, vibrations, smoke, fumes, glare, dust, fuel particles, and other effects of aircraft operations. (See GJMC 21.07.030(g).)

Bar means a premises used primarily for the sale or dispensing of alcoholic beverages by the drink for on-site consumption and where food may be available for consumption as an accessory use. An establishment that serves both food and alcoholic beverages shall be categorized as a bar if the sale of said beverages comprises more than 25 percent of the gross receipts.

Base flood means the flood having a one percent chance of being equaled or exceeded in any given year.

Base flood elevation (BFE) means the elevation shown on a FEMA Flood Insurance Rate Map for Zones AE, AH, A1-A30, AR, AR/A, AR/AE, AR/A1-A30, AR/AH, AR/AO, V1-V30, and VE that indicates the water surface elevation resulting from a flood that has a one percent chance of equaling or exceeding that level in any given year.

Basement means any area of a building having its floor subgrade (below ground level) on all sides.

Bed and breakfast means a house, or portion thereof, where short-term lodging rooms and meals are provided and where the operator of the house lives on the premises or in adjacent premises. A bed and breakfast is a type of short-term rental.

Berm means a mound of earth designed so that slope drainage is directed away from a paved area and sidewalks, which serve as a screen or bufferyard with landscaping (see GJMC 21.06.040(f)(2)). (See graphic.)

Block means a land area consisting of contiguous lots established by recorded plats, usually bordered by a combination of streets, public parks, cemeteries, railroad right-of-way, or other barrier to the continuity of development.

Block frontage means all property fronting on one side of a street between intersecting or intercepting streets, or between a street and a street right-of-way, waterway (wider than 30 feet), or end of a dead end street. An intercepting street shall determine only the boundary of the frontage of the side of the street which it intercepts.

Board, unless otherwise indicated in the text, shall refer to the Zoning Board of Appeals.

Buffering means the process of creating transition between zones by use of open spaces, landscaped areas, fences, walls, berms or any combination thereof used to physically separate or screen one use or property from another so as to visually shield or block noise, lights or other nuisances.

Bufferyard means a strip of land established to protect one type of land use from another land use or to provide screening. Normally, a bufferyard is landscaped and developed in open space areas.

Building means any structure used or intended for supporting or sheltering any use or occupancy. (See also *Structure*.)

Building design capacity means the maximum occupancy load of a building as provided by the most recent version of the International Building Code adopted by the City.

Building envelope means the three-dimensional space occupied by a building, including all eaves, covered porches, breezeways and other portions of the building, but excluding attached decorative walls which are less than or equal to three feet in height.

Building facade means that exterior side of a building which faces, and is most nearly parallel to, a public or private street.

Bulk standard means standards applying to individual lots that control the placement, intensity and character of development, including, but not limited to, the amount of open space on the lot, the height of structures, setbacks from property lines and public rights-of-way, impervious coverage and density.

Business residence means a single residential dwelling unit, accessory to and located within a structure primarily devoted to business or commercial uses (see GJMC 21.04.030(i)).

Caliper means the diameter of a tree trunk.

Campground, overnight means a campground located in urban areas or in close proximity to a major highway intending to serve the traveling public in need of overnight accommodation.

Campground, recreational means a campground located in close proximity to natural recreational areas and/or opportunities providing an outdoor living environment.

Camping guest means one or more persons assigned to a campsite.

Camping unit means a self-propelled or towed recreational vehicle, other vehicle used for temporary human occupancy, or a cabin, tent or other type of shelter intended, designed or used for temporary human occupancy.

> *Dependent camping unit* means a camping unit that has no toilet, sink or bathing facilities and is dependent upon a common building for these services.
>
> *Independent camping unit* means a camping unit that has toilet, sink and bathing facilities requiring connection to a water and/or sanitary sewer system at the individual campsite.

Campsite means any defined area which is used for overnight stays by an individual, a single camping family, group, or other similar entity.

Caretaker dwelling means a dwelling used as the residence for the persons who administer, care for and maintain a particular community service or recreational use, which dwelling is located on the site of that use.

Carport means a roofed structure providing space for the storage of one or more motor vehicles and enclosed on not more than two sides by walls.

Centerline means the true centerline of a street right-of-way that has been fully dedicated to the required width according to the master street plan.

Certificate of occupancy means as defined in the current International Building Code adopted by the City.

Change in use or *change of use* means a change from one principal use of a building or land to another principal use of the building or land.

Channel means a natural or artificial low lying area with definite bed and banks, which confines and conducts continuous or periodic flows of water.

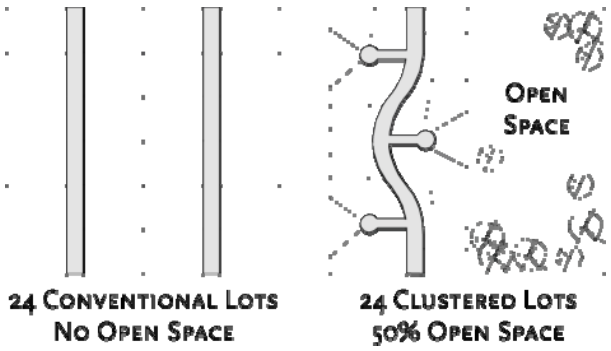
City means the City of Grand Junction.

Civic use means a municipal use that may include cultural, recreational, athletic, convention and entertainment facilities.

Clear zone (airport) means an area located directly off the end of an airport runway in which no above-ground construction or obstruction is permitted.

Cluster/clustered means a development that complies with the requirements, rules and design guidelines set forth in GJMC 21.03.060.

Cluster development means a development design technique that concentrates buildings in specific areas on a site to allow the remaining land to be used for recreation, common open space and preservation of environmentally sensitive areas. (See graphic.)



Code, unless otherwise specified, refers to the City of Grand Junction Zoning and Development Code, which is also referred to as GJMC Title 21.

Collector street means streets, as identified in the master street plan, which access neighborhoods and routes serving intra-city rather than intra-state travel.

Colocation means the location of wireless communications facilities on an existing structure, tower, or building in a manner so that an additional tower, structure or facility is not required.

Commercial vehicles shall include all vehicles that require the issuance of any of the following license plates by the State of Colorado: passenger bus plates; GVW truck and GVW tractor plates; farm trucks and farm tractor plates; special mobile machinery plates/tabs; special use vehicle plates; light truck plates; but shall not include the following: any vehicle issued any of the above license plates that otherwise would be issued passenger plates or recreational truck plates by the State of Colorado were the vehicle not used for commercial purposes; any pickup truck issued light truck plates with bed rails no higher than 30 inches from the floor of the bed; any van issued light truck plates whose basic design could serve as a passenger van and be issued passenger plates.

Commission means the City of Grand Junction's Planning Commission.

Common elements means land amenities, certain areas of buildings, such as lobbies, corridors and hallways, central services and utilities and any other elements and facilities owned and used by all owners and designated in the master deed as common elements.

Common open space means land within or related to a development, not individually owned or dedicated for public use, that is designed and intended for the common use or enjoyment of the residents and their guests of the development and may include such complementary structures and improvements as are necessary and appropriate.

Community corrections facility means:

(1) A facility providing residential or nonresidential services operated under the direction of a community corrections program, as defined by § 17-27-101 C.R.S. et seq.; or

(2) A facility providing residential or nonresidential services substantially similar to that described in § 17-27-102(3) C.R.S., although not being administered pursuant to § 17-27-101 C.R.S. et seq., which is operated by a private individual, partnership, corporation or association. A community corrections facility shall manage and supervise "offenders" in accordance with adopted standards and pursuant to a contract supervised and administered by an agency of the State of Colorado; such a facility is not required to be in direct privity of contract with the State so long as it is subject to the same, or equivalent, standards and rules applicable to a facility which is subject to § 17-27-101 C.R.S., et seq. The applicant for a community corrections facility which is not administered pursuant to § 17-27-101 C.R.S. et seq. shall identify, and provide as required by the Director, the rules and contract under which such facility is regulated and administered. A community corrections facility shall provide to the Director, upon request, evidence that the facility/program: is subject to "program audits" by the State, or an agent of the State; and is operating and has been operated in compliance with all applicable standards. "Offenders" means, for the purposes of this definition, persons accused or convicted of a felony, misdemeanor or other criminal offense.

Concealed or *stealth* means any tower or telecommunications facility which is designed to enhance compatibility with adjacent land, buildings, structures and uses, including, but not limited to, architecturally screened roof-mounted antennas, antennas integrated into architectural elements and towers designed to not look like a tower such as light poles, power poles and trees. The term "stealth" does not necessarily exclude the use of uncamouflaged lattice, guyed or monopole tower designs.

Concentrated fabrication (also *light and heavy fabrication*) is defined as the manufacturing from standardized parts of a distinct object differing from the individual components.

Concept plan means a generalized plan indicating the boundaries of a tract or tracts under common ownership, and identifying proposed land use, land use intensity and thoroughfare alignment.

Conditional letter of map revision (CLOMR) is FEMA's comment on a proposed project which does not revise an effective floodplain map that would upon construction affect the hydrologic or hydraulic characteristics of a flooding source and thus result in the modification of the existing regulatory floodplain.

Conditional use means a use identified by this code which requires action by the Planning Commission or City Council after public hearings. A conditional use means a use which, because of its unique or varying characteristics, cannot be properly classified as a permitted use in a particular district. After due consideration, as provided for in GJMC 21.02.110, of the impact upon neighboring land and of the public need for the particular use at a particular location, such conditional use may or may not be approved.

Condominium means as defined in § 38-33.3-103 C.R.S. or any successor statute.

Construction plan means complete construction drawings of a facility or improvement, including but not limited to road plans and profiles, drainage plans and utility plans.

Contiguous means next to, abutting, or touching and having a boundary, or portion thereof, that is coterminous.

Continuous commercial center means one structure with multiple separate uses.

Convalescent home means a building where persons reside and are provided with medical care designed to restore them to health.

Convey means to transfer all or a part of a title or equitable interest in land; to lease or assign an interest in land; or to transfer any other land interest.

Counseling center means a facility where individuals or small groups are provided professional counseling assistance with personal, emotional, marital, medical, or similar problems on an outpatient basis.

County means Mesa County.

Courtyard means an open area, unobstructed from the ground to the sky, that is bounded on at least three sides by the exterior walls of one or more buildings.

Crematory means an establishment for burning the bodies of deceased people/animals.

Critical facility means a structure or related infrastructure, but not the land on which it is situated, that if flooded may result in significant hazards to public health and safety or interrupt essential services and operations for the City at any time before, during and after a flood.

Critical zone (airport) means a rectangular-shaped zone located directly off the end of a runway's primary surface, which is critical to aircraft operations.

Cul-de-sac means a dead end street terminating in a vehicular turn around area.

Cultural facilities means establishments that document the social and religious structures and intellectual and artistic manifestations that characterize a society and include museums, art galleries, and botanical and zoological gardens of a natural, historic, educational, or cultural interest.

Curb face means the vertical or shaped portion of a curb, facing the roadway, and designed to direct stormwaters.

Daycare means an establishment providing for the care, supervision, and protection of children or adults for less than 24 hours.

Day-night sound level (Ldn). See GJMC 21.07.030.

Days, unless otherwise indicated, means calendar days, if the period of time referred to is more than 30 days. If the period of time referred to is less than 30 days, "days" means working days (days when the City is open for business).

Decorative wall means masonry or masonry with wood, with surface variations so that it is dissimilar from a plain cinderblock wall.

Dedication means the transfer of property by the owner to another party.

Deed means a legal document conveying ownership of real property.

Default standards, default zones means the underlying zone of a planned development (PD) zone district. The default zone shall be established with any PD zone. The standards for the default zone shall be used unless deviations were specifically approved within the PD zoning ordinance.

Density means the number of dwelling units per acre of land.

Density – maximum. *Maximum residential density* means the number calculated by dividing the total number of dwelling units or residential lots by the gross acreage expressed in square feet or acres of the development property. Gross land area includes all of the parcel or property at the time a development application is filed. The "gross residential density" is calculated the same as maximum residential density. See GJMC 21.03.030(j).

Density – minimum. This calculation shall apply to the term "net minimum residential density" as used in this code. *Minimum residential density* means the number calculated by dividing the total number of dwelling units or residential lots by the net developable land area of the development parcel. See GJMC 21.03.030(j).

Department means the Grand Junction Public Works and Planning Department.

Desert landscaping means the use of landscaping materials, both vegetative and nonvegetative, which are native to an arid or semiarid climate. (See *Water wise*.)

Design capacity means the maximum occupancy load of a building as defined and determined by the International Building Code (IBC).

Developer means a person, firm, partnership, joint venture, association, corporation, group or organization who shall participate as owner, promoter, developer or sales agent in the planning, platting, development, promotion, sale or lease of a development.

Development includes all property adjacent or abutting, whether or not to be then planned or developed, owned by the same owner. Includes any of the following: the division of a parcel of land into two or more parcels; the construction, reconstruction, conversion, structural alteration, relocation or enlargement of any structure; any mining, drilling, excavation, clearing of roadways or building sites, landfill or land disturbance and any use or extension of the use of land, the placement of a use on any property, or any planned development. *Development* does not include movement of earth associated with crops and/or farming or landscaping.

Development application means any request for approval, permission or other action made pursuant to the provisions of this code.

Development schedule/phasing schedule means regulating the rate and geographic sequence of development so as to ensure that each phase can stand on its own in terms of circulation, utilities, and so on, in the event subsequent phases are delayed or cancelled.

DIA means development improvements agreement.

Director. The administrator of the code shall be the Director of the Grand Junction Public Works and Planning Department and/or designated staff.

Disposition means a transfer of all or part of a title or equitable interest in land; a lease or an assignment of an interest in land; or any other transfer or conveyance of an interest in land.

District means same as *zone*.

Drive-in means facilities customarily providing parking spaces for the ordering, delivery, and consumption of a product or service in a parked vehicle.

Driveway means a private roadway providing access to a street or highway, excluding the sidewalk when parking vehicles in the driveway.

Dwelling unit means one or more rooms designed, occupied, or intended for occupancy as separate living quarters, with cooking, sleeping and sanitary facilities provided within the dwelling unit for the exclusive use of a single family maintaining a household.

Dwelling, multifamily means a building arranged, designed, and intended to be used for occupancy by three or more families living independently of each other and containing three or more dwelling units on the same or separate lots.

Dwelling, single-family, detached means a single-family dwelling which is not attached to any other dwelling or building by any means, on a single lot.

Dwelling, two-family means a building containing two single-family dwelling units on the same lot and separated by an unpierced common wall extending from ground to roof; or a single-family dwelling attached to only one other single-family dwelling unit by a common wall, with each dwelling located on separate lots.

Easement means an interest in land that is less than fee title which entitles the holder to a specific limited use or enjoyment.

Elderly or disabled persons housing, dependent means dwellings for long-term accommodation of persons who for any reason require on-going medical supervision or assistance with normal daily functions of living.

Elderly or disabled persons housing, independent means dwellings for long-term accommodation of elderly or disabled persons who do not require regular medical supervision or assistance with normal daily functions of living.

Elderly or disabled persons housing, semi-independent means dwellings for long-term accommodation of elderly or disabled persons who require periodic, but not daily, supervision or assistance with normal daily functions of living.

Eminent domain means the authority to acquire or take, or to authorize the taking of, private property for the public use or public purpose.

Engineer means an engineer licensed by the Colorado Board of Registration.

Equipment means rolling stock or movable personal property except that, for the purpose of this code, it shall not include those items defined as heavy equipment.

Evergreen means a plant with foliage that remains green year-round.

Evidence means any map, table, chart, contract or other document or testimony prepared or certified which is offered by a person to establish a claim, condition or assertion.

Exaction means contributions or payments required as an authorized recondition for receiving a development permit.

Existing manufactured home park or subdivision means a manufactured home park for which the construction of facilities serving the lots on which the manufactured homes are to be affixed are completed before the effective date of this code. See GJMC 21.04.030(f).

Exotic animals means those animals not defined as household pets or agricultural animals.

Expansion of existing manufactured home park or subdivision means the preparation of additional sites by the construction of facilities for servicing the lots on which the manufactured homes are to be affixed (including the installation of utilities, the construction of streets, and either final site grading or the pouring of concrete pads).

Extractive uses means surface and/or subsurface natural resources which may be extracted from the land. This includes exploratory drilling or mining but excludes individual water well drilling.

F.A.A. means the Federal Aviation Administration.

Facade means the exterior walls of a building exposed to public view or that wall viewed by persons not within the building.

Family means any number of related persons living together within a single dwelling unit as a single housekeeping unit, but not more than four persons who are unrelated by blood, marriage, guardianship or adoption.

Family foster home means a home which receives children for regular full-time care in a family home.

Farm and ranch structures and uses means those structures and uses devoted to the shelter and raising of livestock, poultry, feed, flowers, crops, field equipment or other agricultural items, with or without a dwelling unit.

Farmers' market means a structure or place where agricultural produce is brought for the purposes of retail sales. (Note: A farmers' market differs from a produce stand in that there may be more than one seller allowed per parcel of land and the structure from which produce is sold at a farmers' market need not be portable or capable of being dismantled or removed from the site.)

Feed lot means an area which is used for custom feeding of livestock where the owners of said livestock pay for yardage, feed and feed processing.

FEMA means the Federal Emergency Management Agency.

Fence means an artificially constructed barrier of any material or combination of materials, including walls but not retaining walls interior to the property, erected to enclose, screen, or separate areas. ("Material" does not include vegetation.)

Fenestration means the arrangement of windows and other exterior openings on a building.

F.I.A. means the Flood Insurance Administration.

Final plat means a survey map of record which indicates the boundaries for streets, blocks, lots and other property divisions which is prepared pursuant to GJMC 21.02.070(s).

Fire flow survey means a testing of fire hydrants to determine capacity by volume and pressure for firefighting purposes in accordance with the requirements of the City Fire Department.

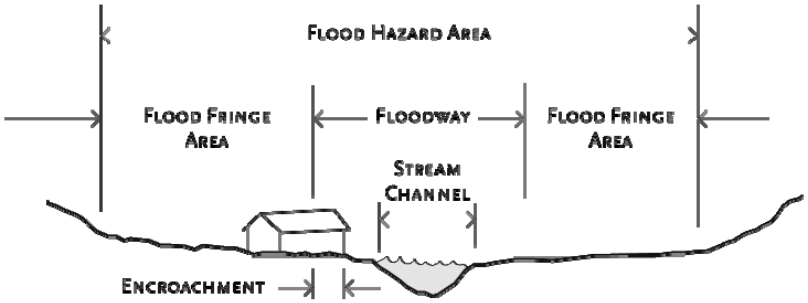
Five-hundred-year (500-year) flood means a flood having a recurrence interval that has a 0.2-percent chance of being equaled or exceeded during any given year (0.2-percent-chance annual flood).

Five-hundred-year (500-year) floodplain means an area of land susceptible to being inundated as a result of the occurrence of a 500-year flood.

Flashing sign means a sign which contains an intermittent or flashing light source or a sign which includes the illusion of intermittent or flashing light by means of animation or an externally mounted light source.

Flea market means a flea market, swap shop, or similar activity by whatever name, where the use involves the setting up of two or more booths, tables, platforms, racks, or similar display areas for the purpose of selling, buying, or trading merchandise, goods, materials, products, or other items offered for sale outside an enclosed building. Flea markets do not include any of the following activities which occur at the same location four or fewer days in any calendar year: garage sales, produce stands, garage sales or fund-raising activities done by a nonprofit organization.

Flood or *flooding* means a general and temporary condition of partial or complete inundation of normally dry land areas from:



(1) The overflow of inland waters; and/or

(2) The unusual and rapid accumulation or runoff of surface waters from any source. (See graphic.)

(3) Mudslides or mudflows that occur from excess surface water that is combined with mud or other debris that is sufficiently fluid so as to flow over the surface of normally dry land areas (such as earth carried by a current of water and deposited along the path of the current).

Flood control structure means a physical structure designed and built expressly or partially for the purpose of reducing, redirecting, or guiding flood flows along a particular waterway. These specialized flood modifying works are those constructed in conformance with sound engineering standards.

Flood fringe district means that area within a 100-year floodplain where the flood waters are relatively shallow, and move at velocities from one to four feet per second. (See graphic.)

Flood Insurance Rate Map (FIRM) means the official map on which the Federal Emergency Management Agency has delineated both the areas of special flood hazards and the risk premium zones.

Flood Insurance Study means the official report provided by the Federal Emergency Management Agency that includes profiles, the Flood Boundary-Floodway Map, and the water surface elevation of the base flood.

Floodplain means an area adjacent to a watercourse which may be subject to flooding as a result of an increase in water flow beyond a normal high water mark. (See graphic.)

Floodplain development means any manmade change to improved or unimproved real estate, including but not limited to buildings or other structures, mining, dredging, filling, grading, paving, excavation or drilling operations located within the area of special flood hazard. (See graphic.)

Flood profile means hydrological conclusions based upon historical facts and engineering principles represented graphically showing the relationship of the water surface elevation during a 100-year flood to the channel and adjacent topography.

Flood prone area means an area near a watercourse which is subject to flooding during a 100-year flood based on historical information, topography, vegetation and other indicators, but where the precise dimensions of a 100-year floodplain have not been delineated by Federal Emergency Management Agency studies. (See graphic.)

Floodproofing means a combination of provisions, changes or adjustments to structures and movable objects or to surrounding areas, primarily for the reduction or elimination of flood damage.

Flood regulatory area means that portion of the floodplain which is subject to inundation by a 100-year flood. This area may be divided into the floodway district and the flood fringe district. (See graphic.)

Floodway means the channel of a river or other water course and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than a designated height. The Colorado Statewide standard for the designated height to be used for all newly studied reaches shall be one-half foot (six inches). (See graphic.)

Foster child means a child who receives regular full-time care by a family in a family home.

Foster family means a family that provides regular full-time care to a foster child in the family home.

Foster parent means an adult who provides regular full-time care to a foster child in the family home.

Fraternity or sorority means a place of residence other than a hotel, rooming or boarding house or dormitory that is operated by a nationally or locally chartered membership organization and is used, occupied and maintained as living and dining quarters for its members who are enrolled in an accredited college or university or other accredited educational institution and which is recognized and subject to controls by such educational institution.

Freeboard means the vertical distance in feet above a predicted water surface elevation intended to provide a margin of safety to compensate for unknown factors that could contribute to flood heights greater than the height calculated for a selected size flood such as debris blockage of bridge openings and the increased runoff due to urbanization of the watershed.

Frontage. The frontage of a parcel of land is that distance where a property line is common with a road right-of-way line.

Front lot line means the property line dividing a lot from a road right-of-way.

Full cutoff light fixture means a light fixture in which no more than two and one-half percent of its total output is emitted above 90 degrees from the vertical pole or building wall on which it is mounted.

Funeral home/mortuary means an establishment with facilities for the preparation of the dead for burial or interment, including cremation, for the viewing of the body, and for funeral services.

Garage, public means a structure, or portion thereof, other than a private customer and employee garage or private residential garage, used primarily for the parking and storage of vehicles and available to the general public.

Gasoline service station means buildings and/or surfaced area where motor vehicles may be refueled and/or serviced.

Geologic hazard area means an area identified by a qualified State or federal government agency as containing or being directly affected by a geologic hazard.

GFA. See "*Gross floor area*."

Grade means the lowest point of elevation of the finished surface of the ground, paving or sidewalk within the area between the building and the property line or, when the property line is more than five feet from the building, the point between the building and a line five feet from the building.

Grade, finished means the level of the soil after completion of site development.

Grade, natural means the undisturbed ground level which may be determined by on-site evidence (vegetation, ground level on adjacent land, elevation of adjacent streets and roads, soil types and locations, etc.).

Grand Junction Circulation Plan (formerly known as Major Street Plan and Grand Valley Circulation Plan) means a plan or plans showing the location of right-of-way which will be developed and for which development and uses must accommodate. Plans for areas smaller than the entire City are still "Grand Valley Circulation Plans or Major Street Plans." The City relies on the authority in Title 31 C.R.S. in addition to its other powers and authority.

Granny flat, elder cottage and *accessory apartment* means a separate, self-contained living unit placed on the same parcel as and adjacent to the existing primary residence as a dwelling unit for a relative who is either over the age of 60 years or has a disability requiring an assisted, but independent, living arrangement. This definition also shall include an accessory apartment that is built onto or into an existing single-family dwelling unit for the same purpose. Such units are small, complete living units which have a living area, kitchen, bathroom and separate entrance.

Greenhouse. See *Nursery-greenhouse*.

Gross acre means a full acre of land prior to subdivision and prior to dedication of any required rights-of-way or easements.

Gross acreage means the area of a proposed development, including proposed dedications of easements, rights-of-way or other property rights, but excluding existing rights-of-way dedicated prior to January 1, 1995.

Gross floor area (GFA) means the sum of the areas of all floor levels of a building or structure measured within the exterior face of exterior walls or the centerline of walls separating two abutting buildings, but excluding any space where floor-to-ceiling height is less than 6.5 feet.

Gross leasable area (GLA) means the total building area, expressed in square feet and designed for tenant occupancy and exclusive use, including any basements, mezzanines, or upper floors, as measured from exterior walls or the centerline of walls separating two abutting buildings, but excluding any space where floor-to-ceiling height is less than 6.5 feet.

Ground cover means grass or other plants and landscaping grown to keep soil from being blown or washed away.

Ground subsidence means a process characterized by the downward displacement of surface material caused by phenomena such as removal of underground fluids, natural consolidation, or dissolution of underground minerals or by manmade phenomena such as underground mining.

Ground story means the story closest to and above grade along the street.

Ground water means subsurface water within and below the zone of continuous saturation.

Group living facility, large means a group living facility with 10 to 16 residents.

Group living facility, small means a group living facility with up to nine residents.

Group living facility, unlimited means a group living facility with 17 or more residents.

Group living, other means housing where unrelated persons live together in a single dwelling unit in a multi-unit complex with common access to and common use of some living and eating areas and areas and facilities for the preparation and serving of food within the dwelling unit; and may include, by way of example and not limitation, dormitory style living.

Guest ranch means a working ranch with an accessory use for the lodging and/or boarding of guests which provides recreational activities on, or adjacent to, the ranch.

Hardscape means stone, brick, rock, sand, textured or shaped concrete, decorative walls and/or pedestrian facilities (i.e., benches, tables, play equipment, walking or bike paths).

Hazard prone area means an area which has not yet been designated by the State or federal government as a geological hazard area but where historical evidence, climatological data, surface or subsurface geological, topographical, vegetative, or other on-site naturally occurring factors indicate a relatively greater risk of property damage than exists on other parcels in the City.

Hazardous substance means any material that, by reason of its toxic, corrosive, caustic, abrasive or otherwise injurious properties, may be detrimental or deleterious to the health of any person handling or otherwise coming into contact with such material or substance.

Headwater means the source of a stream or river.

Health club means an establishment that provides facilities for exercise activities, such as running, jogging, aerobics, weight lifting, court sports and swimming, as well as locker rooms, showers, massage rooms, saunas and related accessory uses.

Health Department means the Mesa County Health Department.

Heavy equipment means large equipment including, but not limited to: trucks with greater than a one and one-half ton rating, cranes, crawler type tractors, earth movers, dump trucks and other equipment of equal or greater size and weight.

Hedge vegetation means a plant from the list approved by the City Forester which will grow, with regular trimming, to a height of four to six feet maximum. At planting, the hedge shall be at least one foot high.

Height of structure means the vertical distance from the grade to the highest point of any portion of a structure. See GJMC 21.03.030(f).

Helipad means a facility without the logistical support provided by a heliport (see *heliport*) where helicopters takeoff and land. Helipads do not include facilities for maintenance, repair, fueling or storage of helicopters.

Heliport means an area providing an area for the takeoff and landing of helicopters and fuel facilities (whether fixed or mobile) or appurtenant areas for parking, maintenance, and repair of helicopters.

Highest adjacent grade means the highest natural elevation of the ground surface prior to construction next to the proposed wall of a structure.

High water mark means the ordinary high water level or bank of a stream, river, lake or impoundment which, in the absence of evidence to the contrary, shall be presumed to be the edge of the vegetation growing along the shore.

Hillside disturbance includes any and all areas of the building site disturbed during construction by grading or excavation and temporary or permanent construction for all buildings, parking areas, driveways, roads, sidewalks, and other areas of concrete, asphalt, or other construction materials.

Homeless shelter means a structure or portion thereof in which sleeping accommodations are provided for the homeless for less than six months. A homeless shelter shall be classified as "lodging."

Home occupation means a business activity conducted as an accessory use to a dwelling unit. See GJMC 21.04.040(g).

Homeowners' association means a formally constituted nonprofit association made up of the property owners and/or residents of a fixed area, which association is formed for the purpose of assuming permanent responsibility for costs and upkeep of common areas, open space and similar shared facilities.

Hospital means any building used for overnight accommodation and medical care of human patients including sanitariums, but excluding clinics, long-term care facilities and convalescent homes.

Household or *household living* means a family, or a group of not more than four unrelated persons, living together in a single dwelling unit, with common access to and common use of all living and eating areas and all areas and facilities for the preparation and serving of food within the dwelling unit.

Household pets means those animals which are commonly kept as pets: dogs, cats, fish, small birds (e.g., parakeets, parrots), rodents (e.g., mice, rats), and reptiles (nonpoisonous snakes, lizards).

Impact fee means a fee imposed on a development to help finance the cost of improvements or services.

Impervious surface means any material that prevents absorption of stormwater into the ground.

Impound lot means a lot for the storage of vehicles which have been towed or otherwise moved to the lot by a towing carrier permitted to operate pursuant to § 40-13-101 C.R.S. et seq., in which lot no vehicle dismantling or repair work occurs.

Improvements means right-of-way pavements, curbs, gutters, sidewalks, paths, trails, bikeways, sedimentation control facilities, revegetation, landscaping, water mains, sanitary and storm sewers, drainageways, gas lines, electrical and telephone lines and appurtenances, street signs, trees and lights, lot pin monuments, range point boxes, and any other similar items required for compliance with the regulations of this code or the conditions of approval.

Infill development means the development of new housing or other buildings on scattered sites in a built-up area.

Infrastructure means facilities and services needed to sustain industry, residential, commercial and all other land use activities.

Integral units means items, equipment, or machinery which are assembled or constructed to function as a single unit, such as, but not limited to, large cranes, drilling rigs or other large vehicles, large diameter pipes or culverts, large scale motors or transformers, etc., or, in the case of salvage or junkyards, shelving or other storage units, not to exceed 20 feet in height, which are used to store and display salvage items.

Irrigation or *irrigate* means use of water, whether or not potable, to sustain or grow landscaping or flora.

Junk means ferrous or nonferrous metals, wood or wood products, appliances not used for their intended purposes, rubber or plastic products, dismantled or inoperable machinery, equipment, tools, junk vehicles, trash or similar materials. The term *junk* excludes outside storage permitted as an accessory use under the provisions of GJMC 21.04.040.

Junk vehicle means any motor vehicle, trailer, or semitrailer, as those terms are defined by § 42-1-102 C.R.S. that: is not operable in its existing condition because of damage or because parts necessary for operation such as, but not limited to, tires, engine, or drive train, are removed, destroyed, damaged, or deteriorated; or, is not capable of being lawfully driven on a public highway or street pursuant to the minimum standards set forth in Title 42 of the Colorado Revised Statutes. Any such motor vehicle, trailer, or semitrailer shall be presumed to be a junk vehicle if no current Colorado license plates are displayed thereon, or if Colorado license plates have been invalid for more than 60 days. (Note: The owner or possessor of such a motor vehicle, trailer, or semitrailer may rebut such a presumption by providing proof of current registration or licensing (see *Motor vehicle repair shop*).)

Junkyard means any yard, lot, land, parcel, building or structure, or part thereof, used for storage, collection, processing, purchase, sale, salvage or disposal of used or scrap materials, equipment, vehicles or appliances. Junkyards include, but are not limited to, wrecking yards, salvage yards and automobile impoundment areas where stored vehicles are inoperative or unlicensed. Junkyards do not include storage of vehicles used for agricultural purposes on a property used for agricultural purposes, or facilities qualifying as motor vehicle repair shops.

Jurisdiction means the sphere of responsibility of the Grand Junction City Council or a political subdivision of the State.

Land use means a list of uses within categories enumerated in this code for various uses of land in the City.

Land reclamation means increasing land use capability by changing the land's character or environment through drainage and/or fill.

Landlocked parcel means a parcel of land without access of record with the County Clerk and Recorder.

Landscape means an area set aside from structures and parking which is developed with natural materials (i.e., lawns, trees, shrubs, vines, hedges, bedding plants, rock) and decorative features, including paving materials, walls, fences and street furniture.

Lateral sewer means a sewer which discharges into a trunk line and has only collection lines tributary to it. A line from a structure or use which discharges into a collection line is not a lateral.

Ldn contour. See GJMC 21.07.030.

Leasehold interest means a contractual agreement for a possessory estate for the use of lands, structures, buildings or parts thereof for a fixed time and consideration.

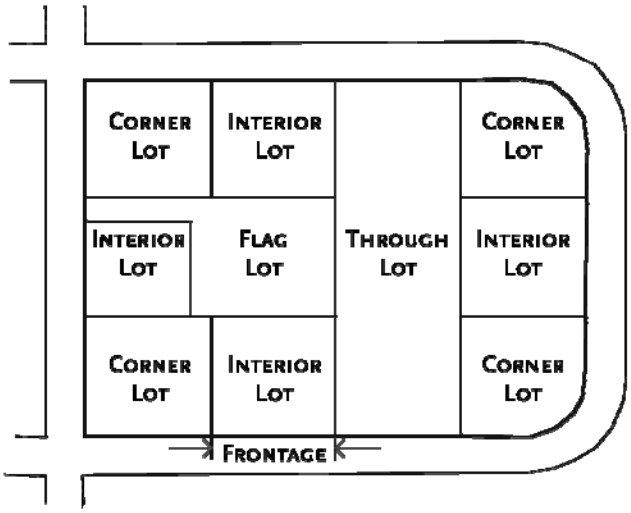
Lighting means an artificial supply of light or the apparatus providing it.

Loading space means an off-street portion of a parcel for the temporary parking of commercial vehicles while loading or unloading materials for use or sale on the parcel. This space shall open onto a street or alley, and any use of the space shall not obstruct pedestrian or vehicular traffic upon the street or alley.

Local road or street provides direct access to adjacent land and access to higher street classifications. All streets or roads not otherwise classified are local.

Lodge means a structure providing lodging or boarding for guests, located in close proximity to natural recreational areas and/or opportunities.

Lot means a parcel of land that is defined on a subdivision plat of record, which is intended to be occupied by a principal building or building and open space. Streets are not included in this definition. (See graphic.)



Lot area. The area of the lot shall be the horizontal area of the lot and shall not include portions of streets and alleys.

Lot, corner means a lot abutting upon two or more intersecting streets. (See graphic.)

Lot coverage means that area of the lot or parcel which may be occupied by principal and accessory structures.

Lot depth means the horizontal distance from the front property line to the rear property line. If front and rear property lines are not parallel, the lot depth is the shortest distance between the front and rear property lines.

Lot, double frontage (through lot) means an interior lot having frontage on two nonintersecting streets.

Lot, flag means a lot having no frontage or access to a street or place except by a narrow strip of land.

Lot frontage means the distance for which a lot abuts on a street.

Lot, interior means a lot whose side lines do not abut on any street.

Lot line means a line of record bounding a lot which divides one lot from another lot or from a public or private street or any other public space.

Lot width means the horizontal distance measured at the front yard setback line between side property lines measured parallel to the street, said property lines or to the tangent of a curved street property line. If side property lines are not parallel, the lot width is the shortest distance between the side property lines.

Low traffic storage yard means an enclosed outdoor storage area generating less than 30 average daily trips (30 ADT).

Lowest floor means the lowest floor of the lowest enclosed area (including basement). An unfinished or flood resistant enclosure, usable solely for parking of vehicles, building access or storage, in an area other than a basement area, is not considered a building's lowest floor; provided, that such enclosure is not built so as to render the structure in violation of the applicable nonelevation design requirements of this code.

Machine shop means a structure containing machinery for the manufacture, modification or repair of metal goods and motor vehicle equipment. This use does not include the dismantling of motor vehicle parts and equipment.

Maintain means to use, to keep in existence. To continue upkeep is not required to meet the definition of "maintain."

Major shopping center means a group of retail and service establishments which are planned and managed as a total entity, and which includes more than 250,000 square feet of gross leasable floor area.

Major subdivision means a subdivision consisting of two or more proposed new lots.

Manufactured home means factory-built, single-family structures that meet the National Manufactured Home Construction and Safety Standards Act (42 U.S.C. Section 5401 et seq.), commonly known as the HUD (U.S. Department of Housing and Urban Development) Code.

Manufactured home park means a parcel of land used for the continuous accommodation of five or more occupied manufactured homes and operated for the pecuniary benefit of the owner of the parcel of land, his agents, lessees, or assignees. A manufactured home park does not include manufactured home subdivisions or property zoned for manufactured home subdivisions.

Manufactured home subdivision means a parcel or contiguous parcels of land subdivided into two or more lots configured for development of manufactured housing.

Manufactured housing means a manufactured structure designed for residential occupancy that conforms to all applicable federal construction and safety standards certifications (42 U.S.C. Section 5401 et seq.). Construction and safety certification shall be affixed in the original and permanent condition and shall not be removed.

Master plan means a long-range plan for major institutional and civic facilities that considers community benefits and impacts.

Master Street Plan (now known as the *Grand Junction Circulation Plan*) means the plan or components of the plan adopted by the City of Grand Junction showing the existing and future layout and classifications of streets within the City.

Material Safety Data Sheet (MSDS) means a form with data regarding the properties of a particular substance. An important component of product stewardship and workplace safety, it is intended to provide workers and emergency personnel with procedures for handling or working with that substance in a safe manner, and includes information such as physical data (melting point, boiling point, flash point, etc.), toxicity, health effects, first aid, reactivity, storage, disposal, protective equipment, and spill-handling procedures.

Medical treatment means health care facilities as well as establishments providing support to the medical profession and patients, such as medical and dental laboratories, blood banks, oxygen, and miscellaneous types of medical supplies and services.

Membership club means an organization with established formal membership requirements, bylaws and objectives, but not including groups organized primarily to provide profit for the club or any of its members.

Mini-warehouse means a structure containing separate, individual, and private storage spaces of varying sizes, leased or rented on individual leases for varying periods of time.

Minor arterial means a street, as identified in the Grand Junction Circulation Plan, which has a relatively high overall travel speed, with minimal interference and which interconnects with the principal arterial system.

Mitigation means methods used to alleviate or lessen the impact of development.

Mobile home means a single-family dwelling, factory-built and factory-assembled residence which does not comply with the National Manufactured Homes Construction Safety and Standards Act. (42 U.S.C. Section 5401 et seq., 1978, as amended).

Motor home means a vehicular designed unit built on, or permanently attached to, a self-propelled vehicle chassis, van, or chassis cab, which is an integral part of the complete vehicle, to provide temporary living quarters for recreational, camping, or travel use.

Motor vehicle repair shop means a shop or place of business used for the repair and maintenance of motor vehicles and other motor vehicle equipment as defined in § 42-1-102 C.R.S. The owner of all motor vehicle equipment on the property shall have a valid registration, have a registration or title applied for, or show a work order. Motor vehicle equipment for which the shop operator holds no valid registration or work order shall be classified as junk and shall not be kept, stored or worked on, in or on the property of a motor vehicle repair shop.

Mudflow means a flowing mass of predominantly fine grained earth material possessing a high degree of fluidity during movement.

Mulch means wood chips, bark, rock or other accepted material placed around plants to assist in moisture retention and weed prevention.

Municipality means an incorporated city or town.

Natural hazard means a geologic, floodplain, or wildfire hazard as identified by a State or federal agency.

Natural resource means existing natural elements relating to land, water, air, plant and animal life, including, but not limited to, soils, geology, topography, surface and subsurface waters, wetlands, vegetation and animal habitats.

Neighborhood means an area of a community with characteristics that distinguish it from other areas and that may include distinct ethnic or economic characteristics, housing types, schools, or boundaries defined by physical barriers, such as major highways and railroads or natural features, such as rivers. (Note: Historically, the neighborhood was defined as the area served by an elementary school, with shopping and recreation facilities to serve neighborhood residents. While the description is probably dated, the neighborhood designation is useful in analyzing the adequacy of facilities and services and in identifying factors affecting the quality of the built environment. In addition, as a distinct and identifiable area, often with its own name, neighborhoods are recognized as fostering community spirit and a sense of place, factors recognized as important in community planning.) Or: That area with definite boundaries as determined by the Director on a case-by-case basis to meet the intent and purpose of the code.

Neighborhood association means any group that has been recognized by the Community Development Department or has registered with the Community Development Department the boundaries of a particular area with which it is related and which the association represents.

Neighboring means any first or second lot in either direction along the same side of the street from the subject lot, or any lot that fronts directly across from the subject lot or first or second lot adjacent thereto.

Net floor area means the square footage of the primary use area of a building including restrooms, hallways and stairwells, but not including normally unoccupied areas such as garages, storage rooms, furnace areas, etc.

New construction means, for purposes of GJMC 21.07.010, Flood damage prevention, structures for which the "start of construction" commenced on or after the effective date of the ordinance enacting GJMC 21.07.010, and includes any subsequent improvements to such structures.

New manufactured home park or subdivision means a manufactured home park or subdivision for which the construction of facilities for servicing the lots on which the manufactured homes are to be affixed (including at a minimum, the installation of utilities, the construction of streets, and either final site grading or the pouring of concrete pads) is completed on or after the effective date of the ordinance enacting GJMC 21.07.010, Flood damage prevention.

Night club means a commercial establishment dispensing alcoholic beverages for consumption on the premises and in which music, dancing or live entertainment is conducted. An establishment that serves both food and alcoholic beverages shall be categorized as a bar/nightclub if the sale of said beverages comprises more than 25 percent of the gross receipts.

Node means an identifiable grouping of uses subsidiary and dependent upon a larger urban grouping of similar or related uses.

Nonconforming means a legal use, structure, and/or development which existed prior to the adoption of this code or any amendment thereto, which does not presently conform to this code or its amendments.

Nonconforming structure or building means a structure or building, the size, dimensions, or location of which was lawful prior to the adoption, revision, or amendment to the zoning ordinance but that fails by reason of such adoption, revision, or amendment to conform to the present requirements of the zoning district.

Nonconforming use means a use or activity that was lawful prior to the adoption, revision or amendment of the zoning ordinance but that fails by reason of such adoption, revision, or amendment to conform to the present requirements of the zoning district.

Nonprofit means organizations having 501(c)(3) filing status with the Internal Revenue Service.

No-rise certification is a record of the results of an engineering analysis conducted to determine whether a project will increase flood heights in a floodway. A no-rise certification must be supported by technical data and signed by a registered Colorado professional engineer.

Notice means the method of informing persons of requests, hearings, actions taken and similar actions. The form and specifics of notice will vary depending on the application, step and other factors.

Nursery means a place where plants are raised, acquired, and maintained for transplanting or sale.

Nursery/greenhouse/landscaping materials means a place where plants are raised, acquired, and maintained for transplanting or sale. It may also include, either exclusively or in conjunction with the above activities, the sale of materials commonly used for landscaping purposes, such as soil, rock, bark, mulch and other materials determined by the Director to be landscaping materials. Sale or rental of small landscaping tools and supplies may be an accessory use.

Nursery school/preschool/day care means a school and/or care facility which is licensed by the State and is maintained for the whole, or part of, the day for more than six children.

Nursing home means an establishment licensed by the State which maintains and operates, for compensation, continuous day and night facilities providing room and board, personal services, and medical care for two or more persons not related to the operator of the home.

Obstruction (relating to floodplains) means a dam, wall, embankment, levee, dike, pile, abutment, projection, excavation, channel rectification, culvert, building, fence, stockpile, refuse, fill, structure or material, in, along, across, or projecting into any drainageway, channel, or watercourse, which might impede, retard or change the direction of the flow of water, either by itself or by catching and collecting debris carried by the water, or which is placed where the 100-year flood may carry the debris downstream.

Off-site improvement means improvements required to be made off site as a result of an application for development and including, but not limited to, road widening and upgrading, stormwater facilities and traffic improvements.

Off-site parking means parking provided for a specific use, but located on a site other than the one on which the specific use is located.

Off-street parking space means the space required to park one vehicle, exclusive of access drives, and not on a public right-of-way.

One-hundred-year (100-year) flood means a flood having a recurrence interval that has a one percent chance of being equaled or exceeded during any given year (one-percent-annual-chance flood).

One-hundred-year (100-year) floodplain means the area of land susceptible to being inundated as a result of the occurrence of a 100-year flood, including the low land near a watercourse which has been, or may be, covered by water of a flood of 100-year frequency, as established by engineering practices of the U.S. Army Corps of Engineers and/or the Colorado Water Conservation Board.

Open mining means the mining of natural mineral deposits by removing the overburden lying above such deposits and mining directly from the deposits exposed. The term includes, but is not limited to, such practices as open cut mining, open pit mining, strip mining, quarrying and dredging.

Open space means any property or portion without any structure or impervious surface and not designated and used for a specific purpose.

Open space, common means open space within a development that is owned in common by a homeowners' association and which is designed and intended for the common use or enjoyment of the residents or occupants of the development. Common open space does not include areas used for streets, alleys, driveways or off-street parking or loading areas. However, the area of recreational activities such as swimming pools, tennis courts and other recreation facilities may be counted as common open space.

Open space fee means a fee paid by the developer of a new residential development to the City for the purpose of acquisition and development of open space.

Other animals means those animals not already defined as household pets or agricultural animals.

Outdoor cultural events means entertainment, educational and cultural events generally involving the outdoor assembly of 50 or more people.

Outdoor living area means any property or portion thereof which is permanently set aside for public or private use, is landscaped with living plant material (a minimum of 75 percent coverage), and will not be further developed. The area can include landscape buffers. The area calculation excludes detention areas, parking areas, and driveways.

Outdoor storage means the keeping, in an unenclosed area, unscreened, of any goods, junk, material, merchandise, vehicles and vehicles for repair, in the same place for more than 48 hours. See GJMC 21.04.040(h).

Outline development plan (ODP). An ODP is required for a planned development. The purpose of an ODP is to demonstrate conformance with the Comprehensive Plan in addition to the approval criteria in GJMC 21.02.150(b)(2).

Overburden means all the earth and other materials which lie above natural mineral deposits or materials disturbed from their natural state in the process of mining and/or other development.

Overflow parking means any off-street, ground level open area used for the temporary storage of excess motor vehicles.

Overlay district means a zoning district which has been superimposed over basic districts to address development constraints which require special attention and treatment and to alert developers to issues they need to address in preparing an application for development.

Owner means an individual, firm, association, syndicate, partnership, or corporation having sufficient proprietary interest to seek development of land.

Parcel means an area of land defined by a legal description and recorded with the County Clerk and Recorder.

Park impact fee means a fee paid by the developer of a new residential development to the City for the purpose of acquisition and development of park facilities.

Parking garage means an attached or detached building which is intended for the storage of motor vehicles and is available for use by the general public for free or for a fee.

Parkway strip means the undeveloped portion of right-of-way between the back of curb and the detached sidewalk.

Pedestrian right-of-way means a right-of-way or easement dedicated for public pedestrian access.

Persigo Agreement means the agreement between the City of Grand Junction and Mesa County, signed on October 13, 1998, setting forth the agreed upon boundaries of the 201 Sewer District and how development and annexation shall occur within those boundaries.

Person means natural persons as well as any other entity recognized by law, including: association, partnership, corporation, and joint venture, whether for-profit or nonprofit.

Pervious surface means any material that permits full or partial absorption of stormwater into previously unimproved land.

Petitioner means an applicant.

Pharmacy means a building, or part of a building, used for the dispensing of medicines or medical supplies only.

Phasing means development undertaken in a logical time and geographical sequence.

Planned development (PD) means an area of land zoned and improved as a development for which the otherwise applicable bulk use and other requirements may be modified in order to allow for more flexible planning in conformance with the development approval process.

Planning clearance means a permit that allows development to proceed, a use to be made or maintained or improvements, including structures to be built.

Planning Commission means the City of Grand Junction's Planning Commission. Also referred to as *Commission*.

Plat means a map approved by the City which creates lots or tracts and is recorded, surveyed and legally described land, having appropriate dedication and/or restrictions, which is an instrument for recording of real estate interests with the Mesa County Clerk and Recorder's office.

Plat, final means a map of all or a portion of a subdivision or site plan that is presented to the approving authority for final approval.

Portable sign. See *Sign, portable*.

Preliminary plan means the map or maps of a proposed development and supporting materials which permit the evaluation of the proposal prior to final detailed engineering and design.

Preliminary subdivision plan means a map indicating the proposed layout of the subdivision or site plan that is submitted to the approving authority for preliminary approval.

Principal arterial means a street, as identified in the Grand Junction Circulation Plan, which provides a network of continuous routes serving intrastate and interstate travel as well as interurban and intraurban travel.

Principal structure means the structure in which the principal use of a property is conducted. This shall include any buildings which are attached to the principal structure by a covered structure.

Principal use means the main or primary use of a parcel of land.

Private means anything not owned or operated by the federal government, State government, or any political subdivision.

Produce stand means a temporary open air stand or place for the seasonal selling of agricultural produce. A produce stand must be portable and capable of being dismantled or removed from the sales site. (See also *Farmers' market*.)

Professional office means an office of a member of a recognized profession maintained for the conduct of that profession and not including storage or sale of merchandise as a primary use.

Projection means the distance by which a sign extends over public property.

Property means a lot, parcel, tract or other real estate. Separate parcels, lots, tracts and/or other real estate which are under the same ownership and which adjoin or abut are, for the purposes of this code, treated as one lot, parcel or tract or other real estate, even if classified as different tax parcels and even if separated by a right-of-way, watercourse or similar barrier.

Public means anything owned or operated by the federal government, State government, or any political subdivision.

Public building means any building owned, leased or held by the United States of America, the State of Colorado, Mesa County, the City of Grand Junction, any school district or other agency or political subdivision, which building is used for governmental purposes.

Public hearing means a public meeting for which public notice has been given and an opportunity for public testimony is provided.

Public land for dedication and ownership means parks, playgrounds, schools, drainage channels, trails, highways, roads and streets or other areas of land accepted by the City Council and dedicated for the public's use or benefit.

Public meeting means a meeting of a board, Planning Commission, City Council or their representatives where the public may attend.

Public notice means notice to the public of a public hearing or meeting as required by State or local law. See GJMC 21.02.070(a)(3) and 21.02.080(g).

Public right-of-way means any street, road, highway, alley, pedestrian/bicycle way or other special purpose way or utility installation owned by, or reserved to, the public for present or future public use.

Public trail means any pathway designed for public recreation.

Public use means a use which is owned by, and operated for, the public by a public entity.

Public use heliport means a heliport or helipad that has been designed for use by the public and is available for such, whether owned or operated by a governmental agency or a private entity, provided that such entity has agreed, in writing, to that use of its property.

Reclamation means rehabilitation of plant cover, soil stability, water resources, and other measures which will allow or cause flora to permanently grow on land.

Recorded/record means a document filed with and indexed by the Mesa County Clerk and Recorder.

Recreation, active means leisure-time activities, usually of a formal nature and often performed with others, requiring equipment and taking place at prescribed places, sites or fields.

Recreation, passive means activities that involve relatively inactive or less energetic activities, such as walking, sitting, picnicking, card games, chess, checkers and similar table games.

Recreational vehicle means all vehicles, with or without motive power, designed, converted or used to provide temporary living quarters that include four or more of the following permanently installed facilities: cooking, refrigeration or ice box, self-contained toilet, heating and/or air conditioning, potable water supply system including faucet and sink, separate 110 to 125 volt electrical power supply and/or LP gas supply. Recreational vehicles shall also include the following: all watercraft subject to registration by the State of Colorado, all motorcycles, mini bikes, all-terrain vehicles (ATVs), go-carts and similar vehicles with motive power that are prohibited from operating on a public street by the State of Colorado. All other vehicles and crafts designed to carry one or more adults used primarily for recreational purposes that are prohibited from operating on a public street by the State of Colorado, all trailers designed or used to carry any recreational vehicle described herein.

For the purposes of this code, an empty trailer or a recreational vehicle not on a trailer shall each be counted as one recreational vehicle. However, a trailer carrying one or more recreational vehicles shall together be counted as one recreational vehicle. Also includes a semi-trailer, loaded or unloaded, utility trailers, loaded or unloaded, or any other type or use of a trailer.

Recreational vehicle park means any lot or parcel developed to provide spaces and facilities for the temporary residential use of two or more recreational vehicles.

Recreational vehicle resort means an integrated development where recreational vehicles are used for temporary residential purposes in conjunction with recreational and social centers designed to provide a significant portion of the recreational and social needs of the occupants of the resort.

Recreational vehicle space means a parcel of land within an approved recreational vehicle park, shown in the records of the City of Grand Junction Community Development Department, and which was designed and intended for the accommodation of one recreational vehicle.

Recycling center/facility means a structure or facility in which used material is separated and processed prior to shipment to others who will use those materials to manufacture new products.

Recycling collection point means an incidental use that serves as a neighborhood drop-off point for temporary storage of recoverable resources. No processing of such items would be allowed. This facility would generally be located on a shopping center parking lot or in other public/quasi-public areas, such as churches and schools.

Regulation, as used in this code, means an applicable provision of this code or any other requirement promulgated under this code or the code of ordinances.

Rental, heavy equipment means the use of any building, land area or other premises for the rental of heavy equipment, large trucks, trailers, or other similar items.

Rental, home oriented means a business providing items for rent which are generally found or used in and around the home including, but not limited to, furniture, appliances and small equipment, but not including heavy equipment.

Request means a writing seeking a planning clearance. This is the same as an application.

Required public facilities means any improvement, facility, or service together with its associated site or right-of-way necessary to provide transportation, drainage, utilities, or similar essential services and facilities and that are usually owned and operated by a governmental agency.

Residence means a home, abode, or place where an individual is actually living at a specified point in time.

Residential care facilities means a home for no more than eight developmentally disabled residents as defined by the State Department of Health.

Residential group homes means a facility which is licensed by the State to provide supervised living quarters for no more than eight persons who are developmentally disabled or recovering from a medical condition, but not including persons who have been convicted and are under a court's supervision for any violent crime.

Residential receiving home means a residential structure housing not more than 10 children up to 18 years, unrelated by blood, marriage, or adoption to head of household, who are awaiting disposition to foster homes or other accommodations.

Restaurant means an establishment serving food and beverages where all service takes place within an enclosed building or accessory outdoor eating areas.

Resubdivision means the changing of an existing parcel created by a plat and recorded with the County Clerk and Recorder.

Retaining wall means a manmade barrier constructed for the purpose of stabilizing soil, retarding erosion, or terracing a parcel or site.

Revision means the changing and/or rescinding of zoning and other land use approvals following notice and an opportunity for objection. The status of the land use approvals, including zoning and/or subdivision approvals, may be that which was applied previously to the property or may be a new and/or different zoning or other land use status.

Revocable permit means a permit issued by the City Council, pursuant to Section 127 of the City Charter, allowing the construction in, or use of, a public right-of-way and revocable after 30 days' notice.

Ridgeline means the highest elevation of a mountain chain or line of hills; the intersection of two roof surfaces forming the highest horizontal line of the roof.

Right-of-way means a strip of land acquired by reservation, dedication, forced dedication, prescription, or condemnation and intended to be occupied by a road, crosswalk, railroad, electric transmission lines, oil or gas pipeline, waterline, sanitary storm sewer, and other similar uses; generally, the right of one to pass over the property of another.

Roadway means the improved portion of a street within a right-of-way and/or easement.

Roof line means the highest edge of the roof or the top of parapet, whichever establishes the top line of the structure when viewed in a horizontal plane.

Rooming/boarding house means a building containing a single dwelling unit and three or more rooms where lodging is provided, with or without meals, for compensation. "Compensation" may include money, services or other things of value. A rooming/boarding house differs from a group living facility in that a boarding and rooming house does not have staff and its residents do not receive care, treatment or assistance with daily living at the facility. For purposes of this definition, receiving compensation in the form of rent or "room and board" does not render someone "staff"; staff is compensated by a salary or rate of pay based upon hours worked or work accomplished.

Rubbish includes but is not limited to food waste, ashes and other solid, semisolid and liquid waste, by-products and generally decomposable residue taken from residences, commercial establishments and institutions. Rubbish may also be known as/referred to as "garbage," "trash," or "waste" as those terms are used and/or defined in this code or any other City code, law, rule or regulation.

Satellite dish means an antenna, consisting of radiation elements that transmit or receive radiation signals, that is supported by a structure with or without a reflective component to the radiating dish, usually circular in shape with a parabolic curve design constructed of a solid or open mesh surface and intended for transmitting or receiving television, radio, microwave signals or other electromagnetic waves to or from earth satellites.

Screening means shielding, concealing and effectively hiding from view of a person standing at ground level on an abutting site, or outside the area of the feature so screened by a wall, fence, hedge, berm or any combination of these methods, or any similar architectural or landscaped feature, such as a landscape perimeter strip or bufferyard. (See GJMC 21.06.040, Landscape, buffering and screening standards.)

Secure facilities means as defined by § 19-1-103 C.R.S., as amended.

Secured/security means cash, letter of credit or other readily available source of money, pursuant to GJMC 21.02.070(m).

Seismic effects means direct and indirect effects caused by an earthquake or manmade phenomena.

Service club means a group of people organized for a common purpose to pursue common goals, interests, or activities, are not commercial in nature, and usually characterized by certain membership qualifications, payment of fees and dues, regular meetings, and a constitution and bylaws.

Service lines means electric, gas, communication, water, sewer, irrigation and drainage lines providing local distribution or collection service.

Service yard and/or entrance means an area and/or entrance to a structure, which is used for pickup and delivery, especially in conjunction with retail and wholesale outlets.

Setback means the minimum distance between a structure and a property line of a parcel of land or other established reference point.

Short-term rental is a type of lodging wherein a dwelling unit, either in full or in part, is rented to a temporary occupant(s) for monetary consideration for fewer than 30 consecutive days.

Shrub means a woody plant, smaller than a tree, consisting of several small stems from the ground or small branches near the ground; may be deciduous or evergreen.

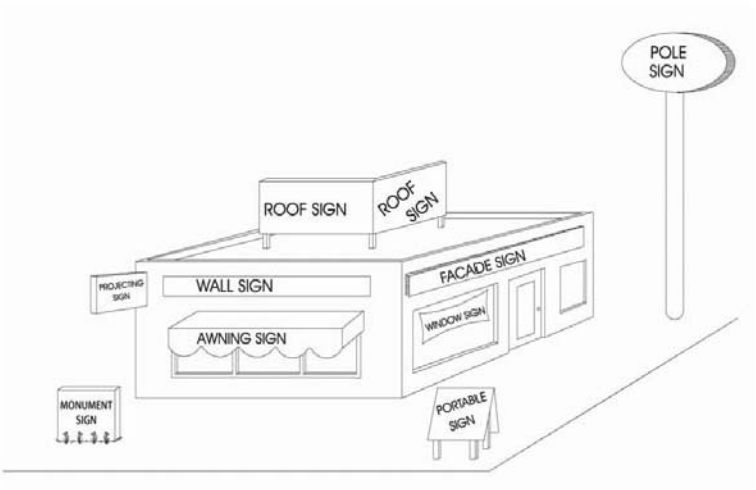
Sight distance triangle means a triangular-shaped portion of land established at street intersections in which nothing is erected, placed, planted, or allowed to grow in such a manner as to limit or obstruct the sight distance of motorists entering or leaving the intersection.

Sign means any device, fixture, placard, structure, painted surface, or part thereof that uses any color, word, written representation, graphic symbol, logo, letters, illumination, numbers, or writing to advertise, announce or identify the purpose of, a person or entity, to advertise or merchandise a product or service, or to communicate written information to the public. (See graphic.)

Sign, awning means a sign that is mounted, painted or attached to an awning.

Sign, monument means a sign other than a pole sign in which the entire bottom is in contact with, or is close to, the ground and is independent of any other structure.

Sign, facade is a sign painted on a wall of a building with or without a background. A facade sign shall not project from the building on which it is painted.



Sign, flush wall means a sign attached to, or erected against, the wall of a structure which has the sign face in a plane parallel to the plane of the wall and which does not extend more than 12 inches from the building face. (See graphic.)

Sign, freestanding means a sign structure which is supported by one or more columns, uprights, poles or braces extended from the ground or which is erected on the ground. (See graphic.)

Sign, illegal means a sign which is in violation of the requirements of this code except for those signs qualifying as nonconforming (see sign regulations, GJMC 21.06.070).

Sign, integral means a sign that is carved into stone, concrete or similar material or made of bronze, aluminum, or other permanent type construction and made an integral part of the structure.

Sign, permanent means a sign which is securely attached to the ground or a structure so that it cannot readily be moved.

Sign, portable means a sign which is not permanently attached to the ground or a structure. A sign that is mounted or erected upon a vehicle, van, truck, automobile, bus, railroad car or other vehicle which is not registered and not in operating condition shall be considered a portable sign. (See graphic.)

Sign, projecting means a sign attached to a structure wall and extending outward from the wall more than 12 inches. (See graphic.)

Sign, roof top means a sign that is mounted on the roof of a building or that is wholly dependent upon a building for support and that projects above the top walk or edge of a building with a flat roof, the eave line of a building with a gambrel, gable or hip roof, or the deck line of a building with a mansard roof. (See graphic.)

Sign, wind driven consists of one or more banners, flags, pennants, ribbons, spinners, streamers, captive balloons or other objects or materials designed or intended to move when subjected to pressure by wind or breeze and by that movement attract attention and function as a sign (see definition of *Sign*).

Sign without backing means any word, letter, emblem, insignia, figure or similar character or group thereof that is neither backed by, incorporated in, or otherwise made a part of any larger display.

Significant landscape feature means any outstanding natural element, including, but not limited to, vegetation, rock outcrops, and prominent landforms.

Single-family residence means a structure containing cooking and bathing facilities that is arranged, designed, and intended to be the residence of one family. (See *Family*.)

Site plan means the development plan for one or more lots on which is shown the existing and proposed conditions of the lot, including topography, vegetation, drainage, floodplains, wetlands and waterways; landscaping and open spaces, walkways, means of ingress and egress, circulation, utility services, structures and buildings, signs and lighting, berms, buffers, and screening devices, surrounding development, and any other information that reasonably may be required in order that an informed decision can be made by the approval authority.

Special flood hazard area means the land in the floodplain within the City subject to a one percent or greater chance of flooding in any given year, i.e., the 100-year floodplain.

SSID means Submittal Standards for Improvements and Development as adopted by the City of Grand Junction.

Staff means the staff of the Grand Junction Public Works and Planning Department.

Start of construction includes substantial improvement and means the date the building permit was issued, provided the actual start of construction, repair, reconstruction, placement or other improvements was within 180 days of the permit date. The "actual start" means the first placement of a permanently constructed structure on a site, such as the pouring of slab or footings, the installation of pilings, the construction of columns, or any work beyond the stage of excavation; or the placement of a manufactured home on a foundation. Permanent construction does not include land preparation such as clearing, grading and filling; nor does it include the installation of streets and/or walkways; nor does it include excavation for a basement, footings, piers or foundations or the erection of temporary forms; nor does it include the installation on the property of accessory buildings, such as garages or sheds not occupied as dwelling units or not part of the main structure.

Stealth or *concealed* means any tower or telecommunications facility which is designed to enhance compatibility with adjacent land, buildings, structures and uses, including, but not limited to, architecturally screened roof-mounted antennas, antennas integrated into architectural elements and towers

designed to not look like a tower, such as light poles, power poles and trees. The term "stealth" does not necessarily exclude the use of uncamouflaged lattice, guyed or monopole tower designs.

Storage means primarily for vehicles when in transit or being worked on. Also the temporary storage of goods and equipment.

Street means any public or private roadway, but not an alley.

Street, primary means the principal frontage for a building site, as defined during site plan review.

Street, side means the frontage that is not a primary street, as defined during site plan review.

Streetscape means the landscaping and other manmade objects located within the public right-of-way which add variety and are placed for aesthetic purposes as well as functional, pedestrian guidance and traffic control.

Structure means anything constructed or erected which requires location on or in the ground, or is attached to something having a location on the ground or anything as defined by the International Building Code. Structures do not include ditches and their appurtenances, poles, lines, cables, transmission or distribution facilities of public utilities, freestanding mailboxes, on grade slabs, walks, driveways, landscaping materials or fences, except that fences in excess of six feet shall be considered a structure. (See also *Building*.)

Subcommunity means a node.

Subdivision means the division of land into two or more parcels, separate interests including condominium(s) and leasehold interest(s), or interests in common, unless exempted of this code. (See GJMC 21.02.070(q).) Unless the method of disposition is adopted for the purpose of evading any provision or purpose of this code, the term "subdivision" shall not apply to any division of land:

(1) Which is created by order of any court in this State, but only if the City Attorney has received sufficient notice of the proposed order so that the City may object thereto, as its interests may dictate;

(2) Which is created by a lien, mortgage, deed of trust, or any other security instrument which became effective prior to June 1, 1989;

(3) Which is created by a security or unit of interest in any investment trust regulated under the laws of this State or any other interest in any investment entity which became effective prior to June 1, 1989;

(4) Which creates cemetery lots;

(5) Which creates an interest or interests in oil, gas, minerals or water which are now or hereafter severed from the surface ownership of real property; or

(6) Which is created by the acquisition of an interest in land in the name of a husband and wife or other persons in joint tenancy or as tenants in common, so long as any partition so that the City may object thereto, as its interests may dictate; any such interest shall be deemed, for the purposes of this code, as only one interest.

Substantial damage means damage to a structure from one event not due to the knowing act of the owner such that the cost to restore the damage is 50 percent or more of the fair market value of the structure before the damage occurred.

Substantial improvement means any reconstruction, rehabilitation, addition, or other improvement of a structure, which costs 50 percent of the market value of the structure before the "start of construction" of the improvement. *Substantial improvement* includes structures which have incurred "substantial damage," regardless of the actual repair work performed. The term does not include either:

(1) Any improvement of a structure to correct existing violations of any code which the local code enforcement official determines and are necessary to make the structure safe or habitable; or

(2) Any alteration of a "historic structure," if the alteration shall not preclude the structure's continued designation as a "historic structure."

Surveyor means a land surveyor registered by the State of Colorado.

SWMM means the Stormwater Management Manual (GJMC Title 28) as adopted by the City.

TEDS means the Transportation and Engineering Design Standards (GJMC Title 29) as adopted by the City.

Telecommunications facilities means cables, wires, lines, wave guides, antennas, other equipment and facilities and any other equipment or facilities associated with the transmission or reception of electromagnetic waves and/or communications which are located or as a part of a tower or antenna support structure.

Temporary use or structure means any use or structure placed on a parcel of land for a period of short duration, if permitted pursuant to Chapter 21.04 GJMC, typically for four months or less.

Threshold planning quantity (TPQ) means a quantity designated for each chemical on the list of extremely hazardous substances that triggers notification by facilities to the State that such facilities are subject to emergency planning requirements.

Tip out or *slide out* means a recreational vehicle component which is within the main structure of the recreational vehicle while traveling and either tips or slides out when used as a living area. A tip out or slide out shall be structurally supported directly to the ground.

Tower means a self-supporting latticed, guyed or monopole structure constructed from grade which supports a telecommunications facility. The term "tower" shall not include amateur radio operators' equipment, as licensed by the FCC.

Traffic means as calculated by the Director, according to National or other Director approved objective standards, such as the Institute of Traffic Engineers publications. If an applicant provides proof that actual traffic will be different, the Director may vary from the approved standards.

Transient means housing or accommodations which are typically occupied by residents for periods of two weeks or less, including, but not limited to, hotels, motels and travel lodges.

Transit operator means the person or entity authorized to operate a transit system pursuant to either a revocable permit or a license; such person or entity may also be termed "permittee."

Transmission lines means electric lines (115 KV and over) and appurtenant facilities; or pipelines/conveyors (10 inches diameter or larger) and appurtenant facilities for transporting natural resources, chemicals, petroleum derivatives, or waste substances.

Travel trailer means a vehicle or portable unit mounted on its own chassis and wheels which does not exceed eight feet in width and/or 40 feet in length, is drawn by a motor vehicle, and provides temporary living quarters for recreational, camping or travel use.

Tree means a woody perennial plant having a single, usually elongate main stem generally with few or no branches on its lower part.

Tree, deciduous means plants that drop their foliage annually before becoming dormant.

Truck camper means a portable unit consisting of a roof, floor and sides designed to be loaded onto, and unloaded from, the bed of a pickup truck, and provides temporary living quarters for recreational, camping or travel use.

Truck parking area means an area for the parking of trucks, which is often left with either their motors running and/or their refrigerator unit motors operating.

201 Planning Area means a regional plan for sewage collection and treatment to prevent pollution of the State's waters; the boundaries are defined by the official map, a copy of which is kept by the Director.

Underground pressurized irrigation system means a watering system for landscaped areas, consisting of underground pressurized pipes connected to sprinkler heads, bubbler heads, or drip systems such that 100 percent irrigation water coverage is provided.

Unoccupied means a dwelling in which no individual resides or a public, commercial, or industrial building, where no storage or use of equipment, merchandise, or machinery is kept for a period of time.

Urban area means the definite boundary inside which the only development will occur by annexing to the City. See 1998 Persigo City/County Agreement.

Use means the purpose for which land or a structure is designed, arranged, intended or occupied.

Use, interim means the type of buildings and activities existing in an area, or on a specific site or parcel, for an interim period of time. Such interim use shall not hinder the ability to redevelop the site or parcel at the density or intensity envisioned by the Comprehensive Plan. The scope and duration of an interim use shall be determined by special permit and approved by the City Council.

Utilities means any agency that provides essential or basic services and facilities such as electricity, gas, water (domestic and irrigation), sewage disposal, drainage systems, solid waste disposal, television, telecommunications, telephone, railway, etc.

Utility structures means electric transformers, switch boxes, telephone pedestals and telephone boxes, cable television boxes, traffic control boxes, and similar devices.

Variance means a grant of relief from the requirements of this code which permits construction in a manner that would otherwise be prohibited by this code.

Vested right means a right that cannot be changed or altered by changes in regulation.

Wall includes the following:

(1) The vertical exterior surface of a building;

(2) Vertical interior surfaces that divide a building's space into rooms; or

(3) A vertical architectural partition used to divide, separate or enclose an outside area, a masonry fence (see definition of "fence").

Water surface elevation means the height, in relation to the North American Vertical Datum (NAVD) of 1988 (or other datum, where specified), of floods of various magnitudes and frequencies in the floodplains of coastal or riverine areas.

Water wise means landscape methods which conserve water through the use of drought-tolerant plants, planting and irrigation techniques.

Watercourse means any natural or artificial stream, river, creek, ditch, channel, canal, conduit, culvert, drain, waterway, gully, ravine, or wash in which water flows in a definite direction or course, either continuously or intermittently, and has a definite channel, bed, and bank and includes any area adjacent thereto subject to inundation by reason of overflow or floodwater.

Wildlife habitat resource area means a geographical area identified by a State or federal agency that contains elements of food, water, cover, or space, alone or in combination, which are adequate to support a rare, threatened or endangered species for at least a portion of a year.

Working day means a business day; those days the Public Works and Planning Department are open to the public for business. Holidays, Saturdays and Sundays are not working days.

Yard means an existing or required open space on a parcel with a principal structure. A yard shall be open, unoccupied and unobstructed from the ground to the sky, except as otherwise provided in this code.

Yard, front means a yard extending across the full width and depth of the lot between a road right-of-way or access easement line and the nearest line or point of the building. (For flag lots, see *Yard, side*.) (See GJMC 21.03.030, Measurements.)

Yard, rear means a yard extending across the full width and depth of the lot between the rear lot line and the nearest line or point of the building. (See GJMC 21.03.030, Measurements.)

Yard setback means the minimum horizontal distance between any building and the property line.

Yard, side means a yard extending from the front yard to the rear yard between the side lot line and the nearest line or point of the building. This side yard definition may apply for three sides of a flag lot if the flagpole portion of the lot exceeds the front yard setback. (See GJMC 21.03.030, Measurements.)

Yard, side setback means the minimum horizontal distance between any building and the side property line.

Zero lot line means the location of a building on a lot in such a manner that one or more of the building sides rests directly on a lot line.

Zone/zoning district means a mapped area with a particular set of rules and regulations which limits the types of uses. See GJMC 21.03.020(c) and 21.04.010. "Zone" is the same as "district."

(Ord. 4858, 6-5-19; Ord. 4813, 8-15-18; Ord. 4744, 4-5-17; Ord. 4737, 2-1-17; Ord. 4710, 7-20-16; Ord. 4601, 9-4-13; Ord. 4583, 4-17-13; Ord. 4546, 7-18-12; Ord. 4428, 6-14-10; Ord. 4419, 4-5-10)

Chapter 21.11

DEVELOPMENT IMPACT FEES

Sections:
21.11.010 Development impact fees.

21.11.010 Development impact fees.

(a) Title. This chapter shall be known and may be cited as the "Grand Junction, Colorado, Impact Fee Ordinance" or "Impact Fee Ordinance."

(b) Authority. The City has the authority to adopt this chapter pursuant to Article XX, § 6 of the Colorado State Constitution, the City's home rule charter, the City's general police powers, and other laws of the State of Colorado.

(c) Application. This chapter shall apply to all development within the territorial limits of the City, except development exempted pursuant to subsection (f)(2) of this section, Exemptions.

(d) Purpose.

(1) The intent of this chapter is to ensure that new development pays a proportionate share of the cost of city parks and recreation, fire, police and transportation capital facilities.

(2) It is the intent of this chapter that the impact fees imposed on new development are no greater than necessary to defray the impacts directly related to proposed new development.

(3) Nothing in this chapter shall restrict the City from requiring an applicant for a development approval to construct reasonable capital facility improvements designed and intended to serve the needs of an applicant's project, whether or not such capital facility improvements are of a type for which credits are available under subsection (g) of this section, Credits.

(e) Definitions. For the purposes of this chapter, the following terms shall have the following meanings:

Capital facilities means any improvement or facility that: (i) is directly related to any service that the City is authorized to provide; (ii) has an estimated useful life of five years or longer; and (iii) is required by the charter, ordinances or policy of the City pursuant to a resolution or ordinance.

Commencement of impact-generating development occurs upon either:

(i) The submittal of a complete application for the development of a nonresidential development or multifamily for-rent development for which construction commences on or before two years from the date of complete application submittal; or

(ii) Planning clearance for residential uses intended for fee simple ownership such as single-family homes, townhomes or condominiums.

Complete application. For the purposes of this chapter, a development application shall not be considered complete unless and until (i) all the required information and submittal materials required by all relevant City ordinances, resolutions, rules and regulations are submitted and received by the Director, and (ii) the Director has determined the application is complete. The decision of the Director with respect to completeness is final.

Development means any construction or expansion of a building, structure, or use, any change in use of a building or structure, or any change in the use of land, which creates additional demand for parks and recreation, fire, and police capital facilities.

Development approval means any final approval of an application for a rezoning, an approved planned development ordinance, conditional use permit, subdivision, development or site plan, planning clearance, or similar application for new construction.

Fee payer means a person commencing impact-generating development who is obligated to pay an impact fee in accordance with the terms of this chapter.

Fee schedule or impact fee schedule means the impact fees for police, fire, parks and recreation, and transportation established by this chapter. The impact fee schedule is set forth in the fee schedule to this chapter and is incorporated herein by reference.

Floor area means the total finished square footage of all levels included within the outside walls of a building or portion thereof, but excluding courts, garages having no habitable area, uninhabitable areas that are located above the highest habitable level, or uninhabitable areas that are located below the first floor level.

Impact fee study means the study entitled "City of Grand Junction, Colorado 2019 Impact Fee Study," prepared by TischlerBise dated August 8, 2019 and/or the study entitled "Transportation Impact Fee Study" by Duncan Associates dated November 2019 with Minor Revisions February 28, 2019.

Independent fee calculation study means a study prepared by a fee payer, calculating the cost of parks and recreation capital facilities, fire capital facilities, and police capital facilities required to serve the fee payer's proposed development, that is performed on an average cost (not marginal cost) methodology, uses the level of service standards, service units and unit construction costs stated in the impact fee study, and is performed in compliance with any criteria for such studies established by this chapter.

Level of service (LOS) means a measure of the relationship between service capacity and service demand for capital facilities.

Planning clearance means a planning clearance issued by the Director permitting the construction of a building or structure within the City of Grand Junction.

Successor-in-interest means a person, as defined by this chapter, who is conveyed a fee simple interest in land for which an impact fee is paid or a credit is approved pursuant to the terms of this chapter.

For the purposes of this chapter, site-related improvements such as minimum street improvements, local street improvements and safety improvements shall not constitute transportation capital facilities.

(f) Development Impact Fees to Be Imposed.

(1) Fee Obligation, Payment and Deposit.

(i) Obligation to Pay and Time of Payment. Commencing January 1, 2020, any person who causes the commencement of impact-generating development, except those exempted pursuant to subsection (f)(2) of this section, Exemptions, shall be obligated to pay impact fees pursuant to the terms of this chapter. The obligation to pay the impact fees shall run with the land. The amount of the impact fees shall be determined in accordance with subsection (f)(3) of this section, Calculation of Amount of Impact Fees, and the fee schedule in effect at the time of issuance of a planning clearance and paid to the Director at the time of issuance of a planning clearance. If any credits are due pursuant to subsection (g) of this section, Credits, those shall be determined prior to the issuance of a planning clearance and payment of the impact fees.

(ii) Fees Promptly Deposited into Accounts. All monies paid by a fee payer pursuant to this chapter shall be identified as impact fees and shall be promptly deposited in the appropriate impact fee trust accounts established and described in subsection (h) of this section, Impact Fee Trust Accounts.

(iii) Extension of Previously Issued Development Approval. If the fee payer is applying for an extension of a development approval issued prior to January 1, 2020, the impact fees required to be paid shall be the net increase between the impact fees applicable at the time of the current permit extension application and any impact fees previously paid pursuant to this chapter, and shall include any impact fees established subsequent to such prior payment.

(iv) Fee Based on Approved Development. If the planning clearance is for less floor area than the entire development approved pursuant to the development approval, the fee shall be computed separately for the floor area of development covered by the planning clearance, and with reference to the use categories applicable to such development covered by the planning clearance.

(v) Permit for Change in Use, Expansion, Redevelopment, Modification. If the fee payer is applying for a planning clearance to allow for a change of use or for the expansion, redevelopment, or modification of an existing development, the impact fees required to be paid shall be based on the net increase in the impact fees for the new use as compared to the previous use and actual fee paid for the previous use, and shall include any impact fees established subsequent to such prior payment.

(vi) Prior Conditions and/or Agreements. Any person who prior to January 1, 2020, has agreed in writing with the City, as a condition of permit approval, to pay an impact fee shall be responsible for the payment of the impact fees under the terms of such agreement, and the payment of the impact fees may be offset against any impact fees due pursuant to the terms of this chapter.

(vii) Time of Submittal. For nonresidential and multifamily development (excluding townhomes, duplexes and condominium residence(s)) the fee shall be calculated as of the submission of a complete application and construction commences within two years of approval. Should construction fail to commence within two years, the applicant shall pay those fees in place at the time of issuance of a planning clearance.

(2) Exemptions. The following types of development shall be exempted from payment of impact fees. Any claim for exemption shall be made no later than the time when the applicant applies for the first planning clearance. Any claim for exemption not made at or before that time shall be waived. The Director shall determine the validity of any claim for exemption pursuant to the standards set forth below.

(i) Replacing Existing Residential Unit with New Unit. Reconstruction, expansion, alteration or replacement of a previously existing residential unit that does not create any additional residential units.

(ii) New Impact-Generating Development Creates No Greater Demand than Previous Development. New impact-generating development that the fee payer can demonstrate will create no greater demand over and above that produced by the existing use or development.

(iii) Building after Fire or Other Catastrophe. Rebuilding the same amount of floor space of a structure that was destroyed by fire or other catastrophe.

(iv) Accessory Structures. Construction of unoccupied accessory structures related to a residential unit.

(v) Previous Payment of Same Amount of Impact Fees. Impact-generating development for which an impact fee was previously paid in an amount that equals or exceeds the impact fee that would be required by this chapter.

(vi) Government. Development by the federal government, the State, school district, County or the City.

(vii) Complete Development Application Approved Prior to Effective Date of Chapter. For development for which a complete application for a planning clearance was approved prior to January 1, 2020; and for nonresidential and multifamily development for which a complete application was submitted prior to January 1, 2020, so long as construction commences by January 1, 2022, the required fees shall be those in effect at time of submittal.

(viii) Small Additions and Renovations for Residential Uses. Construction of an addition to an existing dwelling unit of 500 square feet or less, or expansion of finished space for an existing dwelling unit of 500 square feet or less. This exemption shall only be used one time for each dwelling unit and does not apply to accessory dwelling units.

(3) Calculation of Amount of Impact Fees.

(i) Except for those electing to pay impact fees pursuant to subsection (f)(3)(ii) of this section, Independent Fee Calculation Study, the impact fees applicable to the impact-generating development shall be as determined by the impact fee schedule, which is hereby adopted and incorporated herein. The impact fee schedules are based on the impact fee studies. It applies to classes of land uses within the City, differentiates between types of land uses, and is intended to defray the projected impacts caused by proposed new development on city capital facilities. The determination of the land use category(ies) in the impact fee schedules that are applicable to impact-generating development shall be made by the Director with reference to the impact fee studies and the methodologies therein; the then-current edition of the ITE Trip Generation Manual, published by the Institute of Traffic Engineers; the City zoning and development code; the then-current land use approvals for the development; and any additional criteria set forth in duly promulgated administrative rules.

(A) Annual Adjustment of Impact Fees to Reflect Effects of Inflation. The impact fee schedule shall be adjusted annually and/or biannually consistent with the impact fee study. Commencing on January 1, 2023, and on January 1st of each subsequent year, each impact fee amount set forth in the impact fee schedule shall be adjusted for inflation, as follows:

a. For transportation impact fees, the fees shall be adjusted for inflation based on the latest 10-year average of the Colorado Department of Transportation Construction Cost Index, published quarterly by CDOT.

b. For fire, police, and parks the fees shall be adjusted for inflation based on the most recent Construction Cost Index published by Engineering News Record.

c. Adjusted Fees. The adjusted impact fee schedule shall become effective immediately upon calculation and certification by the City Manager and shall not require additional action by the City Council to be effective.

(B) Impact-Generating Development Not Listed in the Impact Fee Schedule. If the proposed impact-generating development is of a type not listed in the impact fee schedule, then the impact fees applicable are those of the most nearly comparable type of land use. The determination of the most nearly comparable type of land use shall be made by the Director with reference to the impact fee study and City code.

(C) Mix of Uses. If the proposed impact-generating development includes a mix of those uses listed in the impact fee schedule then the impact fees shall be determined by adding the impact fees that would be payable for each use as if it was a free-standing use pursuant to the impact fee schedule.

(ii) Independent Fee Calculation Study. In lieu of calculating the amount(s) of impact fees by reference to the impact fee schedule, a fee payer may request that the amount of the required impact fee be determined by reference to an independent fee calculation study.

(A) Preparation of Independent Fee Calculation Study. If a fee payer requests the use of an independent fee calculation study, the fee payer shall be responsible for retaining a qualified professional (as determined by the Director) to prepare the independent fee calculation study that complies with the requirements of this chapter, at the fee payer's expense.

(B) General Parameters for Independent Fee Calculation Study. Each independent fee calculation study shall be based on the same level of service standards and unit costs for the capital facilities used in the impact fee study, and shall document the relevant methodologies and assumptions used.

(C) Procedure.

a. An independent fee calculation study shall be initiated by submitting an application to the Director together with an application fee to defray the costs associated with the review of the independent fee calculation study.

b. The Director shall determine if the application is complete. If it is determined the application is not complete, a written statement outlining the deficiencies shall be sent by mail to the person submitting the application. The Director shall take no further action on the application until it is complete.

c. When it is determined the application is complete, the application shall be reviewed by the Director and a written decision rendered on whether the impact fees should be modified, and, if so, what the amount should be, based on the standards in subsection (g)(1) of this section, Standards.

(D) Standards. If, on the basis of generally recognized principles of impact analysis, the Director determines the data, demand information and assumptions used by the applicant to calculate the impact fees in the independent fee calculation study more accurately measure the proposed impact-generating development's impact on the appropriate capital facilities, the impact fees determined in the independent fee calculation study shall be deemed the impact fees due and owing for the proposed development. The fee adjustment shall be set forth in a fee agreement. If the independent fee calculation study fails to satisfy these requirements, the impact fees applied shall be the impact fees established in the impact fee schedule.

(g) Credits.

(1) Standards.

(i) General. Any person causing the commencement of impact-generating development may apply for credit against impact fees otherwise due, up to but not exceeding the full obligation of impact fees proposed to be paid pursuant to the provisions of this chapter, for any contributions or construction (as determined appropriate by the Director) accepted in writing by the City for capital facilities. Credits against impact fees shall be provided only for that impact fee for which the fee is collected.

(ii) Valuation of Credits.

(A) Construction. Credit for construction of capital facilities shall be valued by the City based on complete engineering drawings, specifications, and construction costs estimates submitted by the fee payer to the City. The Director shall determine the amount of credit due, if any, based on the information submitted, or, if he/she determines the information is inaccurate or unreliable, then on alternative engineering or construction costs determined by and acceptable to the Director.

(B) Contributions. Contributions for capital facilities shall be based on the value of the contribution or payment at the time it is made to the City.

(iii) When Credits Become Effective.

(A) Construction. Credits for construction of capital facilities shall become effective after the credit is approved pursuant to this chapter, a written credit agreement is entered into and (a) all required construction has been completed and has been accepted by the City, (b) suitable maintenance and financial warranty has been

received and approved by the City, and (c) all design, construction, inspection, testing, financial warranty, and acceptance procedures have been completed in compliance with all applicable City requirements. Approved credits for the construction of capital facilities may become effective at an earlier date if the fee payer posts security in the form of an irrevocable letter of credit, escrow agreement, or cash and the amount and terms of such security are acceptable by the City Manager. At a minimum, such security must be in the amount of the approved construction credit plus 20 percent, or an amount determined to be adequate to allow the City to construct the capital facilities for which the credit was given, whichever is higher.

(B) Contribution. Credits for contributions for capital facilities shall become effective after the credit is approved in writing pursuant to this chapter, a credit agreement is entered into and the contribution is made to the City in a form acceptable to the City.

(iv) Transferability of Credits. Credits for contributions, construction or dedication of land shall be transferable within the same development and for the same capital facility for which the credit is provided, but shall not be transferable outside the development. Credit may be transferred pursuant to these terms and conditions by a written instrument, to which the City is a signatory, that clearly identifies which credits issued under this chapter are to be transferred. The instrument shall be signed by both the transferor and transferee, and the document shall be delivered to the Director for registration of the change in ownership. If there are outstanding obligations under a credit agreement, the City may require that the transferor or transferee or both (as appropriate) enter into an amendment to the credit agreement to assure the performance of such obligations.

(v) Total Amount of Credit. The total amount of the credit shall not exceed the amount of the impact fees due for the specific facility fee (e.g., fire, police, parks).

(vi) Capital Contribution Front-Ending Agreement. The City may enter into a capital contribution front-ending agreement with any developer who proposes to construct capital facilities to the extent the fair market value of the construction of these capital facilities exceeds the obligation to pay impact fees for which a credit is provided pursuant to this chapter. The capital contribution front-ending agreement shall provide proportionate and fair share reimbursement linked to the impact-generating development's use of the capital facilities constructed.

(2) Procedure.

(i) Submission of Application. In order to obtain a credit against impact fees, the fee payer shall submit an offer for contribution or construction. The offer shall be submitted to the Director, and must specifically request a credit against impact fees.

(ii) Contribution Offer Contents. The offer for contribution credit shall include the following:

(A) Construction. If the proposed credit involves construction of capital facilities:

a. The proposed plan for the specific construction certified by a duly qualified and licensed Colorado engineer;

b. The projected costs for the suggested improvement, which shall be based on local information for similar improvements, along with the construction timetable for the completion thereof. Such estimated costs may include the costs of construction or reconstruction, the costs of all labor and materials, the costs of all lands, property, rights, easements and franchises acquired, financing charges, interest prior to and during construction and for one year after completion of construction, costs of plans and specifications, surveys of estimates

of costs and of revenues, costs of professional services, and all other expenses necessary or incident to determining the feasibility or practicability of such construction or reconstruction;

c. A statement made under oath of the facts that qualify the fee payer to receive a contribution credit.

(B) Contribution. If the proposed offer involves a credit for any contribution for capital facilities, the following documentation shall be provided:

a. A copy of the planning clearance for which the contribution was established;

b. If payment has been made, proof of payment; or

c. If payment has not been made, the proposed method of payment.

(iii) Determination of Completeness. The Director shall determine if the application is complete. If it is determined that the proposed application is not complete, the Director shall send a written statement to the applicant outlining the deficiencies. No further action shall be taken on the application until all deficiencies have been corrected.

(iv) Decision. The Director shall determine if the offer for credit is complete and if the offer complies with the standards in subsection (g)(1) of this section, Standards.

(3) Credit Agreement. If the offer for credit is approved by the Director, a credit agreement shall be prepared and signed by the applicant and the City Manager. The credit agreement shall provide the details of the construction or contribution of capital facilities, the time by which it shall be dedicated, completed, or paid, and the value (in dollars) of the credit against the impact fees the fee payer shall receive for the construction or contribution.

(4) Accounting of Credits. Each time a request to use approved credits is presented to the City, the Director shall reduce the amount of the impact fees, and shall note in the City's records and the credit agreement the amount of credit remaining, if any.

(h) Impact Fee Trust Accounts.

(1) Establishment of Trust Accounts.

(i) Establishment of Trust Accounts. For the purpose of ensuring impact fees collected pursuant to this chapter are designated for the mitigation of capital facility impacts reasonably attributable to new impact-generating development that paid the impact fees.

(ii) Establishment of Accounts. Impact fees shall be deposited into five accounts: transportation, parks and recreation, capital facilities, fire capital facilities, and police capital facilities accounts.

(2) Deposit and Management of Accounts.

(i) Managed in Conformance with § 29-1-801, C.R.S. et seq. The impact fee accounts shall be maintained as interest bearing and shall be managed in conformance with § 29-1-801, C.R.S. et seq.

(ii) Immediate Deposit of Impact Fees in Appropriate Account. All impact fees collected by the City pursuant to this chapter shall be promptly deposited into the appropriate account.

(iii) Interest Earned on Trust Account Monies. Any impact fees not immediately expended shall be deposited in interest-bearing accounts. Interest earned on monies in the accounts shall be considered part of such account and shall be subject to the same restrictions on use applicable to the impact fees deposited in such account.

(iv) Income Derived Retained in Accounts until Spent. All income derived from the deposits shall be retained in the accounts until spent pursuant to the requirements of this chapter.

(v) Expenditure of Impact Fees. Monies in each account shall be considered to be spent in the order collected, on a first-in/first-out basis.

(i) Expenditure of Impact Fees.

(1) Capital Facilities Impact Fees. The monies collected from each capital facilities impact fee shall be used only to acquire or construct capital facilities within the City.

(2) No Monies Spent for Routine Maintenance, Rehabilitation or Replacement of Capital Facilities. No monies shall be spent for periodic or routine maintenance, rehabilitation, or replacement of any City transportation, parks and recreation, fire, or police capital facilities.

(3) No Monies Spent to Remedy Deficiencies Existing on Effective Date of Chapter. No monies shall be spent to remedy existing deficiencies in transportation capital facilities, parks and recreation capital facilities, fire capital facilities, or police capital facilities.

(4) Transportation impact fee monies may be spent for the reconstruction and replacement of existing roads, the construction of new road systems and may be used to pay debt service on any portion of any current or future general obligation bond or revenue bond issued after July 6, 2004, and used to finance major road system improvements.

(j) Refund of Impact Fees Paid.

(1) Refund of Impact Fees Not Spent or Encumbered in 10 Years. A fee payer or the fee payer's successor-in-interest may request a refund of any impact fees not spent or encumbered within 10 years from the date the fee was paid, along with interest actually earned on the fees. Impact fees shall be deemed to be spent on the basis of the first fee collected shall be the first fee spent.

(2) Procedure for Refund. The refund shall be administered by the Director, and shall be undertaken through the following process:

(i) Submission of Refund Application. A fee payer or successor-in-interest shall submit within one year following the end of the tenth year from the date on which the planning clearance was issued for which a refund is requested. The refund application shall include the following information:

(A) A copy of the dated receipt issued for payment of the impact fee;

(B) A copy of the planning clearance.

(ii) Determination of Completeness. The Director shall determine if the refund application is complete. If the application is not complete, the Director shall mail the applicant a written statement outlining the deficiencies. The Director shall take no further action on the refund application until it is complete.

(iii) Decision on Refund Application. When the refund application is complete, it shall be reviewed and approved if the Director determines a fee has been paid which has not been spent within the 10-year period. The refund shall include the fee paid plus interest actually earned on the impact fee.

(3) Limitations.

(i) Expiration of Planning Clearance without Possibility of Extension. If a fee payer has paid an impact fee required by this chapter and obtained a planning clearance, and the planning clearance for which the impact fee was paid later expires without the possibility of further extension, then the fee payer or the fee payer's successor-in-interest may be entitled to a refund of the impact fee paid, without interest. In order to be eligible to receive a refund of impact fees pursuant to this subsection, the fee payer or the fee payer's successor-in-interest shall be required to submit an application for such refund to the Director within 30 days after the expiration of the planning clearance for which the fee was paid. If a successor-in-interest claims a refund of the impact fee, the City may

require written documentation that such rights have been conveyed to the claimant. If there is uncertainty as to the person to whom the refund is to be paid or if there are conflicting demands for such refund, the City Attorney may interplead such funds.

(ii) No Refund If Project Demolished, Destroyed, Altered, Reconstructed or Reconfigured. After an impact fee has been paid pursuant to this chapter, no refund of any part of such fee shall be made if the development for which the impact fee was paid is later demolished, destroyed, or is altered, reconstructed, reconfigured, or changed in use so as to reduce the size or intensity of the development or the number of units in the development.

(k) Low-Moderate Income Housing. In order to promote the provision of low-moderate income housing in the City, the City Council may agree in writing to pay some or all of the impact fees imposed on a proposed low or moderate income housing development by this chapter from other unrestricted funds of the City. Payment of impact fees on behalf of a fee payer shall be at the discretion of the City Council and may be made pursuant to goals and objectives adopted by the City Council to promote housing affordability.

(l) Administration, Appeals and Updates of Determination or Decision of Director to City Manager.

(1) Review Every Seven Years. The impact fees described in this chapter and the administrative procedures of this chapter shall be reviewed at least once every seven years by the City Manager to ensure that (i) the demand and cost assumptions underlying the impact fees are still valid, (ii) the resulting impact fees do not exceed the actual costs of constructing capital facilities that are of the type for which the impact fees are paid and that are required to serve new impact-generating development, (iii) the monies collected or to be collected in each impact account have been and are expected to be spent for capital facilities for which the impact fees were paid, and (iv) the capital facilities for which the impact fees are to be used will benefit the new development paying the impact fees.

(2) Appeal.

(i) Any determination or decision made by the Director under this chapter may be appealed to the City Manager by filing with the City Manager within 30 days of the determination or decision for which the appeal is being filed: (A) a written notice of appeal on a form provided by the City Manager, (B) a written explanation of why the appellant feels the determination or decision is in error, and (C) an appeal fee established by the City.

(ii) City Manager Review. The City Manager shall fix a time and place for hearing the appeal, and shall mail notice of the hearing to the appellant at the address given in the notice of appeal. The hearing shall be conducted at the time and place stated in the notice given by the City Manager. At the hearing, the City Manager shall consider the appeal and either affirm or modify the decision or determination of the Director based on the relevant standards and requirements of this chapter. The decision of the City Manager shall be final.

(3) Administrative Rules. The City Manager and Director, and their respective designees, may from time to time establish written administrative rules, not inconsistent with the provisions of this chapter, to facilitate the implementation of this chapter as provided in GJMC 2.12.010. Without limiting the foregoing, the Director is authorized to establish written administrative rules, not inconsistent with the provisions of this chapter, for use in the determination of the land use category(ies) in the impact fee schedule that is applicable to impact-generating development. All administrative rules adopted pursuant hereto shall be published in written form and copies thereof maintained in the offices of the Director and City Clerk. Administrative rules adopted pursuant hereto and a copy of such rules shall be made available without charge to fee payers and other persons requesting a copy thereof.

Impact Fee Schedule
Fire, Police and Parks and Recreation

	Land Use Type	Unit	Current Fees	Jan 1 2020	Jan 1 2021	Jan 1 2022	Jan 1 2023*
Residential	**Single-Family**						
	Fire	Dwelling	$0	$0	$0	$710	$710
	Police	Dwelling	$0	$0	$0	$305	$305
	Parks and Recreation	Dwelling	$225	$484	$743	$1,001	$1,260
	Multifamily						
	Fire	Dwelling	$0	$0	$0	$467	$467
	Police	Dwelling	$0	$0	$0	$200	$200
	Parks and Recreation	Dwelling	$225	$381	$537	$692	$848
Nonresidential	Retail/Commercial						
	Fire	1,000 sf	$0	$0	$0	$489	$489
	Police	1,000 sf	$0	$0	$0	$206	$206
	Parks and Recreation	1,000 sf	$0	$0	$0	$0	$0
	Office/Institutional						
	Fire	1,000 sf	$0	$0	$0	$191	$191
	Police	1,000 sf	$0	$0	$0	$81	$81
	Parks and Recreation	1,000 sf	$0	$0	$0	$0	$0
	Industrial						
	Fire	1,000 sf	$0	$0	$0	$66	$66
	Police	1,000 sf	$0	$0	$0	$28	$28
	Parks and Recreation	1,000 sf	$0	$0	$0	$0	$0
	Warehousing						
	Fire	1,000 sf	$0	$0	$0	$34	$34
	Police	1,000 sf	$0	$0	$0	$14	$14
	Parks and Recreation	1,000 sf	$0	$0	$0	$0	$0

* Fee plus inflation

Impact Fee Schedule
Transportation

	Land Use Type	Unit	Current Fees	Jan 1 2020 12.5%	July 1 2020 25.0%	Jan 1 2021 37.5%	Jul 1 2021 50.0%	Jan 1 2022 67.5%	July 1 2022 75.0%	Jan 1 2023* 87.5%	July 1 2023* 100.0%
Residential	All Multifamily	Dwelling	$1,769	$1,908	$2,047	$2,186	$2,325	$2,464	$2,603	$2,742	$2,881
	<1,250 sq. ft. of living area	Dwelling	$2,554	$2,620	$2,685	$2,751	$2,816	$2,882	$2,947	$3,013	$3,078
	1,250 to 1,649 sq. ft. of living area	Dwelling	$2,554	$2,824	$3,093	$3,363	$3,633	$3,902	$4,172	$4,441	$4,711
	1,650 to 2,299 sq. ft. of living area	Dwelling	$2,554	$2,907	$3,260	$3,613	$3,966	$4,318	$4,671	$5,024	$5,377
	2,300 sq. ft. or more of living area	Dwelling	$2,554	$3,115	$3,676	$4,237	$4,798	$5,359	$5,920	$6,481	$7,042
	Mobile Home/RV Park	Pad	$1,284	$1,500	$1,715	$1,931	$2,146	$2,362	$2,577	$2,793	$3,008
Hotel/Lodging	Hotel/Motel	Room	$2,407	$2,574	$2,740	$2,907	$3,073	$3,240	$3,406	$3,573	$3,739
Retail/Commercial	Shopping Center/Commercial	1,000 sf	$4,189	$4,569	$4,949	$5,328	$5,708	$6,088	$6,468	$6,847	$7,227
	Auto Sales/Service	1,000 sf	$3,780	$4,211	$4,642	$5,073	$5,504	$5,934	$6,365	$6,796	$7,227
	Golf Course	Hole	$5,951	$6,111	$6,270	$6,430	$6,589	$6,749	$6,908	$7,068	$7,227
	Movie Theater	1,000 sf	$10,574	$7,227	$7,227	$7,227	$7,227	$7,227	$7,227	$7,227	$7,227
	Restaurant, Standard	1,000 sf	$5,159	$5,418	$5,676	$5,935	$6,193	$6,452	$6,710	$6,969	$7,227
Convenience Commercial (Gas/Drive Thrus)	Bank, Drive-In	1,000 sf	$6,359	$7,485	$8,610	$9,736	$10,861	$11,987	$13,112	$14,238	$15,364
	Convenience Store w/Gas Sales	1,000 sf	$9,143	$9,921	$10,698	$11,476	$12,254	$13,031	$13,809	$14,586	$15,364
	Restaurant, Drive-Through	1,000 sf	$11,544	$12,022	$12,499	$12,977	$13,454	$13,932	$14,409	$14,887	$15,364
Office	Office, General	1,000 sf	$3,141	$3,473	$3,806	$4,138	$4,470	$4,802	$5,135	$5,467	$5,799
	Office, Medical	1,000 sf	$8,862	$5,799	$5,799	$5,799	$5,799	$5,799	$5,799	$5,799	$5,799
	Animal Hospital/Vet Clinic	1,000 sf	$8,862	$5,799	$5,799	$5,799	$5,799	$5,799	$5,799	$5,799	$5,799
	Hospital	1,000 sf	$4,112	$4,323	$4,534	$4,745	$4,956	$5,166	$5,377	$5,588	$5,799
Institutional/Public	Nursing Home	1,000 sf	$1,149	$1,184	$1,218	$1,253	$1,288	$1,322	$1,357	$1,391	$1,426
	Place of Worship	1,000 sf	$1,967	$1,426	$1,426	$1,426	$1,426	$1,426	$1,426	$1,426	$1,426
	Day Care Center	1,000 sf	4,086	$1,426	$1,426	$1,426	$1,426	$1,426	$1,426	$1,426	$1,426
	Public/Institutional	1,000 sf	$639	$737	$836	$934	$1,033	$1,131	$1,229	$1,328	$1,426
Industrial	Industrial	1,000 sf	$1,864	$1,884	$1,904	$1,924	$1,945	$1,965	$1,985	$2,005	$2,025
Warehousing	Warehouse	1,000 sf	$1,328	$921	$921	$921	$921	$921	$921	$921	$921
	Mini-Warehouse	1,000 sf	$460	$518	$575	$633	$691	$748	$806	$863	$921

* Fee plus inflation

(Ord. 4878, 10-16-19)

Title 22

H ROAD/NORTHWEST AREA PLAN

Chapters:

22.04 Background Information
22.08 Plan Adoption
22.12 Policies and Performance Standards

Chapter 22.04

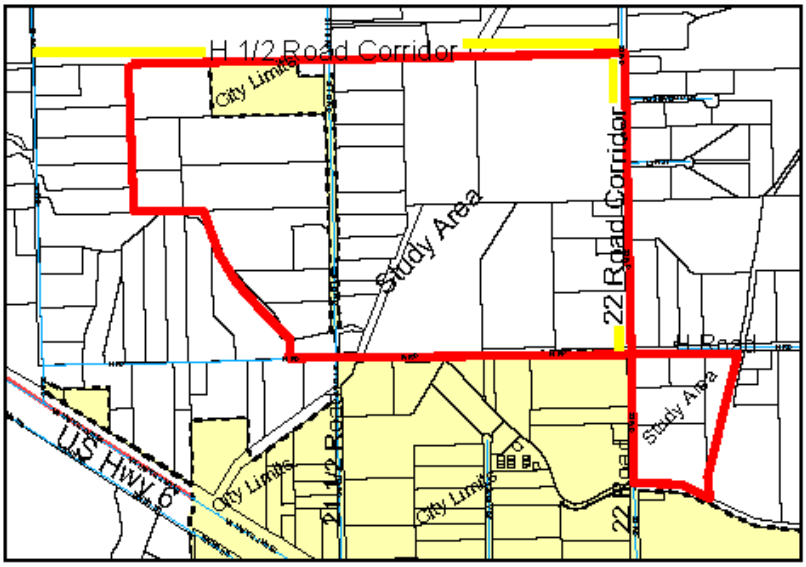
BACKGROUND INFORMATION

Sections:

22.04.010 Background information.
22.04.020 Planning process.
22.04.030 Public comments.

22.04.010 Background information.

The H Road/Northwest Area Plan is located in the 21 1/2 Road and H Road vicinity. The plan area was added to the Persigo 201 sewer service area (which is the urban growth boundary) in March 2006. This area plan establishes appropriate future urban land uses and policies for ensuring compatible future development options for the study area. In September 2006 the plan (study) area contained:



(a) Approximately 250 acres;

(b) Thirty-seven parcels;

(c) Thirty ownerships;

(d) Fourteen residences on 13 parcels;

(e) Fifteen businesses on 16 parcels;

(f) Eight vacant parcels.

(Ord. 4066, 4-18-07; (City) GPA 2007-025, (County) 2007-027 MP1)

22.04.020 Planning process.

The planning process began in the fall of 2006 with initial meetings among City, County and Colorado Department of Transportation staff. Focus groups were held to discuss traffic/transportation needs and commercial/industrial needs for vacant land.

Planning staffs conducted baseline inventories and met with in-house and external service providers to help identify key issues prior to meeting with the public. Focus group meetings were held with Grand Junction economic development representatives, oil and gas representatives and property owners along the 22 Road and H 1/2 Road corridors. A public open house was held in November 2006. The entire schedule is outlined below:

September 20, 2006	City/County Meeting #1
October 3, 2006	Base Mapping Completed
October 4, 2006	City/County Meeting #2
October 17, 2006	Focus Group Meeting – Economic Development Needs
October 30, 2006	Focus Group Meeting – Transportation Needs

November 1, 2006	City Council's Strategic Planning Team #1 Meeting
November 17, 2006	Sent Notice for Neighborhood Meeting
November 29, 2006	Neighborhood Meeting/Open House
December 8, 2006	City/County Meeting #3
January 16, 2007	City/County Meeting #4
February 6, 2007	Sent Invitation Letter to 22 Road and H 1/2 Road Residents
February 15, 2007	Focus Group Meeting – 22 Road and H 1/2 Road Residents
February 21, 2007	City/County Meeting #5
March 8, 2007	Joint City/County Planning Commission Workshop
March 12, 2007	Newsletter/Notice for Public Hearing Mailed
March 27, 2007	City/County Meeting #6
March 27, 2007	Joint City/County Planning Commission Hearing
April 18, 2007	City Council Hearing

Public input was solicited at the open house held November 29, 2006, and the February 15th focus group. Staff also received numerous written comments, phone calls, letters and comments by e-mail, and other personal communications throughout the planning period. The public meetings were well attended, more than 60 individuals signed in at the open house and 17 people attended the focus group meeting. Two newsletters were mailed to every property owner in the planning area and within one-half mile of the plan area. The City Internet website kept the public up-to-date on issues and progress of the plan.

(Ord. 4066, 4-18-07; (City) GPA 2007-025, (County) 2007-027 MP1)

22.04.030 Public comments.

Public comments received at the open house were clearly divided between those that expressed a desire to:

(a) Not allow commercial/industrial land uses east of Pritchard Wash and only allow residential densities no greater than residential estates (two to five acres per lot); and

(b) Make the entire study area commercial/industrial including the areas east of Pritchard Wash.

The comments from the adjacent residential neighborhood were in opposition to commercial/industrial land uses east of Pritchard Wash for such reasons as compatibility, quality of life, noise, feared loss of property values, etc.

The need for commercial/industrial land uses east of Pritchard Wash was strongly supported by many of the property owners as well as the Grand Junction economic development community, oil and gas representatives, the Grand Junction Area Chamber of Commerce, and the business incubator staff and board. These groups all stated the need for additional commercial/industrial land in the Grand Junction area, especially industrial parcels greater than 10 acres in size.

22 Road (north of H Road) in foreground – looking west to Pritchard Wash

(Ord. 4066, 4-18-07; (City) GPA 2007-025, (County) 2007-027 MP1)

Chapter 22.08

PLAN ADOPTION

Sections:

22.08.010 Plan adoption.
22.08.020 Future Land Use Map.
22.08.030 Grand Junction Circulation Plan Map amendment.

22.08.010 Plan adoption.

Amendment to the Joint Urban Area Future Land Use Plan, an element of the Mesa County Master Plan, and a part of the Grand Junction Growth Plan in recognition that the area was added to the Persigo Sewer Service Area in March 2006.

After six months of review, the City Planning Commission and the Mesa County Planning Commission held a public hearing on March 27, 2007, and approved the H Road/Northwest Area Plan. The City Council held a public hearing on April 18, 2007, and approved the plan. The H Road/Northwest Area Plan includes the following elements:

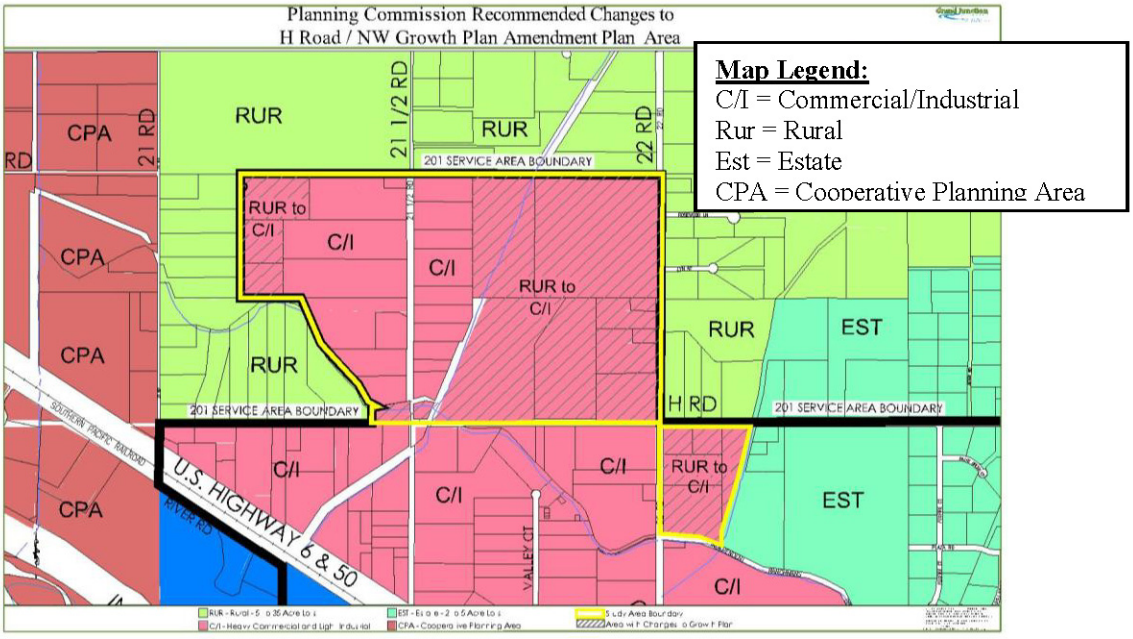
(a) An amendment to the City and County's Future Land Use Map from "Rural" to "Commercial/Industrial" (C/I) for all properties located within the plan area that are currently designated as "Rural."

(b) Adoption of policies and performance standards that will help mitigate impacts to the adjacent residential neighborhood(s) outside of the plan area.

(c) An amendment to the Grand Junction Circulation Plan to include the plan area and establish an appropriate street network that will accommodate future growth in the area.

(Ord. 4066, 4-18-07; (City) GPA 2007-025, (County) 2007-027 MP1)

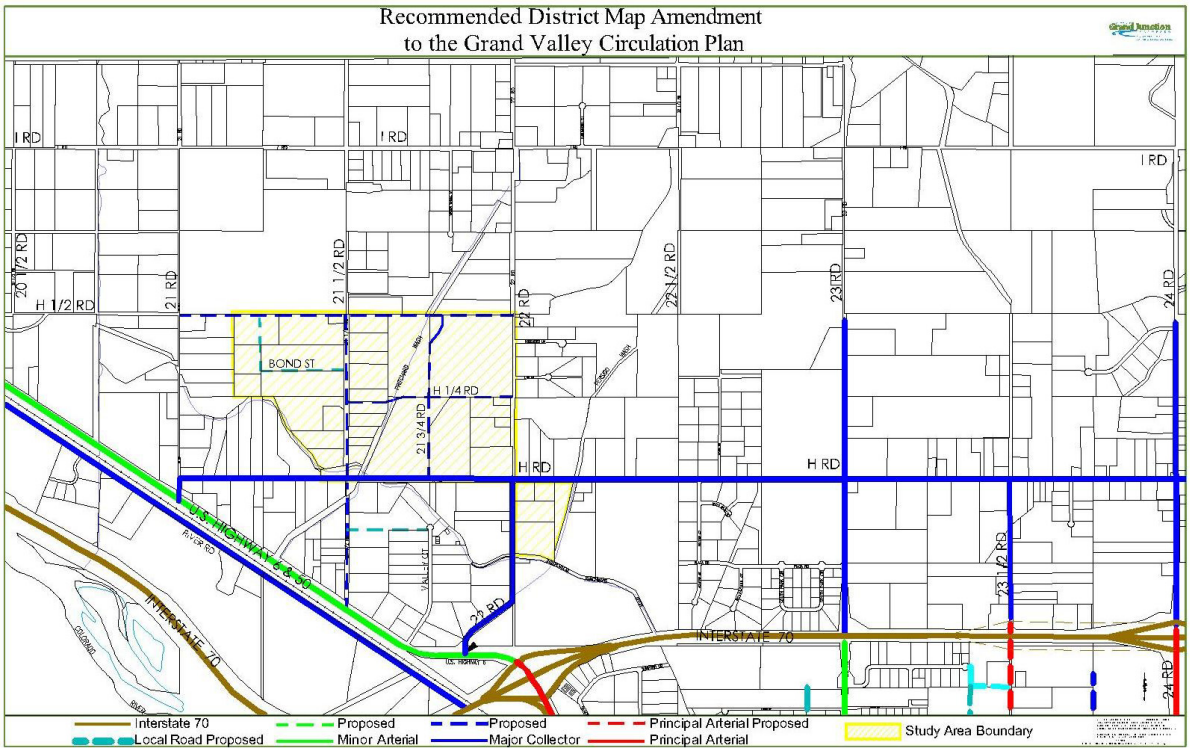
22.08.020 Future Land Use Map.



Cross-hatched area illustrates changes to the Future Land Use Map
(RUR to C/I = Rural to Commercial/Industrial)

(Ord. 4066, 4-18-07; (City) GPA 2007-025, (County) 2007-027 MP1)

22.08.030 Grand Junction Circulation Plan Map amendment.



Changes to the Grand Junction Circulation plan (formerly Grand Valley Circulation Plan) include adding major collector roads including 21 1/2 Road between U.S. Highway 6 and H 1/2 Road, H 1/4 Road between 21 1/2 Road and 22 Road, 21 3/4 Road between H Road and H 1/2 Road, and H 1/2 Road between 21 Road and 22 Road. The plan also identifies the need for a local street to be constructed between Valley Court and 21 1/2 Road and Bond Street and H 1/2 Road.

Potential intersection improvements were identified through the planning process for the intersections of 21 1/2 Road and U.S. Highway 6 where the potential exists for a proposed traffic control location such as a traffic signal or other traffic control improvements. The two intersections of Valley Court and 22 Road with U.S. Highway 6 where traffic movements may need to be restricted in the future were not included in the final Grand Valley Circulation Plan (now the Grand Junction Circulation Plan) amendment, although they were identified as needing additional study.

(Ord. 4066, 4-18-07; (City) GPA 2007-025, (County) 2007-027 MP1)

Chapter 22.12

POLICIES AND PERFORMANCE STANDARDS

Sections:

Article I. Policies

22.12.010 Affected area.
22.12.020 Truck traffic.
22.12.030 Billboards.

Article II. Performance Standards

22.12.040 Affected area.
22.12.050 Corridor aesthetics/landscaping.
22.12.060 Loading docks and fleet parking.
22.12.070 Outdoor storage and display.
22.12.080 Parking lots.
22.12.090 Architectural standards.
22.12.100 Signage standards.
22.12.110 Other standards.

Article I. Policies

22.12.010 Affected area.

The following performance standards shall affect the entire H Road/Northwest Area Plan.

(Ord. 4066, 4-18-07; (City) GPA 2007-025, (County) 2007-027 MP1)

22.12.020 Truck traffic.

Site design shall direct truck (operations) traffic to the 21 1/2 Road Corridor. All other traffic including customer or light vehicle traffic may also use 22 Road and H 1/2 Road.

(Ord. 4066, 4-18-07; (City) GPA 2007-025, (County) 2007-027 MP1)

22.12.030 Billboards.

All signage as defined under the existing development codes and regulations of the City and County as off-premises signs are not allowed anywhere within the H Road/Northwest Area Plan boundaries.

(Ord. 4066, 4-18-07; (City) GPA 2007-025, (County) 2007-027 MP1)

Article II. Performance Standards

22.12.040 Affected area.

Development on all parcels abutting the west side of 22 Road from H Road to H 1/2 Road and the south side of H 1/2 Road from 21 Road to 22 Road shall be required to meet the following performance standards.

(Ord. 4066, 4-18-07; (City) GPA 2007-025, (County) 2007-027 MP1)

22.12.050 Corridor aesthetics/landscaping.

All property frontages along these corridors shall provide at a minimum:

(a) A 25-foot-wide landscaping strip the entire length of the frontage (excluding driveways).

(b) A berm the entire length of the frontage with a minimum of 36 inches in height.

Fencing shall not be allowed within the 25-foot landscape strip with the exception of split rail fences with up to three rails and not more than four feet in height.

(Ord. 4066, 4-18-07; (City) GPA 2007-025, (County) 2007-027 MP1)

22.12.060 Loading docks and fleet parking.

All loading docks and fleet/equipment parking shall be located in the rear half of the lot or behind the principal structure (i.e., south side of buildings fronting on H 1/2 Road and west of buildings fronting on 22 Road).

(Ord. 4066, 4-18-07; (City) GPA 2007-025, (County) 2007-027 MP1)

22.12.070 Outdoor storage and display.

Outdoor storage areas shall be:

(a) Adequately screened so as not to be visible from adjacent public roads (i.e., H 1/2 Road and 22 Road);

(b) In the rear half of the lot or behind the principal structure (i.e., south of buildings fronting on H 1/2 Road and west of buildings fronting on 22 Road);

(c) Trash dumpsters shall be fully screened and located in the rear half of the lot or behind the principal structure.

(Ord. 4066, 4-18-07; (City) GPA 2007-025, (County) 2007-027 MP1)

22.12.080 Parking lots.

All parking lots located within the front half of the parcel or front of the principal structure (adjacent to 22 Road and H 1/2 Road rights-of-way) shall only be used for customer parking.

(Ord. 4066, 4-18-07; (City) GPA 2007-025, (County) 2007-027 MP1)

22.12.090 Architectural standards.

Applies only to building facades facing the 22 Road and H 1/2 Road rights-of-way. Building form shall incorporate projected and recessed elements to provide architectural variety, such as entryways, special functional areas, rooflines, and other features, including the following requirements:

(a) Blank, windowless walls are discouraged. Where the construction of a blank wall is necessary, the wall shall be articulated.

(b) Large monolithic expanses of uninterrupted facades (greater than 50 feet) are not allowed. Pilasters, texture transitions, windows and stepping of the wall plane are required.

(c) Buildings with flat roofs shall provide a parapet with an articulated cornice.

(d) All primary buildings shall use materials that are durable, economically maintained, and of quality that will retain their appearance over time including but not limited to stone, brick, stucco, and pre-cast concretes.

(Ord. 4066, 4-18-07; (City) GPA 2007-025, (County) 2007-027 MP1)

22.12.100 Signage standards.

Only monument style signs at a maximum of eight feet in height with a maximum total of 64 square feet per sign face shall be allowed. Signs shall not be internally illuminated. External illumination is allowed.

(Ord. 4066, 4-18-07; (City) GPA 2007-025, (County) 2007-027 MP1)

22.12.110 Other standards.

The following are adequately addressed under existing development codes and City of Grand Junction and Mesa County regulations and therefore conformance must be met through the development process under then-existing code requirements:

(a) Retail sales/wholesale sales area;

(b) Odors;

(c) Glare;

(d) Parking lots;

(e) Lighting standards;

(f) Noise (regulated in § 25-12-103, C.R.S., maximum permissible noise levels, and GJMC 8.16.010).

(Ord. 4066, 4-18-07; (City) GPA 2007-025, (County) 2007-027 MP1)

Title 23

NORTH AVENUE OVERLAY ZONE DISTRICT

Chapters:

23.04 Background and Intent
23.08 Options and Boundaries
23.12 Overlay Zone District Standards and Guidelines

Chapter 23.04

BACKGROUND AND INTENT

Sections:

23.04.010 Overlay zoning.
23.04.020 The vision.
23.04.030 North Avenue.
23.04.040 Definitions.

23.04.010 Overlay zoning.

Overlay zoning creates a special zoning district over a base zone. An overlay adds to or changes the regulations, standards or requirements of the base zone in order to protect or guide development within a specific area or corridor to meet specific needs or objectives. While the base zone determines the permitted land uses, the overlay zone establishes design or other standards that meet the overlay's purposes.

The overlay zone for North Avenue provides direction, vision and incentives for development in the corridor. The purpose of the overlay is to stimulate new development, redevelopment and business and other human activity along the corridor. The overlay supports and implements the Comprehensive Plan goal of making the City a more livable place. The overlay's standards and guidelines are intended to stimulate commercial, pedestrian and other activity in the corridor.

(Ord. 4564, 2-20-13)

23.04.020 The vision.

The vision for the North Avenue corridor was established in the 2007 and 2011 North Avenue Corridor Plans ("the Plans"). The North Avenue overlay zone encourages development features considered critical to implementing the plans by establishing guidelines, standards, development incentives and alternative approaches for development and redevelopment. The Plans envision buildings located near the street, front doors that are inviting and readily accessible, signage on the building rather than pole signs, more and safer pedestrian facilities, and an inviting streetscape, which will create an environment of vitality and livability.

The "streetscape" is the area between the street curb and the building facade. The combination of the adjacent land use and the public space of the streetscape can create a dynamic and inviting space. Streetscape features that create a visually interesting corridor and a safer pedestrian and transit experience create a dynamic

sense of place inviting activity. The overlay also includes development incentives to encourage design and development of an attractive streetscape.

(Ord. 4564, 2-20-13)

23.04.030 North Avenue.

Revitalize North Avenue by establishing it as a "complete street." Development is encouraged to be designed and built according to the plans, which establish a "complete street" vision for North Avenue.

The North Avenue "Complete Street" concept includes:

(a) A multi-modal corridor designed for not only the vehicle, but also for the pedestrian, bicyclist and the transit user.

(b) Wide sidewalks detached from the roadway.

(c) Buildings located close to the street with pedestrian access to the building at the streetscape.

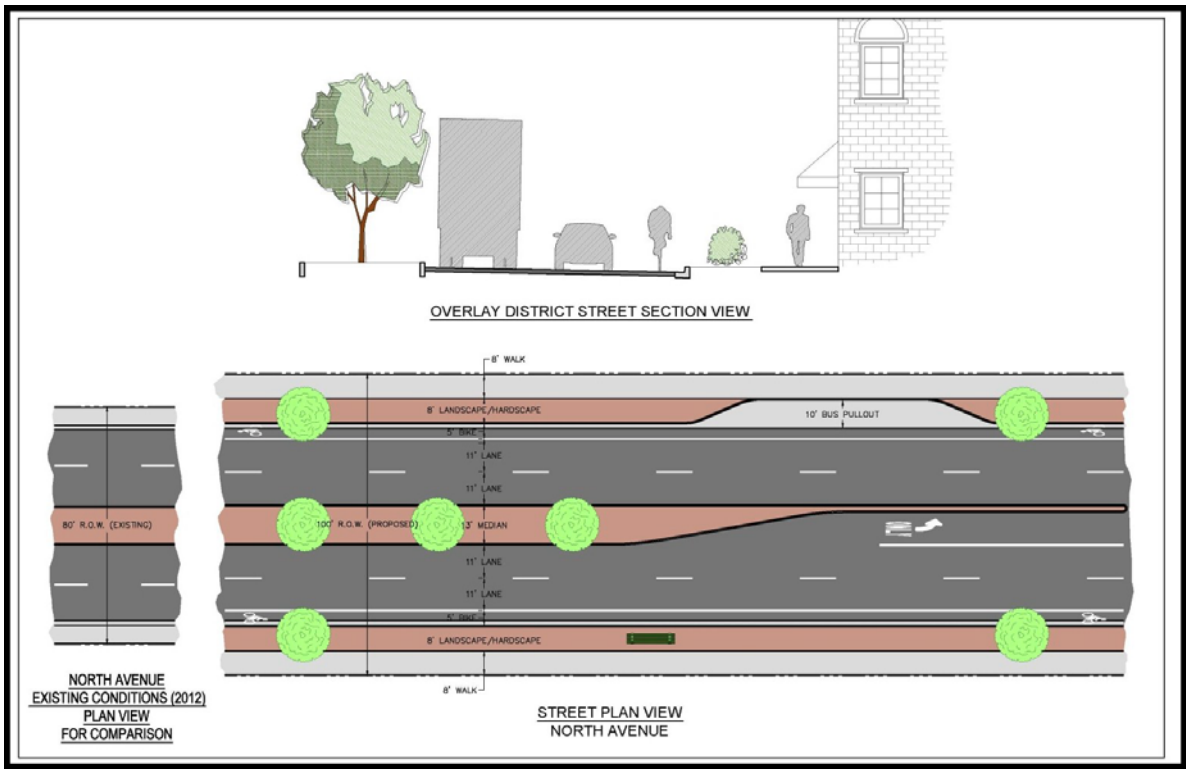
(d) Safe access to businesses from the street and sidewalks and parcel interconnectivity to minimize multiple access points to North Avenue.

(e) Safe and efficient transit stops.

(f) Adequate lighting creating a safer vehicle and pedestrian experience.

(g) Landscaping, street furniture and other hardscape features and amenities that enhance the pedestrian and motoring public's experience, but still allow buildings to be near the street.

The diagram below establishes the right-of-way standards for the overlay district.



23.04.040 Definitions.

The following definitions apply to this overlay:

Abutting means directly touching. For example, parcels across a public right-of-way from one another would not be abutting, but would be adjacent to one another.

Adjacent to something means lying within a 100-foot radius of it. For purposes of adjacency, public right-of-way, easements, canals, waste ditches and waterways are not included in the 100-foot calculation.

(Ord. 4564, 2-20-13)

Chapter 23.08

OPTIONS AND BOUNDARIES

Sections:
23.08.010 Options for development within the district.
23.08.020 Boundaries of the overlay district.

23.08.010 Options for development within the district.

The North Avenue zoning overlay establishes mandatory standards, "opt-in" standards, and a point system for specific site upgrades. Any and all property development within the district must adhere to the mandatory standards, and in addition must choose among the following three options:

(a) Follow all of the opt-in standards;

(b) Develop according to the "base" zone standards; or

(c) Upgrade a site using the point system.

The mandatory standards of the overlay zone establish the right-of-way width and streetscape features for the corridor. The opt-in standards include incentives which relax some of the base-zone standards (landscaping requirements, for example) in exchange for meeting specified standards which will shape the desired character of the built environment. The point system allows a landowner to improve the site in specific ways which will help create the desired character of the built environment and provides framework for distribution of financial incentives that may become available. (The overlay zone does not establish those financial incentives, but merely establishes a point system for accessing such funds if and when they become available.)

(Ord. 4564, 2-20-13)

23.08.020 Boundaries of the overlay district.

The North Avenue overlay district applies to all properties abutting the North Avenue right-of-way from First Street on the west to I-70 Business Loop on the east.

(Ord. 4564, 2-20-13)

Chapter 23.12

OVERLAY ZONE DISTRICT STANDARDS AND GUIDELINES

Sections:

23.12.010 Applicability/conflicts.
23.12.020 Mandatory standards.
23.12.030 Opt-in standards.
23.12.040 Site upgrade point system.

23.12.010 Applicability/conflicts.

Where the standards or requirements of this overlay zone conflict with another overlay zone, area plan or the balance of the Zoning and Development Code, this overlay shall control. Where another overlay zone or area plan gives the Director authority to waive, vary or diverge from a development standard, a requirement of a zone district or another land use regulation, that authority shall not apply to property within the boundaries of this overlay district. The variance procedure and criteria set forth in GJMC 21.02.200 shall apply.

(Ord. 4564, 2-20-13)

23.12.020 Mandatory standards.

(a) Right-of-way Standards. All development in the overlay district shall include dedication of sufficient right-of-way so that there are 50 feet of half right-of-way for North Avenue.

(b) Pedestrian/Sidewalk Standards. The North Avenue standard for public sidewalks is an eight-foot detached sidewalk with an eight-foot park strip separating the sidewalk from the street. In connection with any development in the overlay district, the landowner shall dedicate the appropriate amount of land to meet those standards, and the landowner/developer shall construct the sidewalk and park strip areas to City specifications. Exception: The sidewalk and/or park strip widths may be adjusted if a building existing on the property that is not being demolished or substantially remodeled encumbers all or part of the area 16 feet from the back of curb of North Avenue; provided, that the adjustment is the minimum necessary to accommodate the building. Neither the sidewalk nor the park strip, however, can be eliminated altogether, and the sidewalk shall be the higher priority between the two.

The park strip is part of the streetscape and shall include pedestrian and transit amenities including landscaping and hardscape features. It shall include different features which distinguish it from the sidewalk; in other words, the park strip cannot be solid concrete pavement like the sidewalk.

Hardscape features and materials include, but are not limited to the following:

Benches	Bike racks	Pedestrian lighting
Transit pullouts	Transit shelters	Trash cans
Planters	Water features	Art/sculptures
Newsstands	Mail boxes	Banners, hanging baskets

Landowner/developer may select among these and other appropriate (as approved by the Director) hardscape features to install in the park strip. A minimum of two such features shall be installed in the park strip in front of the parcel being developed, improved or re-developed.

(c) Multipurpose Easement. No multi-purpose easement is required along the North Avenue frontage. Utilities shall be located in the street right-of-way, to the rear of the property, in an alley, or in another appropriate location. If public utilities are located on private property, an easement shall be granted or dedicated for those utilities.

All other development standards of the Zoning and Development Code relating to right-of-way, sidewalk and park strip shall apply. Development of property within the district shall in all other respects not addressed in this overlay meet the requirements of the balance of the Zoning and Development Code.

(Ord. 4564, 2-20-13)

23.12.030 Opt-in standards.

The opt-in section includes guidelines and standards. Guidelines are permissive recommendations for development; standards are mandatory requirements once the developer/landowner has opted in.

(a) Benefits/Incentives. There are significant benefits to opting in to the standards of this section. Opting into all these standards entitles a landowner/developer to the following reductions to the base zone and other Zoning and Development Code standards:

(1) Landscaping and Buffering. Landscaping is required only in parking areas.

- No landscaping/screening buffer is required between adjacent properties.
- No street-frontage landscaping is required.
- Where all parking is located behind a building, no landscaping along access from North Avenue is required.
- No street trees are required in front of buildings that abut or are within 10 feet of North Avenue right-of-way. If a parking area abuts the North Avenue right-of-way, street trees are required along the North Avenue street frontage of the parking area.
- A 30-inch tall decorative screen wall may be substituted for the required parking lot screening between the parking lot located at the right-of-way/property line and North Avenue. Shrub planting in front of the wall is not required for this option.

All other landscaping regulations of the Grand Junction Municipal Code shall apply.

Purpose: North Avenue is a major commercial district located within the City Center. Historically its development pattern has been both urban and suburban in scale. The Comprehensive Plan identifies high growth in the City Center area through 2035 as the community nearly doubles in population. The plans likewise emphasize urban growth along the North Avenue corridor, including more building mass, hardscape areas, less landscaping, and more pedestrian activity.

(2) Setbacks. The building setback is reduced to zero.

- Minimum building setbacks:
  Front = 0 ft.
  Side = 0 ft.
  Rear = 0 ft.

Purpose: Reducing the setbacks to zero creates more buildable area and creates a more urban built environment. This standard also encourages better site design and complements the streetscape by emphasizing a pedestrian experience.

(3) Parking Space Credits. (See below).

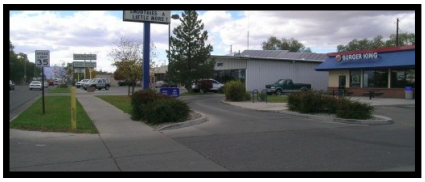
(b) Standards.

(1) Maximum Building Setback Equals 10 Feet. The maximum building setback of 10 feet applies to all building construction including additions with exceptions for public plazas, outdoor seating areas and other pedestrian spaces.

Purpose: A maximum building setback of 10 feet supports the streetscape vision for North Avenue. Buildings close to the street enhance the pedestrian experience and create visual interest along the corridor.

(2) Drive Through Lanes. Drive through lanes shall not be installed between the North Avenue right-of-way and the building.

Purpose: This standard will reduce conflict between vehicles and pedestrians entering the building from the front and therefore enhance pedestrian activity and safety. In the first two examples pictured below, there are potential conflicts between motorists and pedestrians because a drive lane interferes with pedestrian access from North Avenue. The third picture (Taco Bell) shows a drive through lane that does not interfere with the front door access into the restaurant reducing pedestrian/vehicle conflicts and making pedestrian access to the building safer.



(3) Parking.

(i) Parking shall not be permitted between the building and the North Avenue right-of-way.

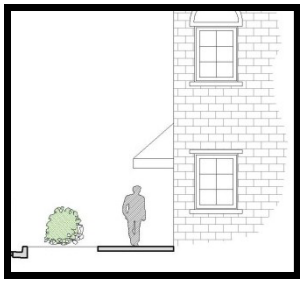
Purpose: The purpose of this standard is to reduce the amount of parking along the North Avenue frontage and to emphasize the buildings and pedestrian friendly streetscape.

(ii) All development shall meet the parking requirements established for the use and the base zone with the following exception. Parking space credit shall be allowed under the following conditions:

(A) Providing shared parking between two abutting properties through a recorded, permanent shared parking easement.

(B) When on-street parking is available (for corner lot development only), two on-street spaces may count as one on-site parking space.

(4) Awning Standards. Awnings and other facade enhancements are encouraged. One or more awnings extending from the building may be erected. Awnings shall be at least eight feet above the sidewalk and shall be at least four feet wide, along the building frontage on North Avenue, and shall not overhang into the right-of-way more than six feet. Awnings shall otherwise meet with the requirements of the Grand Junction Municipal Code and Colorado Department of Transportation (CDOT) regulations.



Purpose: Awnings provide visual interest to the corridor and enhance the pedestrian experience.

(5) Building Entry Standards. The main entrance to the building shall be on the North Avenue face of the building. Additional entrance(s) may be provided on the side and/or rear of the building to parking areas or other pedestrian facilities. A front door may be constructed anywhere along the front facade of the building including at the corner of the front facade as shown in the two examples pictured to the right.

Purpose: When an entrance is visible from the North Avenue corridor, it invites in the pedestrian and motorist alike. A front door also provides direct pedestrian access from the public sidewalk within the streetscape, supporting the revitalization of North Avenue as envisioned by the plans.

(6) Development of property within the district shall in all other respects not addressed in this overlay meet the requirements of the balance of the Zoning and Development Code.

(c) Guidelines. Whenever possible North Avenue development/redevelopment should:

(1) Minimize the number of traffic conflict points into and out of a business.

(2) Create pedestrian, bike and transit friendly amenities.

(3) Better define and consolidate driveways into businesses and access between/among businesses to minimize vehicle access points onto North Avenue.

(4) Provide turn lanes where appropriate.

(5) Maximize the use of existing local streets and alleys for access to eliminate vehicle access points onto North Avenue.

(6) Include awnings or other visually interesting building features on the front of the building to provide visual interest and enhance the pedestrian experience.

(7) Include living landscaping within the park strip. The use of xeric landscape is encouraged.

Purpose: These guidelines promote pedestrian safety and efficient vehicle movement and provide visual interest along the corridor.

(Ord. 4564, 2-20-13)

23.12.040 Site upgrade point system.

(a) This section is known and may be cited as the "Site Upgrade Point System for the North Avenue Overlay Zone District." It establishes a rating system whereby points are awarded in the development review process when a developer/owner upgrades a site or structure to meet the standards established by the North Avenue overlay zone and/or to achieve the vision of the plans. An owner may choose to develop under this section in lieu of the opt-in section of the overlay district. Also, an owner who opts in can receive points for those aspects of the development that are listed in the improvement table.

(b) Purpose. The purpose of this site upgrade point system is to encourage property owners along North Avenue to take steps that will bring their existing structures and sites more into alignment with the vision for the corridor as established by the plans and by this overlay.

(c) Use with Nonconformities. When installing only one or more specific site upgrade(s) selected from table below, without making other site improvements, a landowner with a nonconforming use, site or structure is not required to bring the site or structure into conformance with the code as prescribed in the "nonconformities" section of the Zoning and Development Code (Chapter 21.08 GJMC).

However, if such landowner undertakes a site or structure remodel that includes improvements not listed in the table below, the nonconforming section of the Zoning and Development Code (Chapter 21.08 GJMC) applies, or, if the developer/owner has opted in, the opt-in standards apply.

(d) Validity of Points. Points may be awarded by the Director according to the table below. The points are assignable (subject to any expiration date or time established in the program), but may only be assigned one time. Points can also be shared by two or more landowners (for example, where adjacent owners agree to consolidate and eliminate access points and establish cross-access between or among parcels). If points are shared, the owners must agree in writing to the allocation of points between/among themselves.

(e) Improvement Table and Point Values. The improvement table below establishes the improvements to the right-of-way, streetscape and private property that are encouraged by the plans and by this overlay and the points that will accrue upon completion of said improvements. The improvement table may be amended by the City Council by resolution. Regardless of the point values in the improvement table, no points shall be awarded for improvements to private property or to right-of-way that are part of a capital improvement program or project of any governmental entity, including but not limited to the City, the County or the Colorado Department of Transportation.

Improvement Table

First Priorities	**Points**
Construction of detached sidewalk/park strip running the entire length of the property along North Avenue and meeting the overlay standards. Total points are determined by dividing proposed streetscape area square feet by 1,600 square feet and multiplying by 30 pts. Benefit: Aesthetics and Pedestrian Safety	30
Right-of-way dedicated along North Avenue for entire frontage sufficient to allow eight feet detached sidewalk and eight feet park strip. Total points are determined by dividing the dedicated ROW area square feet by 1,000 square feet and multiplying by 30 pts. Benefit: Pedestrian Safety	30
Elimination of a North Avenue street access point[1], including construction of curb and gutter and removing the driveway apron and must include dedication of all required North Avenue right-of-way. Benefit: Pedestrian and Vehicle Safety	20
Second Priorities	**Points**
Pole or free-standing sign removed and sign placed on building facade Benefit: Aesthetic Value	7
Addition of plaza, fountain or outdoor dining in front of building along North Avenue Benefit: Pedestrian Access and Aesthetic Values	7
Construction of an addition to building that meets maximum setback (10 or fewer feet from property line); shall include the addition of a front door facing North Avenue; and 50 feet half right-of-way must be dedicated. Benefit: Pedestrian and Aesthetic Values	6
Elimination of parking along North Avenue frontage and placing all parking behind building(s) Benefit: Pedestrian Safety and Aesthetic Values	5
Pole sign removed and replaced with a monument sign Benefit: Aesthetic Value	5
Elimination of parking along North Avenue in front of the building(s) and all parking placed along the side and/or behind the building(s) Benefit: Pedestrian Safety and Aesthetic Values	3

Improvement Table (Continued)

Parking shared with adjacent properties[2] Benefit: Aesthetic Value	3
Permanent elimination of front yard display or storage[3] Benefit: Aesthetic Value	2
Two hardscape features installed in park strip (maximum for point system) Benefit: Aesthetic Value	2
One hardscape feature installed in park strip Benefit: Aesthetic Value	1

[1]Can be accomplished by sharing access point with neighbor by a cross access easement (which must be reviewed and approved by the City Attorney), or by one property taking access from a lower order street.

[2]Must be established by recorded permanent easement appurtenant, not by shared parking agreement.

[3]Must be established by amended site plan, CUP or other land use approval.

(f) Incentive Program. If and when funding becomes available, the Director shall develop a program and process for allocating funds to points under the improvement table.

(g) Appeals. Any person aggrieved by a decision of the Director regarding an award of points or incentive funds under this section may appeal that decision to the City Council within 30 days of the decision.

(Ord. 4564, 2-20-13)

Title 24

GREATER DOWNTOWN OVERLAY

Chapters:

24.04 Introduction
24.08 Corridor Standards and Guidelines
24.12 Downtown District Standards and Guidelines

Chapter 24.04

INTRODUCTION

Sections:
24.04.010 Implementation – Standards and guidelines.

24.04.010 Implementation – Standards and guidelines.

One of the first steps in implementing the Greater Downtown Plan is a zoning overlay. The overlay is intended to provide guidance and criteria for the planning, design and implementation of public and private improvements in the Greater Downtown area and is set forth in this document to be known as the Greater Downtown overlay district (zoning overlay). If properly administered and adhered to, the standards and guidelines should result in public and private development improvements (or a combination thereof) that achieve, as a minimum, a common level of quality in terms of site design, architectural design, landscaping and other site improvements.

The general purposes of the standards and guidelines are to support the overall goals of the Greater Downtown Plan.

(a) Maintain and enhance the economic, cultural and social vitality of Greater Downtown. Promote downtown living by providing a wide range of housing opportunities in appropriate areas within Greater Downtown.

(b) Enhance the transportation system to accommodate automobiles, bikes and pedestrians, and provide adequate, convenient parking.

(c) Stabilize, preserve, protect and enhance the downtown residential neighborhoods.

(d) Promote and protect the unique identity of the Greater Downtown area.

The standards and guidelines were developed upon an analysis of the existing character of the Greater Downtown area. The area was divided into subdistricts and the Downtown District was further divided into subareas based on existing zoning, character of existing development and potential for redevelopment opportunities. In addition, primary corridors were identified for which overlay guidance is created with the adoption of the document. The subdistricts, primary corridors and subareas are shown on Figures 1, 2 and 3.

These standards supplement other development regulations such as the City of Grand Junction Zoning and Development Code, which includes detailed criteria by zone district, planned development regulations, design and improvement standards, supplemental use regulations, sign regulations and the City Transportation and Engineering Design Standards (TEDS). In the instance the following standards are silent on a development concern, the existing regulations shall apply. None of the guidelines and standards within the zoning overlay is intended to apply to properties within the North Seventh Street Historic Residential District or the North Avenue Corridor Overlay since separate guidelines and standards have been established through overlays for those areas.

The standards identify design alternatives and specific design criteria for the visual character and physical treatment of private development and public improvements within Greater Downtown. They are adopted through an overlay zoning district, which will establish the means by which the standards are administered and enforced. The Director will make all decisions, and appeals and variance requests will be heard by the City of Grand Junction Planning Commission. The Downtown Development Authority (DDA) will be a review agency for all applications and will make recommendations for proposals in the Central Business District.

(Ord. 4572, 3-20-13)

Figure 1: Greater Downtown Plan Subdistricts

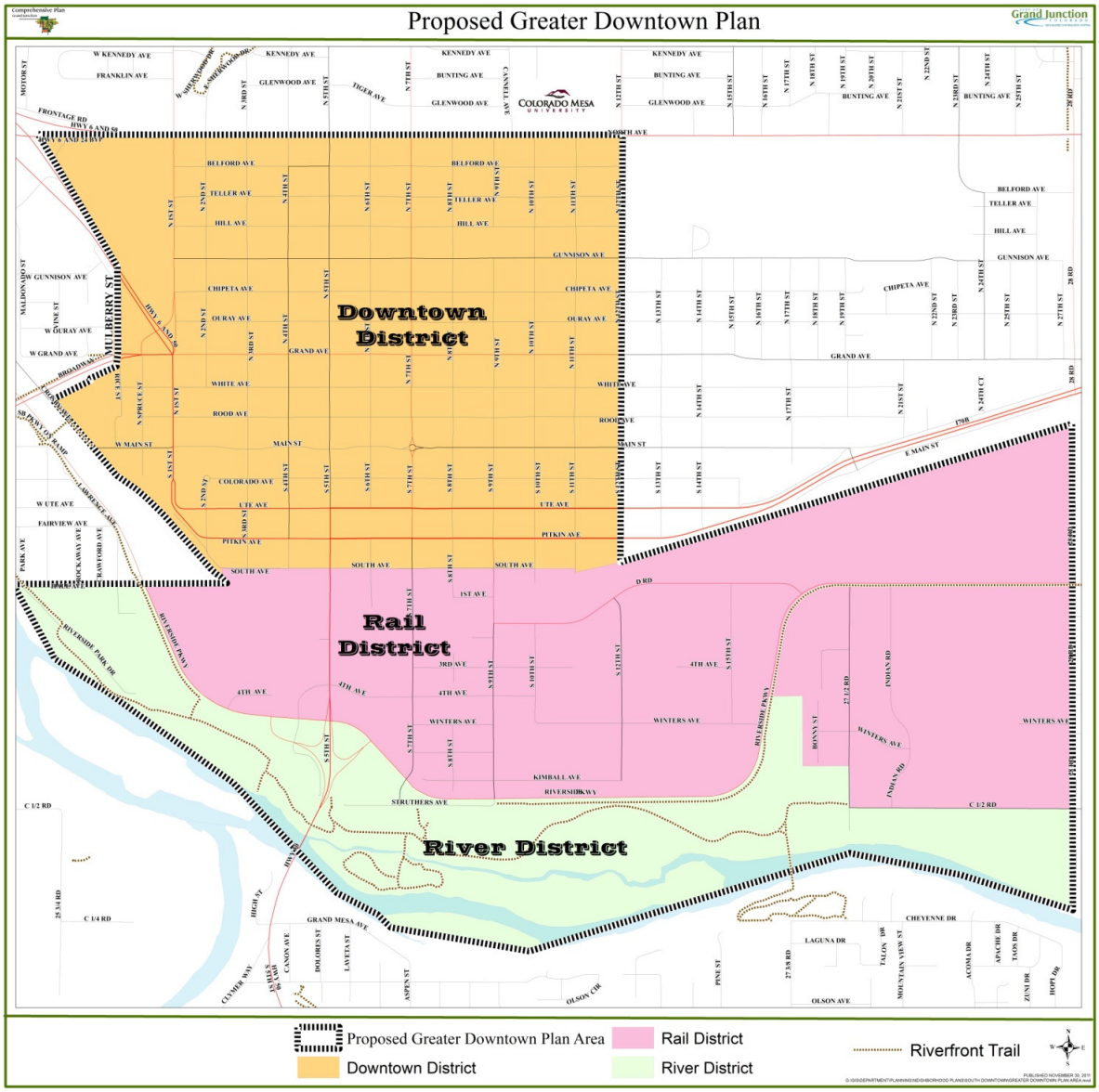


Figure 2

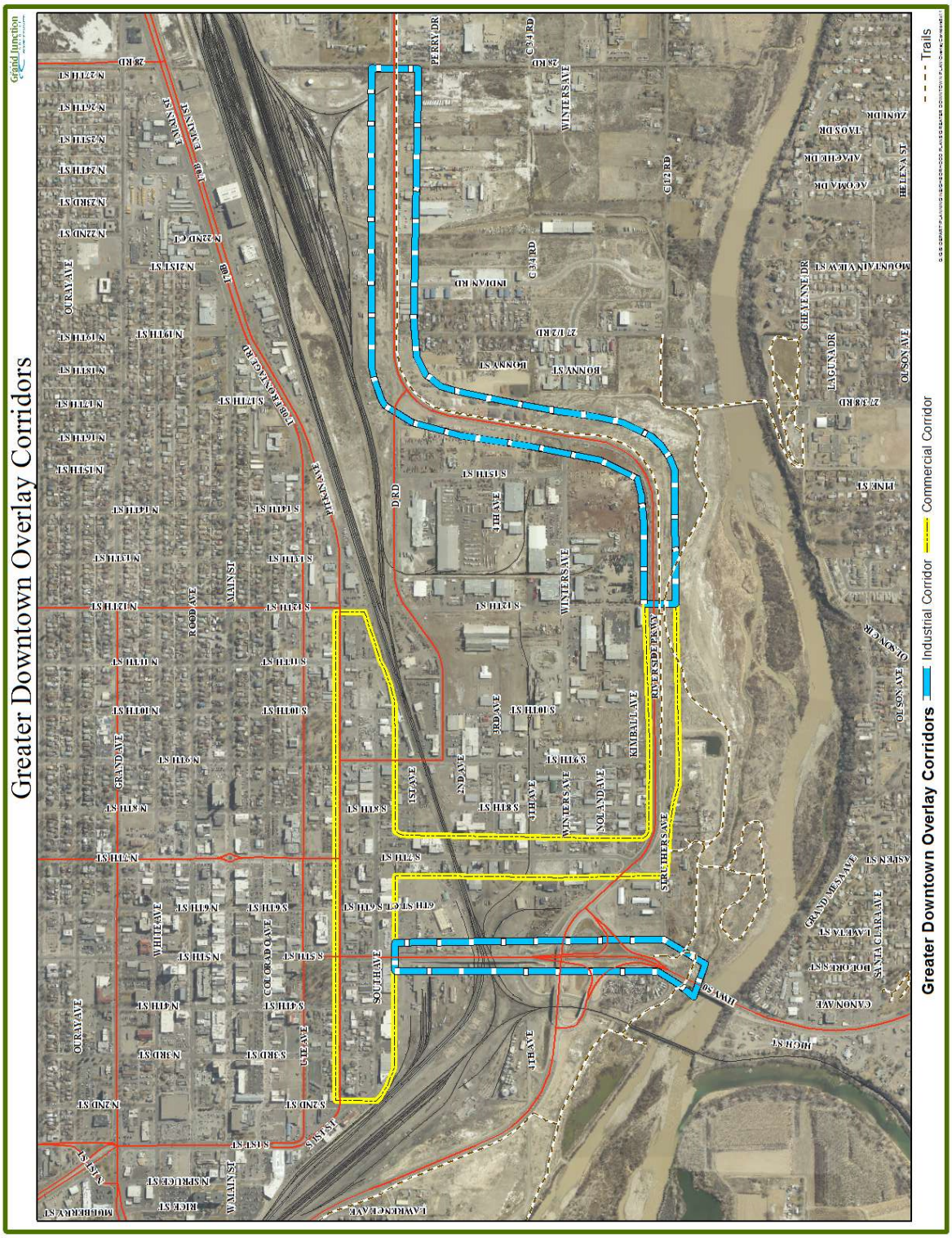
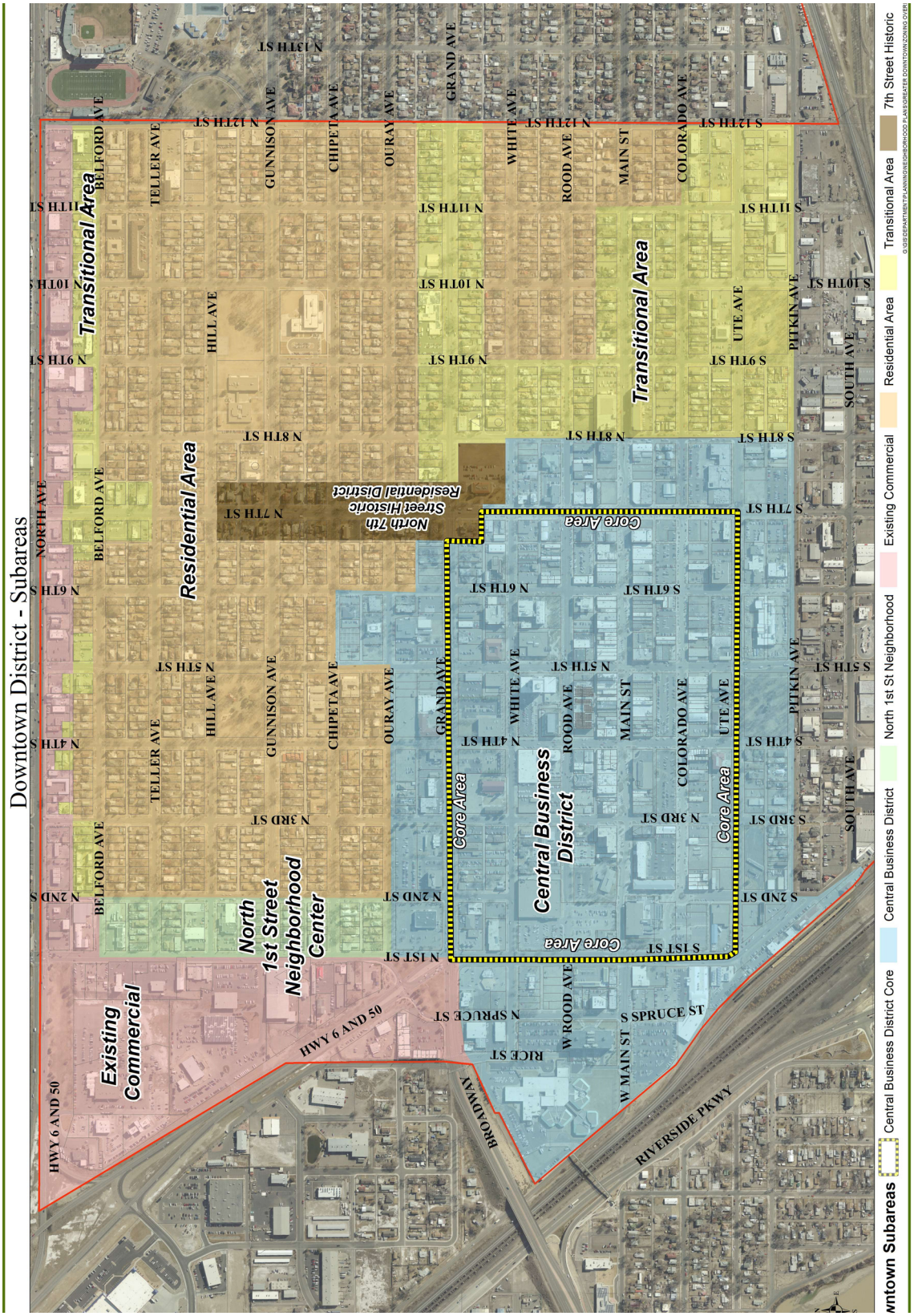

Greater Downtown Overlay Corridors
Greater Downtown Overlay Corridors
Industrial Corridor
Commercial Corridor
Trails

Figure 3


Downtown District - Subareas
Transitional Area
Residential Area
Existing Commercial
North 1st Street Neighborhood Center
Central Business District
Core Area
North 7th Street Historic Residential District
Transitional Area
Core Area
Core Area
HWY 6 AND 50
HWY 6 AND 50
BROADWAY
RIVERSIDE PKWY
GRAND AVE
GUNNISON AVE
CHIPETA AVE
OURAY AVE
WHITE AVE
ROOD AVE
MAIN ST
COLORADO AVE
UTE AVE
PITKIN AVE
SOUTH AVE
TELLER AVE
HILL AVE
BELFORD AVE
NORTH AVE
N 1ST ST
N 2ND ST
N 3RD ST
N 4TH ST
N 5TH ST
N 6TH ST
N 7TH ST
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S 10TH ST
S 11TH ST
S 12TH ST
N SPRUCE ST
S SPRUCE ST
RICE ST
W MAIN ST
W ROOD AVE
Downtown Subareas
Central Business District Core
Central Business District
North 1st St Neighborhood
Existing Commercial
Residential Area
Transitional Area
7th Street Historic

Chapter 24.08

CORRIDOR STANDARDS AND GUIDELINES

Sections:

I. Overall Corridor Vision/Concepts

24.08.010 Purpose.
24.08.020 Architectural features.
24.08.030 Building materials.
24.08.040 Streetscape and site design.

II. Commercial Corridor Standards and Guidelines

24.08.050 Application of standards and guidelines.
24.08.060 New site development or redevelopment – Standards.
24.08.070 Architectural design of new buildings/additions or substantial exterior remodel.
24.08.080 Landscaping for new site development or redevelopment – Standards.
24.08.090 Signage – Standards.

III. Industrial Corridor Standards and Guidelines

24.08.100 Application of standards and guidelines.
24.08.110 5th Street industrial corridor standards.
24.08.120 Riverside Parkway industrial corridor standards.

I. Overall Corridor Vision/Concepts

24.08.010 Purpose.

The Greater Downtown overlay district standards for the Greater Downtown commercial and industrial corridors in the Rail and River Districts begin to implement goals of the Greater Downtown Plan to (i) improve the visual impact of development along the corridors; and (ii) promote higher quality architectural treatment and site design as new development and redevelopment occurs along the corridors. The visual features identified below define the concepts proposed along the corridors and, as implemented as new development and redevelopment occurs, will shape the desired character of the built environment. The features are grouped into three categories: architectural features; building materials; and streetscape and site design.

(Ord. 4572, 3-20-13)

24.08.020 Architectural features.

(a) Facade Modulation and Roofline Variations. The corridors can be improved through use of visually interesting architectural features that are designed to reduce mass and scale, including variation in the building form with recessed or projecting bays and variation in the rooflines.

(b) Facade Design. Design details can be used to emphasize architectural features such as the modulation and roof line changes discussed above or other features such as entryways and windows. Facade design details that break up a facade and add visual interest include:

(1) Columns and pilasters that help break up a horizontal plane of a building or other site feature.

(2) Change of material such as on an exterior wainscoting panel.

(3) Accent colors that help define and/or accentuate architectural features.

(c) Defined Entry. Many of the other architectural features above can be used to accentuate and define the primary entrance to a building, add architectural interest, as well as make the building more pedestrian- or customer-friendly.

(d) Window Sizes and Shapes. The shape and sizes of windows used on a building break up the facade, provide visual variety and provide a pedestrian- and customer-friendly character.

(e) Awnings and Porticos. Awnings and porticos are encouraged to help provide architectural interest.

(Ord. 4572, 3-20-13)

24.08.030 Building materials.

(a) Mix of Materials. Variations of materials used on exterior facades break up large building forms and walls.

(b) Different Textures, Colors and Tones. Use of different textures, colors and tones provide visual interest and can be used to accentuate architectural features.

(Ord. 4572, 3-20-13)

24.08.040 Streetscape and site design.

Streetscape features along the primary corridors within the Rail and River Districts in Greater Downtown also help establish the visual character of the corridors. Examples of the desired characteristics are illustrated below.

(a) Building Placement. Buildings are encouraged to be brought forward on a site to the street or sidewalk.

(b) Landscaping. Many of the streets within the Rail and River Districts do not have, nor are planned to have, a sidewalk. However, streetscape interest can be created through landscaping, encouraging use of xeriscape concepts.

Example Existing Streetscape Landscaping

(c) Streetscape Design. An urban streetscape is desired that includes hard surfaces, tree grates and street trees. This design concept exists along some of the corridors in the Rail and River District. The urban streetscape along the street can be blended with the site design of the adjacent parcel so that on-site landscaping complements and enhances the existing streetscape.

Existing 7th Street Landscaping

(d) Detached Sidewalks. Where possible, detached sidewalks are desired along the commercial and industrial overlay corridors and already exist along some streets. The park strip between the curb and sidewalk can provide the landscape relief for an abutting developed property.

Existing Detached Sidewalk on Riverside Parkway (left) and South Avenue (right)

(e) Outdoor Storage, Display and Operations. Minimize the visual impact of outdoor storage, display and operations areas through placement on a site behind a building, to the rear of the property or otherwise screened.

(Ord. 4572, 3-20-13)

Examples of Outdoor Storage and Operations Located Behind Buildings on 7th Street (left) and Riverside Parkway (right)

Screening Example on Riverside Parkway

II. Commercial Corridor Standards and Guidelines

24.08.050 Application of standards and guidelines.

The following Commercial Corridor standards and guidelines apply to those parcels on the south side of Pitkin Avenue between 2nd Street and 12th Street as shown in Figure 4: all parcels, or aggregation of parcels to be developed that have frontage on: (i) the east side of 2nd street between Pitkin Avenue and South Avenue; (ii) South Avenue between 2nd Street and 12th Street; (iii) South 7th Street between Pitkin Avenue and the south side of the Riverside Parkway; (iv) Struthers Avenue and Riverside Parkway area from just west of South 7th Street to the alignment of 12th Street; and all parcels between South 7th

Street and 12th Street within 100 feet immediately north and south of the centerline of the Riverside Parkway. This area shall be referred to hereafter as the Commercial Corridor.

(Ord. 4572, 3-20-13)

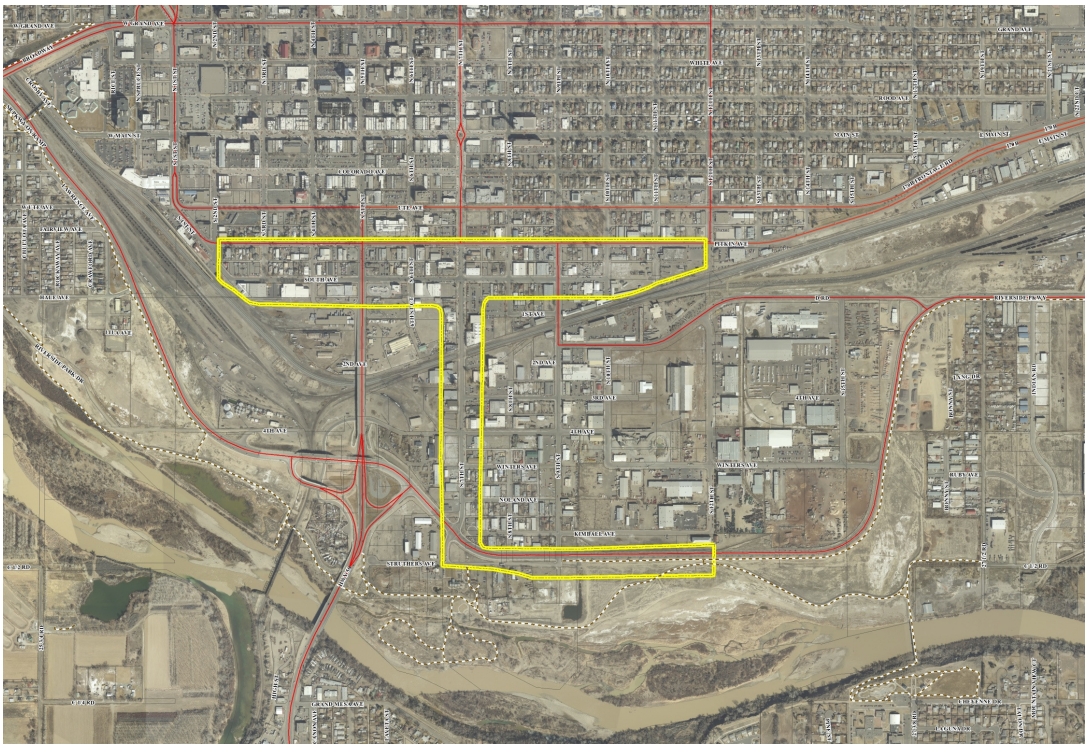


Figure 4

24.08.060 New site development or redevelopment – Standards.

(a) Outdoor storage and permanent display areas shall only be allowed in the rear half of the lot, beside and/or behind the principal structure. For properties with more than one street frontage, the front of the lot shall be considered, for purposes of this standard, to be the side abutting the higher or highest order street. Portable display of retail merchandise may be permitted subject to the provisions of the Zoning and Development Code.

(b) In order to prevent parking from dominating the visual setting of the Commercial Corridor, front yards shall allow only principal structures, landscaping, sidewalks, driveway access to parking areas and signage. No parking shall be allowed in the front yard. All parking that is accessory to a principal use shall be located behind or to the side of the building.

(c) Front yard setbacks for principal structures on parcels within the Commercial Corridor are reduced to zero feet.

(d) Residential uses are allowed as allowed in the Light Commercial (C-1) zone district in the Zoning and Development Code, regardless of how the property is zoned.

(Ord. 4572, 3-20-13)

24.08.070 Architectural design of new buildings/additions or substantial exterior remodel.

(a) Policy. For construction of new buildings and additions, or substantial exterior remodel (see definition under subsection (b)(2) of this section), any facade(s) on all buildings that face a street within the Commercial Corridor shall be designed to relate directly to and reinforce the pedestrian scale and quality of the abutting streets, civic and open spaces.

(b) Standards.

(1) Any facade(s) of a new building, addition or substantial exterior remodel (see definition under subsection (b)(2) of this section) that face a street within the Commercial Corridor or that face the public property containing the Riverfront Trail, shall have visually interesting architectural features and patterns that are designed to reduce mass and scale and reflect the desired vision for the corridors as described in GJMC 24.08.010 through 24.08.040. In order to do so, the facade(s) of a new building, addition or substantial remodel that face a street within the Commercial Corridor shall exhibit a minimum of three of the following nine architectural design elements:

(i) Variation in materials, material modules, expressed joints and details, surface relief and texture to break up building forms and wall surfaces. Such detailing may include sills, headers, belt courses, reveals, pilasters, window bays or similar features.

(ii) Facade articulation/variation such as recessed or projecting bays or pilaster/column projections a minimum of every 30 feet.

(iii) Variation in color.

(iv) Facade feature that emphasizes the primary building entrance through projecting or recessed forms, detail, color and/or materials.

(v) Variation in roof lines/roof materials in order to add interest to and reduce the scale of buildings or expanses of blank wall. This can be accomplished through design elements such as overhangs/eaves, recesses/projections, raised cornice parapets over doors or bays and peaked roof forms.

(vi) Screening of mechanical equipment either located on the roof or on the ground.

(vii) Windows.

(viii) Window or entry awning.

(ix) Other architectural features that achieve the goals of the overall corridor vision/concept as outlined in GJMC 24.08.010 through 24.08.040 as determined by the Director.

(2) Definition of Substantial Exterior Remodel. Exterior building alteration that is greater than or equal to 65 percent of the value of the existing site and building. This increase shall trigger 100 percent site development compliance and 100 percent architectural standards compliance. Value shall be the greater of: total actual value per the Mesa County Assessor; or a current appraisal.

(c) Guidelines.

(1) Exterior building materials should be durable, economically maintained, and of a quality that will retain their appearance over time.

(Ord. 4572, 3-20-13)

24.08.080 Landscaping for new site development or redevelopment – Standards.

On-site landscaping shall be required per the Zoning and Development Code. The total amount of required landscaping may be reduced by the Director if a minimum of two of the following five conditions exist or are proposed:

(a) A higher quality of architectural design is achieved with greater than three of the architectural design elements listed in GJMC 24.08.070.

(b) Fifty percent or more of the building facade is set back no more than 15 feet.

(c) Street trees and other finished landscaping or hardscape exists within the public street immediately in front of the property.

(d) All parking is located to the side and/or rear of the building.

(e) All outdoor storage and operations are located behind the building.

(Ord. 4572, 3-20-13)

24.08.090 Signage – Standards.

(a) Only flush wall and monument style signs are allowed on the parcels that have frontage on 7th Street, Struthers Avenue, and/or Riverside Parkway within the Commercial Corridor. Flush wall signs are allowed in accordance with the Zoning and Development Code. Monument signs shall be a maximum of 12 feet in height with a maximum total of 100 square feet per sign face allowed per parcel. Illumination shall comply with the Zoning and Development Code.

(b) Off-premises signs and billboards as defined by the Zoning and Development Code that did not exist as of April 21, 2013, are not allowed on properties within the Commercial Corridor.

(Ord. 4572, 3-20-13)

III. Industrial Corridor Standards and Guidelines

24.08.100 Application of standards and guidelines.

The following Industrial Corridor standards and guidelines apply to all properties or aggregation of parcels to be developed with frontage on 5th Street or the 5th Street/Riverside Parkway intersection right-of-way, south of South Avenue to the river, referred to hereafter as the 5th Street Industrial Corridor (Figure 5), and on Riverside Parkway from the east edge of 12th Street, extended along the Riverside Parkway, east to 28 Road, referred to hereafter as the Riverside Parkway Industrial Corridor (Figure 6). Please see the maps below. Collectively, the two shall be referred to as the Industrial Corridors.

(Ord. 4572, 3-20-13)

24.08.110 5th Street industrial corridor standards.

Figure 5

(a) No new outdoor uses and operations shall be allowed on parcels that have frontage on 5th Street or on the right-of-way for the 5th Street/Riverside Parkway interchange. Maximum expansion and construction of any outdoor uses and operations (such as outdoor operation of rail yards, salvage yards, etc.) on properties that abut the 5th Street right-of-way shall be 25 percent of the total square footage as it existed on April 21, 2013.

(b) For uses that require screening per the Zoning and Development Code and will be visible from the elevated portions of the 5th Street viaduct, screening shall be provided on the viaduct that limits views to adjacent uses but still provides longer vistas to the east (Grand Mesa) and west (Colorado National Monument and Uncompahgre Plateau), in accordance with CDOT specifications as follows: 36 inches by three-eighths inches by 11 ga Core, 10 ga finish vinyl coated chain link. The City may accept payment in lieu of screening; the amount of the payment-in-lieu may be established by resolution of the City Council.

(c) Off-premises signs and billboards as defined by the Zoning and Development Code that did not exist as of April 21, 2013, are not allowed on properties within the 5th Street Industrial Corridor.

(Ord. 4572, 3-20-13)

24.08.120 Riverside Parkway industrial corridor standards.

Figure 6

(a) New Site Development or Redevelopment.

(1) Service entrances, service yards and loading areas shall be located only in the rear or side yard. For properties with more than one street frontage, the front yard shall be considered, for purposes of this standard, to be the side abutting the higher or highest order street. The rear and side yards are any other sides that do not meet the definition of a front yard. Along the Riverside Parkway right-of-way, a six-foot-high solid fence or wall of stone, wood or masonry shall screen each service yard or area from adjoining single-family residential zones and uses which are not separated by a street (not counting an alley or any easement).

(2) Outdoor storage and permanent display areas shall be allowed per the zone district of the property. Any storage in the front yard adjacent to the Riverside Parkway right-of-way shall be screened with a six-foot-high solid architectural wall constructed of stone, masonry or combination thereof with a minimum 14-foot landscape buffer provided outside of the wall unless modified per the landscaping in subsection (c) of this section.

(3) The front yard setback for principal structures on parcels within the Riverside Parkway Industrial Corridor is reduced to zero feet.

(b) Architectural Design of New Buildings or Substantial Exterior Remodel.

(1) Any side of a new building, addition or substantial remodel that faces the Riverside Parkway or the public property containing the Riverfront Trail shall exhibit a minimum of three of the following eight architectural design elements:

(i) Variation in materials.

(ii) Facade modulation/articulation a minimum of every 30 feet.

(iii) Variation in color.

(iv) Facade feature that emphasizes the primary building entrance.

(v) Variation in roofline.

(vi) Windows.

(vii) Window or entry awning.

(viii) Other architectural features that achieve the goals of the overall corridor vision/concept as outlined in GJMC 24.08.010 through 24.08.040 as determined by the Director.

(c) Landscaping for New Site Development or Redevelopment.

(1) On-site landscaping shall be required per the Zoning and Development Code. The total amount of required landscaping may be reduced by the Director if a minimum of two of the following five conditions exist or are proposed:

(i) A higher quality of architectural design is achieved with greater than three of the architectural design elements listed in subsection (b) of this section.

(ii) Fifty percent or more of the building facade has no more than a 20-foot setback.

(iii) Street trees exist within the abutting public street.

(iv) All parking is located to the side and/or rear of the building.

(v) All outdoor storage and operations are located behind the building.

(d) Signage.

(1) Only flush wall and monument style signs are allowed on the Riverside Parkway Industrial Corridor properties. Flush wall signs are allowed per the Zoning and Development Code. Monument signs shall be a maximum of 12 feet in height with a maximum total of 100 square feet per sign face allowed per parcel.

(2) Off-premises signs and billboards as defined by the Zoning and Development Code that did not exist as of April 21, 2013, are not allowed on properties within the Riverside Parkway Industrial Corridor.

(Ord. 4572, 3-20-13)

Chapter 24.12

DOWNTOWN DISTRICT STANDARDS AND GUIDELINES

Sections:

I. Overall Downtown District Vision/Concepts

24.12.010 Purpose.

II. Downtown District Area-Wide Policies, Standards and Guidelines

24.12.020 Policies.
24.12.030 Standards.
24.12.040 Guidelines.

III. Central Business District (CBD) Standards and Guidelines

24.12.050 Applicability.
24.12.060 Application of Standards and Guidelines.
24.12.070 Overall Central Business District (CBD) vision/concepts/policies.
24.12.080 Overall Central Business District (CBD) standards.
24.12.090 Central Business District Core Area (Downtown Core or Core Area) guidelines.
24.12.100 Central Business District Core Area (Downtown Core or Core Area) standards.

IV. Residential Areas Standards and Guidelines

24.12.110 Applicability.
24.12.120 Policies.
24.12.130 Standards.
24.12.140 Guidelines.

V. Transitional Areas Standards and Guidelines

24.12.150 Applicability.
24.12.160 Policy.
24.12.170 Standards.
24.12.180 Guidelines.

I. Overall Downtown District Vision/Concepts

24.12.010 Purpose.

In order to implement the Greater Downtown Plan, the following zoning overlay standards have been developed for the subareas of the Downtown District. Application of the standards and guidelines will begin to implement goals of the plan to:

(a) Maintain and enhance the economic, cultural and social vitality of the Downtown District.

(b) Promote downtown living by providing a wide range of housing opportunities.

(c) Enhance the transportation system to accommodate automobiles, transit, bikes and pedestrians, and provide adequate, convenient parking.

(d) Stabilize and enhance the historic residential neighborhoods.

(e) Establish and promote a unique identity for each of the subareas of the Downtown District.

(f) Preserve and restore significant historic structures.

(g) Activate the edges of the downtown parks with mixed use and programmed/active use of the parks as urban open space rather than passive green parks.

(Ord. 4572, 3-20-13)

II. Downtown District Area-Wide Policies, Standards and Guidelines

24.12.020 Policies.

(a) Maintain and enhance the economic, cultural and social vitality of downtown.

(b) Promote downtown living by providing a wide range housing opportunities.

(c) Enhance the transportation system to accommodate automobiles, bikes and pedestrians and provide adequate, convenient parking.

(d) Stabilize and enhance the historic residential neighborhoods.

(e) Establish and promote a unique identity.

(f) Preserve and restore significant historic structures.

(g) Activate the edges of the downtown parks with mixed use and programmed/active use of the park as urban open space rather than passive green parks.

(Ord. 4572, 3-20-13)

24.12.030 Standards.

Due to the constraints of many downtown properties and the City's desire to promote improvement and redevelopment in the Downtown District, the Director may make reasonable exceptions to the provisions of the Zoning and Development Code and the Greater Downtown Overlay District to bulk standards (except for building height), landscaping, parking or other use-specific special regulations for properties that are within the Central Business District (CBD), Transitional or Residential subareas. The following criteria shall be used to consider exceptions from the bulk standards, landscaping, parking or other use-specific special regulations:

(a) Hardship Unique to Property, Not Self-Inflicted. There are exceptional conditions creating an undue hardship, applicable only to the property involved or the intended use thereof, which do not apply generally to the other land areas or uses within similar zone districts, and such exceptional conditions or undue hardship was not created by the action or inaction of the applicant or owner of the property;

(b) Special Privilege. The exception shall not confer on the applicant any special privilege that is denied to other lands or structures within similar zone districts;

(c) Literal Interpretation. The literal interpretation of the provisions of the regulations would deprive the applicant of rights commonly enjoyed by other properties in similar zoning districts and would work unnecessary and undue hardship on the applicant;

(d) Greater Downtown Plan Goals. The proposal actually meets overall goals of the plan better than if standards are followed;

(e) Conformance with the Purposes of the Zoning Overlay and the Zoning and Development Code. The granting of an exception shall not conflict with the purposes and intents expressed or implied in this Zoning Overlay District or the Zoning and Development Code; and

(f) Conformance with Comprehensive Plan. The granting of an exception shall not conflict with the goals and principles in the City's Comprehensive Plan.

(Ord. 4572, 3-20-13)

24.12.040 Guidelines.

(a) Projects will include good, interconnected transportation choices for better access and better health.

(b) Traffic calming measures will be provided where appropriate, including pedestrian refuge areas, medians, landscaping and corner bulb-outs.

(Ord. 4572, 3-20-13)

III. Central Business District (CBD) Standards and Guidelines

24.12.050 Applicability.

The following standards and guidelines apply to the CBD area shown in Figure 7 (blue area). Further development and implementation of these concepts will be done in coordination with the DDA. The standards and guidelines are intended to apply to new development or redevelopment within the area.

(Ord. 4572, 3-20-13)

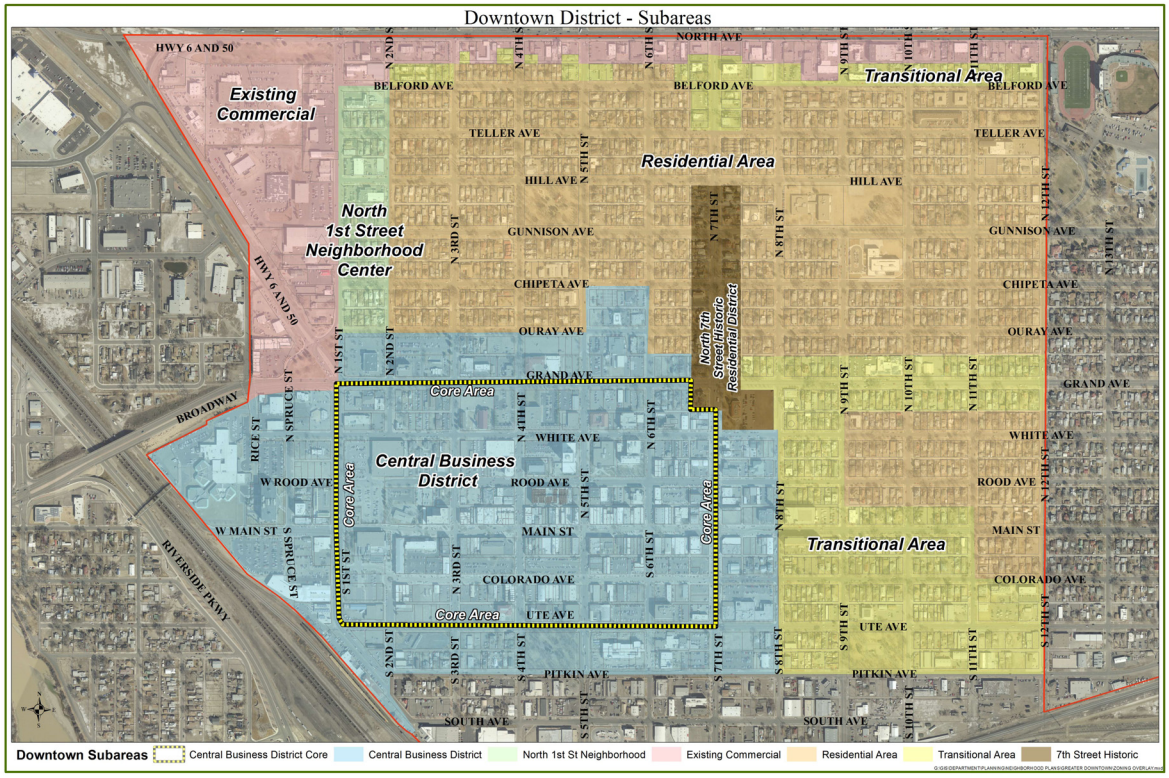


Figure 7

24.12.060 Application of standards and guidelines.

(a) Unless otherwise noted below, the standards and guidelines shall apply under the following conditions:

(1) Construction of a new building.

(2) Addition. Construction of an addition to an existing building if the addition increases total building square footage by 100 percent or greater (baseline is building square footage of existing building on April 21, 2013). This expansion standard is cumulative after this date in 2013. Once square footage has exceeded 100 percent of the 2013 square footage, the standards and guidelines shall apply to all further expansions.

(3) Substantial Exterior Remodel. Exterior building alteration that is greater than or equal to 65 percent of the value of the existing site and building. This increase shall trigger 100 percent site development compliance and 100 percent architectural standards compliance. This shall not trigger the requirement of minimum height. Value shall be the total actual value per the Mesa County Assessor or the appraised value based on an appraisal completed by a certified appraiser licensed to do business in the State of Colorado utilizing the "cost" approach.

(b) The standards and guidelines do not apply to:

(1) Construction of an addition to an existing building if the addition will increase the total building square footage by less than 100 percent (baseline is building square footage of existing building on April 21, 2013). This expansion standard is cumulative after this date in 2013. Once square footage has exceeded 100 percent of the 2013 square footage, the standards and guidelines shall apply to all further expansions.

(2) Exterior building alteration that does not exceed 65 percent of the value of the existing site and building (value determined as set forth above).

(3) Interior remodel of an existing building.

(4) This zoning overlay does not prohibit rezoning to a form-based zone within the Downtown District and this zoning overlay shall not apply to properties within a form-based zone within the Downtown District.

(Ord. 4572, 3-20-13)

24.12.070 Overall Central Business District (CBD) vision/concepts/policies.

(a) Activate the Downtown Core area streets through emphasis on higher pedestrian traffic, businesses on the ground level that are oriented towards attracting higher pedestrian volumes, and buildings that "turn the corner" (invite activity on both the primary and cross streets). Refer to the CBD Core Area map in Figure 8.

Existing Downtown Street Activity

(b) Maintain the prominence of buildings along the streets by minimizing building setbacks.

(c) Encourage high quality, compatible design for all new buildings and establish a cohesive architectural character/theme that harmonizes new structures with the existing buildings through common materials, scale and basic architectural details as outlined in greater detail in the following standards and guidelines.

(d) Typical building materials found in the CBD materials are traditional and weather well, allow a broad variety in appearance and ensure buildings are of high quality. To facilitate the creation of a cohesive architectural character/theme for new buildings, additions or exterior remodels in the Downtown Core, the following exterior finishes are most appropriate: brick, sandstone, stucco, metal cladding, tiles, wood, glazing and decorative concrete masonry units (CMU).

Example Downtown Building Materials

(e) Encourage high density, mixed-use development and structures (e.g., retail at street level and residential or office above).

(f) Encourage gradual scale transitions between the CBD and adjacent neighborhoods. Taller buildings will be located in the center and southern and western perimeter of the CBD, with shorter buildings on the northern and eastern edges of the CBD.

(g) Encourage maximizing building scale and intensity/density by offering incentives to build above the required minimum height.

(h) Minimize single use, surface parking throughout the CBD.

(i) Maintain streetscapes dominated by buildings with parking located behind. Consider elimination of existing curb cuts as a performance benefit.

Existing Downtown Mixed Use

(j) Encourage shared parking.

(k) Encourage new infill development on existing, under-utilized surface parking lots.

(l) Provide streetscape details and landscaping that compliment the architectural character of the CBD and exhibit urban character.

(m) Create entries to the CBD at strategic locations as shown on the Wayfinding and Signage Map in the Greater Downtown Plan report. Enhancements may include landscaped medians, corner bulbs and special signs.

(n) The DDA will assist in developing sign standards and guidelines for private signage placed on buildings or as freestanding signs for consideration and adoption by the City.

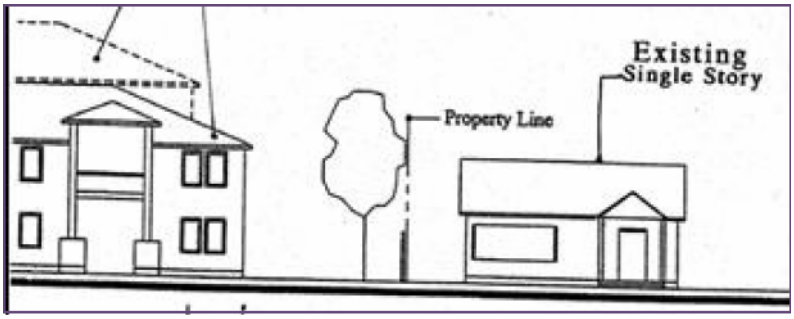
(Ord. 4572, 3-20-13)

24.12.080 Overall Central Business District (CBD) standards.

(a) Maximum building height in the CBD shall be 90 feet. A one-time increase of up to 25 percent per property may be considered by the Grand Junction Planning Commission.

(b) Buildings shall be set back a minimum of 20 feet from the street on Chipeta and Ouray Avenues.

(c) The buildings will step down so that the front facade of the buildings that are directly across Ouray and Chipeta Avenues from residential buildings or uses are no taller than 40 feet. Minimum depth of the step shall be 10 feet.



Example of Building Stepping Down to Single-Family Residential Scale

(d) Scale and massing of buildings or portions of buildings along Ouray and Chipeta Avenues will be compatible with residential scale.

(e) If off-street parking is provided, it shall be located behind buildings on private property. If the property abuts an alley, the parking area shall take access from the alley. If the property has more than one street frontage, "behind the building" shall mean on the opposite side of the building from the front door or the main public door entrance to the building.

(f) Maximize opportunities for on-street parking by minimizing curb cuts along the street.

(g) All pedestrian level lighting shall be downlit and, if on poles, shall be in a historical style light standard.

(h) The streetscape along Grand Avenue and 4th and 5th Streets north to Ouray Avenue within the CBD will continue in a design compatible with the existing improvements along Grand Avenue (e.g., decorative pavement and street trees).

(i) Landscaping is expected to comply with the Zoning and Development Code per the requirements of the zone district. The Director may approve variations for new development or redevelopment in the CBD if: (a) street trees exist within the abutting public street; and (b) streetscape elements (plantings, low walls and/or street furniture) are proposed with the development consistent with the urban design character of the CBD.

(j) The streetscape along 5th and 6th Streets north of Ouray Avenue to Chipeta Avenue within the CBD shall transition between the urban hardscape and a more residential streetscape character (e.g., detached sidewalk, landscaping in park strip between curb and sidewalk and street trees).

(Ord. 4572, 3-20-13)

Existing Grand Avenue Streetscape

24.12.090 Central Business District Core Area (Downtown Core or Core Area) guidelines.

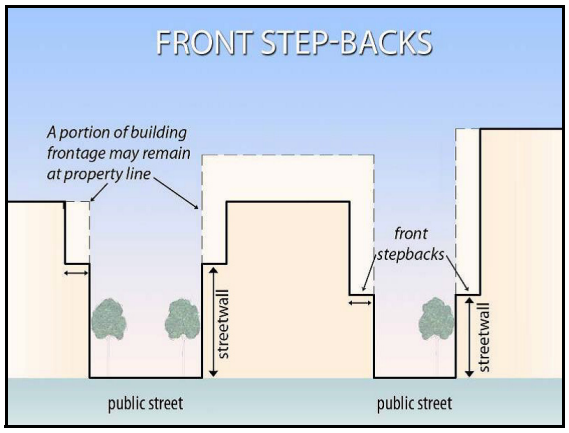
(a) Facade detailing should be compatible with, but not be identical to, that of a neighboring historic building. New facades should have their own, unique design. To create continuity, horizontal lines should be in alignment with neighboring buildings.

(b) Entrances are often the primary focal point of a building and, as such, should be designed to fit with the overall character of the area.

(c) Doorways may be finished with paints, stains, metal and aluminum cladding set to match the existing trim colors.

(d) Single, double, revolving and corner doorways are acceptable in new construction or substantial remodels.

(e) On upper floors of street-facing facades on buildings taller than the traditional three stories in the CBD, consider stepping back the upper floors a minimum depth of 10 feet in order to enhance the traditional scale of the CBD and ensure adequate air and light at the sidewalk level.



(Ord. 4572, 3-20-13)

24.12.100 Central Business District Core Area (Downtown Core or Core Area) standards.

The following standards apply only to the Downtown Core shown in Figure 8 (within the yellow-black dashed line).

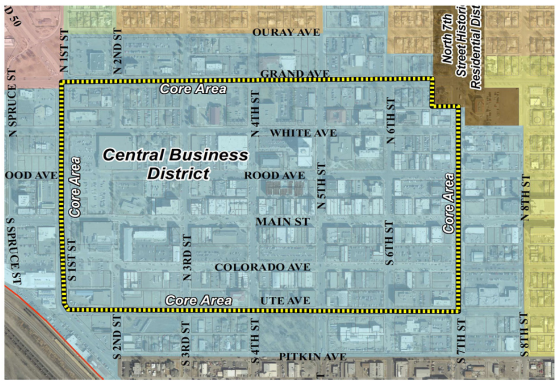


Figure 8

Existing Downtown Core Scale

(a) Building Height.

(1) Minimum building height in the Downtown Core shall be two stories.

The following uses as allowed in the zone district and as defined by the Zoning and Development Code shall be exempt from the minimum two-story requirement:

(i) Schools, colleges and universities;

(ii) Vocational, technical and trade schools;

(iii) Community activity building;

(iv) All other community service;

(v) Museums, art galleries, opera houses, libraries;

(vi) Day care;

(vii) Detention facilities;

(viii) Hospital/clinic;

(ix) Parks and open space;

(x) Religious assembly;

(xi) Funeral homes/mortuaries/crematories;

(xii) Safety services;

(xiii) Utility infrastructure and corridors;

(xiv) Car wash, gasoline service station, quick lube;

(xv) Industrial services, contractors and trade shops with indoor operations and storage.

Exemptions to this requirement for other uses of land or occupancies of a building not listed and that is not conducive to a vertical organization of operational space may be considered and approved by the Grand Junction Planning Commission with input from the DDA upon a review of a conceptual level development proposal.

(2) The following criteria shall be used by the Planning Commission to consider exemptions from the bulk standards, landscaping, parking or other use-specific special regulations:

(i) Hardship Unique to Property, Not Self-Inflicted. There are exceptional conditions creating an undue hardship, applicable only to the property involved or the intended use thereof, which do not apply generally to the other land areas or uses within similar zone districts, and such exceptional conditions or undue hardship was not created by the action or inaction of the applicant or owner of the property;

(ii) Special Privilege. The exception shall not confer on the applicant any special privilege that is denied to other lands or structures within similar zone districts;

(iii) Literal Interpretation. The literal interpretation of the provisions of the regulations would deprive the applicant of rights commonly enjoyed by other properties in similar zoning districts and would work unnecessary and undue hardship on the applicant;

(iv) Greater Downtown Plan Goals. The proposal actually meets overall goals of the plan better than if standards are followed;

(v) Conformance with the Purposes of the Zoning Overlay and the Zoning and Development Code. The granting of an exception shall not conflict with the purposes and intents expressed or implied in this zoning overlay or the Zoning and Development Code; and

(vi) Conformance with Comprehensive Plan. The granting of an exception shall not conflict with the goals and principles in the City's Comprehensive Plan.

(b) Building Setbacks/Site Placement, Scale, Massing and Street Encroachment.

(1) Maximum building setback from the abutting street shall be two feet or compatible with the mean setback of the immediately adjoining lots on both sides of the subject lot but in no case greater than 20 feet.

(2) When building setbacks are not determined as in subsection (b)(1) of this section, setbacks of up to 10 feet from the abutting street may be allowed if there is a designed function for the space such as limited outdoor display, seating, outdoor dining areas or a small street park, whether for private or public use.

(3) Architectural features on stories above street level may encroach on the public right-of-way, provided all safety considerations have been met. A revocable permit for such encroachments shall be reviewed and may be approved by the Director or a permanent easement for such encroachments may be reviewed and considered for approval by City Council.

(4) Awnings that overhang windows or entries on street level facades are encouraged and shall be constructed of canvas or heavy cloth or metal (no plastic), utilizing primarily neutral colors.

Existing Canopy on Main Street Building

(c) Architectural Character. The facade(s) of a new building, addition or substantial exterior remodel that abut the streets within the Downtown Core shall have articulated architectural features and patterns that are designed to reflect the desired vision for the CBD described in GJMC 24.12.070. In order to do so, the facade(s) of a new building, addition or substantial exterior remodel within the Downtown Core shall exhibit a minimum of four of the following nine architectural design elements:

Example Ornamentation for Visual Interest

(1) On corner parcels, facade design of ground floors "turn the corner" to induce activity and interest in the streetscape on the north-south streets within the Downtown Core.

(2) Facades are articulated and have ornamentation such as varied brick patterns, change in material or color accents and window headers or columns that create shadow lines are examples of acceptable ornamentation.

(3) The street level front facade of the building is "active" with at least 50 percent of the facade in windows, with doors spaced no more than 50 feet apart. Side facades shall meet a minimum of 50 percent of this requirement.

(4) Facade features that emphasize the primary building entrance through projecting or recessed forms, detail, color or materials.

(5) Building facades are articulated on any street-facing side. Larger buildings are articulated in a hierarchy of smaller volumes and masses that better relate to other buildings and the scale of streets. This is accomplished through establishment of building bays that are distinguished by recessed or protruding elements or a variation in materials or color to break up the facade and reduce the overall scale of large buildings.

Example Facade Articulation to Define Smaller Scale Bays

(6) Higher levels of fenestration are required for buildings along both sides of the streets within the CBD Core Area. At a minimum, fenestration shall be concentrated on the street level facade and diminish on upper floors (e.g., window size decreases as the floor level increases).

Existing facade with Diminishing Fenestration on Upper Floors

(7) Buildings include a facade cap. The cap is be defined by a distinct roof line or parapet. The design uses ornamentation of these features to enhance the building's identity and support the architectural character of the CBD. The facade cap is in three dimensions that projects and casts a shadow and relates proportionately to the overall building design.

(8) Building design minimizes the visual impact of mechanical equipment located on the roof as viewed from the adjacent streets.

(9) Other architectural features that achieve the goals of the overall Central Business District (CBD) vision/concept as outlined in GJMC 24.12.070 as determined by the Director.

Example Three Dimensional Facade Cap

(d) On-street parking shall be located and designed to maintain and support a safe pedestrian environment on streets located within the Downtown Core (yellow-

black outline in Figure 9). This includes coordinating crosswalks with parking location and eliminating visual and physical obstructions to the pedestrian travel way.

(Ord. 4572, 3-20-13)

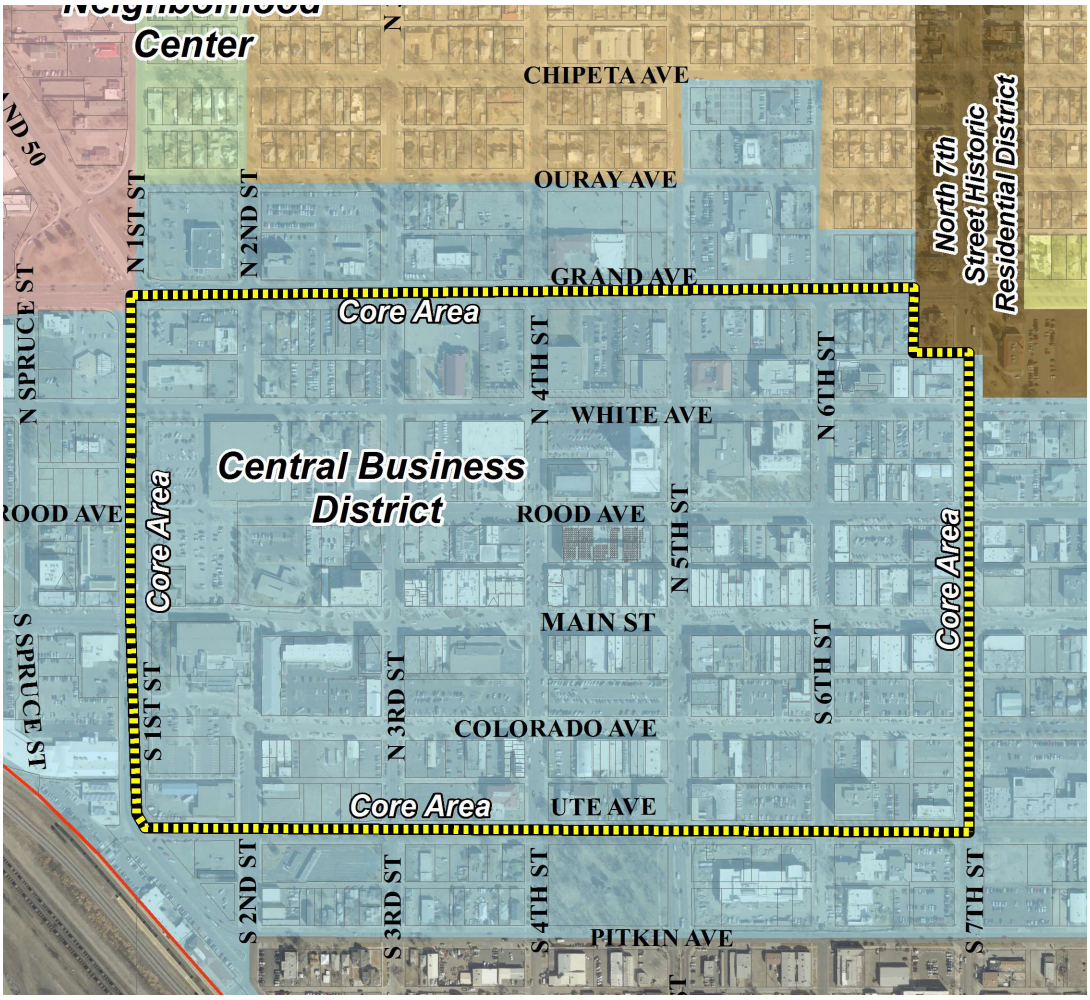


Figure 9

IV. Residential Areas Standards and Guidelines

24.12.110 Applicability.

The following standards and guidelines apply to the residential areas shown in Figure 10 (orange areas). The standards and guidelines are intended to apply to new development or substantial redevelopment within the area. Substantial redevelopment is any reconstruction, rehabilitation, addition or other improvements to the existing structure(s) on a site where the value of the improvement exceeds 50 percent of the fair market value of the building(s) before the start of construction.

(Ord. 4572, 3-20-13)

24.12.120 Policies.

(a) The existing historic residential neighborhoods within the Downtown District will be stabilized and enhanced.

(b) The existing historic residential neighborhoods within the Downtown District will be preserved for residential uses, with no further encroachment by nonresidential uses.

(c) Where existing residential zoning allows, provide a diversity of housing types through development of multifamily housing that is in keeping with the character of the neighborhood (refer to multifamily development, GJMC 24.12.130(c)).

(d) Enhance access to and improvements within existing public open spaces (e.g., parks and school grounds) within the downtown residential core.

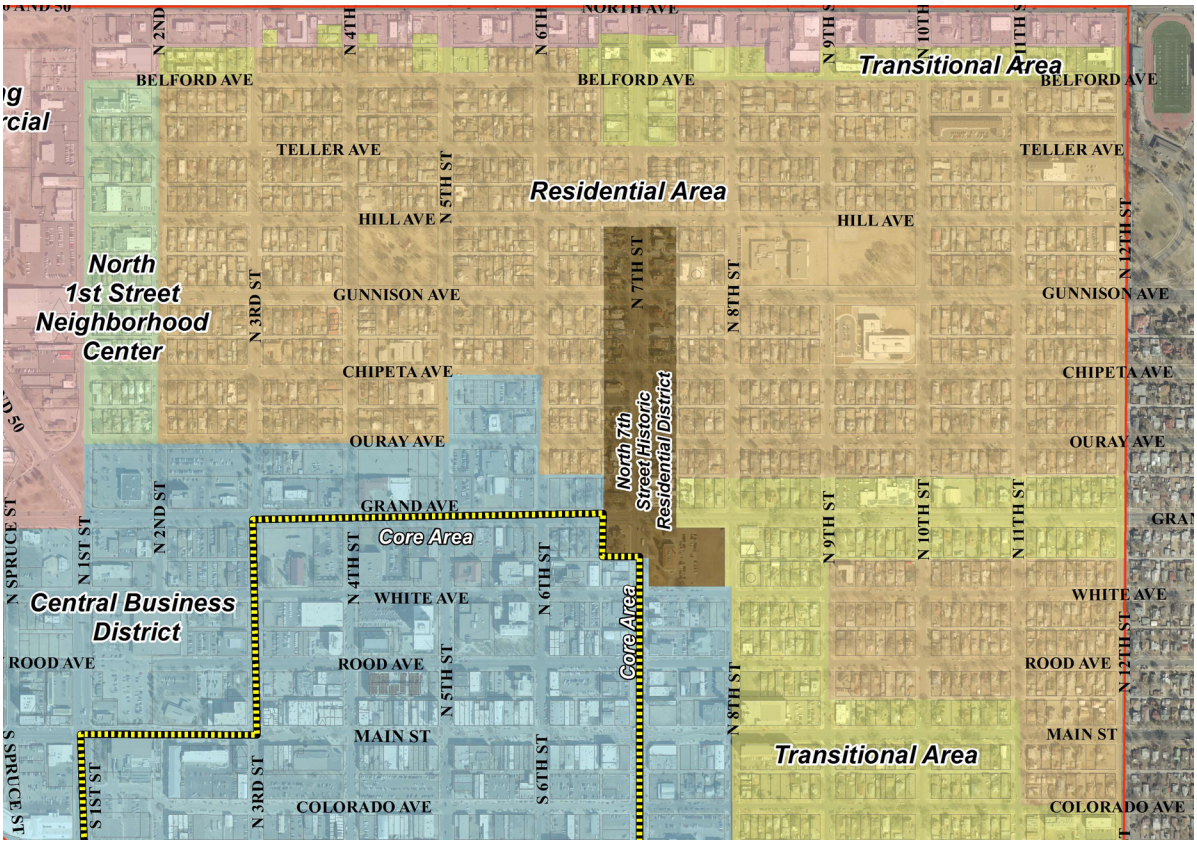


Figure 10

(e) Maintain and enhance the historic character of the streetscape with emphasis on the following elements: street trees, landscaping rather than parking or other uses in the park strip between sidewalk and curb, street signs that identify the neighborhoods, lighting and detached sidewalks.

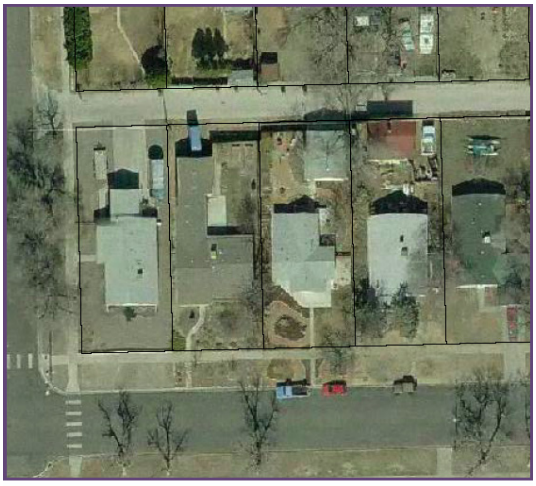
(Ord. 4572, 3-20-13)

Existing Residential Subarea Streetscape Character

24.12.130 Standards.

(a) Architectural Considerations.

(1) Building Style and Character. Maintain the existing character of the house styles within the residential neighborhoods in the Downtown District. New construction and alterations shall be compatible with key architectural characteristics and site elements of the area.



Existing Residential Building Alignment

(2) Accessory Structure Setbacks. The setback for accessory structures is a zero-foot setback from the alley and three feet from neighboring property line(s). Garages with overhead doors facing the alley must be set back a minimum of 25 feet from the far edge of the alley or the zoning setback, whichever is greater.

(3) Building Mass/Scale and Proportion. New buildings or additions to existing buildings shall be visually compatible with the area. Visually compatible means compatible with adjacent and neighboring buildings including mass and scale, shape, windows, doors, openings, roof shape, roof pitch and orientation.

(4) Roof Shape. The roofs of new buildings shall be visually compatible with adjacent buildings.

(5) Fenestration. The pattern of windows and doors on structures shall be visually compatible with buildings in the area. Visually compatible includes the relationship of width to height,

and the spacing of windows and doors. For example, tall evenly spaced rectangular windows are typical of many of the residential styles in the downtown area.

Example Existing Architectural Character

(6) Materials. The exterior materials of all new buildings, additions and alterations shall be similar in size and appearance to area buildings.

(7) Setbacks. On a corner lot, the front yard setback for that part of the yard that extends to and along the side property line on the street side may be reduced to 10 feet on properties within the Downtown District residential subareas. On corner lots where an existing parkway strip exceeds 10 feet in width between a sidewalk and the curb, the front yard setback on a side street may be reduced to five feet.

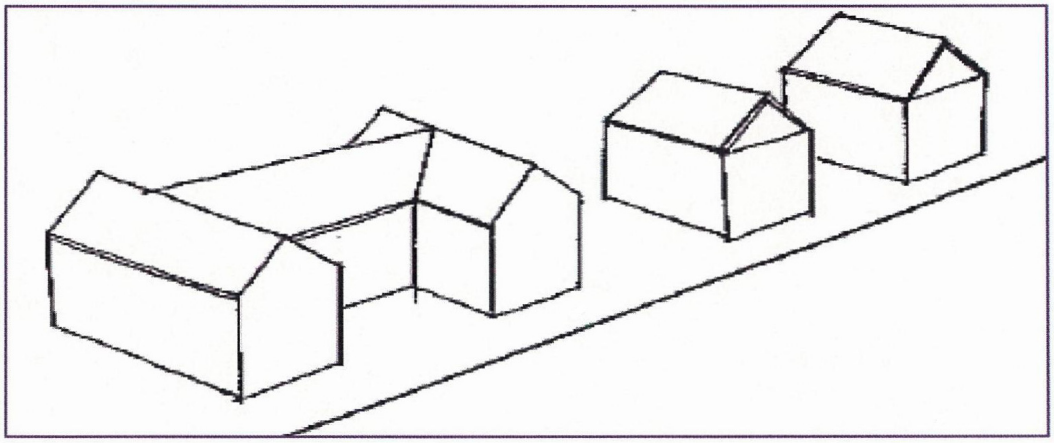
(b) *Repealed by Ord. 4723.*

(c) Multifamily Development. Infill of new multifamily buildings may occur where zoning allows within the residential neighborhoods of the Downtown District. However, the site design and structures for this type of development must maintain a scale and character compatible with the residential neighborhoods in the Downtown District. In addition to the architectural considerations listed in subsection (a) of this section, multifamily development shall follow the standards below.

(1) Incorporate forms typical of the single-family residential architecture of the Downtown District including sloping roofs, porches, roof dormers and other architectural details.

(2) Break up the mass of larger buildings into forms that are similar in scale to the residential character.

(3) Facades must be composed of smaller sections, similar in scale and material finish to residential structures.



Example – Break Up Facade of Larger Structure to be Compatible with Single-Family Scale

(4) Off-street parking for multifamily development shall not be located in the front yard setback. Parking shall be in the rear or side yards. If the property abuts an alley, the parking area shall take access from the alley. If the property has more than one street frontage, "behind the building" shall mean on the opposite side of the building from the front door or the main public door entrance to the building.

(5) Develop pedestrian links between the front sidewalk and building entrances and between parking and rear or side entrances.

(Ord. 4890, 11-20-19; Ord. 4812, 9-19-18; Ord. 4723, 10-21-16; Ord. 4572, 3-20-13)

24.12.140 Guidelines.

(a) Demolition of existing historic homes in order to construct new residential structures is strongly discouraged.

(b) Maintain and enhance the pattern of landscaped front yards that gives the residential neighborhoods within the Downtown District a distinctive, friendly appearance.

(c) Each new building and addition should be located so that it aligns with existing buildings in the area. "Aligns" means elevation (e.g., horizontal lines of peaks of roofs, cornices and window sills) and plan (e.g., setbacks from the street and rear property lines and spacing between structures/setbacks from side property lines).

(d) Main entrances should open onto a street and should align with those of adjacent residential buildings. For example, on many of the downtown homes, raised foundations and steps that define the main entrance are prevailing characteristics. Door styles should be similar to those found on residential buildings within the area.

(e) New buildings and additions should have the same number of stories and a height which is compatible with buildings in the area.

(f) Park strips will be landscaped in a traditional style, including street trees, grass, and low plantings or a combination thereof. Park strip landscaping should include some live material – use of all non-living material such as rock is discouraged. Use of drought-tolerant plants is encouraged.

Existing Character of Front Yards and Park Strips

(Ord. 4812, 9-19-18; Ord. 4572, 3-20-13)

V. Transitional Areas Standards and Guidelines

24.12.150 Applicability.

The following standards and guidelines apply to the Transitional areas shown in Figure 11 (yellow areas). The standards and guidelines are intended to apply to new development or substantial redevelopment within the area. Substantial redevelopment is any reconstruction, rehabilitation, addition or other improvements to the existing structure(s) on site where the value of the improvement exceeds 50 percent of the fair market value of the building(s) before the start of construction.

(Ord. 4572, 3-20-13)

24.12.160 Policy.

The peripheral areas of the CBD provide a mix of established residential uses and low intensity, nonretail, neighborhood service and office uses that are compatible with adjacent residential uses and neighbor-

hoods. New development or reuse of existing structures will maintain compatibility with building scale and appearance in the area.

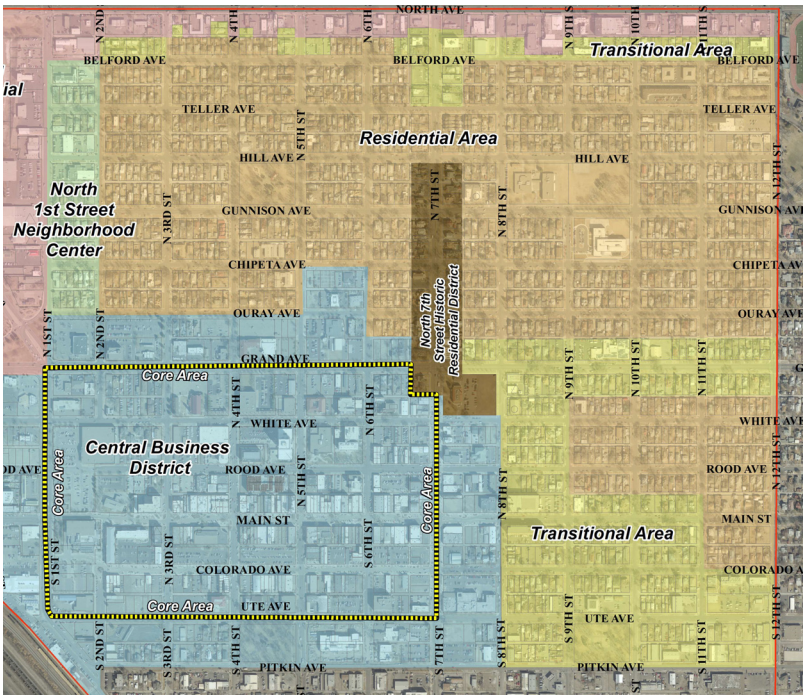


Figure 11

(Ord. 4812, 9-19-18; Ord. 4572, 3-20-13)

24.12.170 Standards.

(a) Land Use and Development Intensity. Nonresidential uses within the transitional subareas shall not open earlier than 7:30 a.m. and shall close no later than 8:00 p.m.

(b) Architectural Considerations. New construction, including additions and rehabilitations, in the transitional subareas shall be designed to have a residential character consistent with existing buildings in the area. "Consistent" means the operational, site design and layout, and architectural considerations described below.

(1) New principal buildings shall be located to align with existing buildings in the area. "Aligns" means elevation (e.g., horizontal lines of peaks of roofs, cornices, window sills) and plan (e.g.,

setbacks from the street and rear property lines and spacing between structures/setbacks from side property lines).

Example Infill Development in Transitional Area - 9th Street and Colorado Avenue

(2) Building entrances shall face a street or architectural features shall be provided that visually suggest an entrance. Door styles shall be similar to those found on residential buildings.

(3) Each new principal building, its mass in relation to open spaces and its windows, doors, and openings shall be visually compatible. "Visually compatible" means compatible with buildings in the area, including mass, shape, window, doors, openings, roof shape, roof pitch and orientation. For example, a large building shall be compatible with surrounding smaller dwellings by dividing its mass into smaller components to create a building elevation that is more like the size and proportion of the buildings in the area.

(4) The roofs of new principal buildings or additions to principal buildings shall be visually compatible with buildings in the area.

(5) Window and door spacing on structures shall be visually compatible with structures in the area. Visually compatible includes the relationship of width to height, and the spacing of windows and doors. For example, tall evenly spaced rectangular windows are typical of certain residential styles near the transitional subareas.

(c) Signs.

(1) Flush wall signs and monument signs shall be the only sign type allowed.

(2) Signs shall be located at least 10 feet behind the front property line. Total sign area shall not exceed 25 square feet per street frontage. The sign allowance for one street frontage may be

transferred to a side of a building that has no street frontage but cannot be transferred to another street frontage. Monument signs shall not exceed eight feet in height.

Example Signs within Transitional Subarea

(d) Parking and Site Development.

(1) Non-single-family uses in the transitional subareas shall be designed and utilized not to increase on-street parking in front of single-family dwellings in the neighborhood.

(2) Service entrances, loading areas and dumpster areas shall be located only in the rear or side yard. If the property has more than one street frontage, the rear or side shall mean on the opposite side of the building from the front door or the main public door entrance to the building; and each loading area shall be screened from each abutting residential use.

(Ord. 4812, 9-19-18; Ord. 4572, 3-20-13)

24.12.180 Guidelines.

(a) New buildings should have the same number of stories and a height which is compatible with those of buildings in the area.

(b) The exterior of all new buildings, additions and alterations should be similar in size and appearance to buildings in the area.

(c) Sign materials should be visually compatible with materials used on the building facade.

(Ord. 4812, 9-19-18; Ord. 4572, 3-20-13)

Title 25

24 ROAD CORRIDOR DESIGN STANDARDS

Chapters:

25.01 Introduction
25.02 Site Development
25.03 Architectural Design
25.04 Site Lighting
25.05 Signs

Prior legislation: Ords. 3305 and 4666.

Chapter 25.01

INTRODUCTION

Sections:
25.01.010 Background and intent.

25.01.010 Background and intent.

The 24 Road Corridor Design Standards provide development standards for public and private improvements in the 24 Road Corridor in order to implement the goals and objectives of the 24 Road Corridor Subarea Plan and to:

(a) Establish a practical, interconnected system of streets, parks, and parkways that allows easy orientation and convenient access for all modes of transportation;

(b) Utilize natural open spaces, such as creeks, and developed public spaces, streets, parks and parkways, to organize and coordinate development;

(c) Accommodate a broad mix of development types that encourage alternative transportation, especially walking, and transit use;

(d) Provide common usable open space that is of mutual benefit to surrounding property owners, businesses, and residents; and

(e) Establish a pattern and character for the long-term evolution of the corridor.

Adherence to these standards and guidelines will ensure that public and private improvements in the 24 Road Corridor will be well planned and executed in a high quality manner, which were important goals established through the 24 Road Corridor Subarea Plan.

These standards supplement other development regulations in the Grand Junction Municipal Code. Where there is a conflict between this title and GJMC Title 21, Zoning and Development Code, the more restrictive standard shall apply.

View corridor along 24 Road highlights natural features

(Ord. 4719, 9-21-16)

Chapter 25.02

SITE DEVELOPMENT

Sections:

25.02.010 Purpose.
25.02.020 Community framework.
25.02.030 On-site open space.
25.02.040 Organizing features.
25.02.050 Site grading and drainage.
25.02.060 Building and parking setbacks.
25.02.070 Building location and orientation.
25.02.080 Parking, access, and circulation.
25.02.090 Auto-oriented uses.
25.02.100 Pedestrian and bicycle circulation.
25.02.110 Sidewalks.
25.02.120 Bicycle circulation.

25.02.010 Purpose.

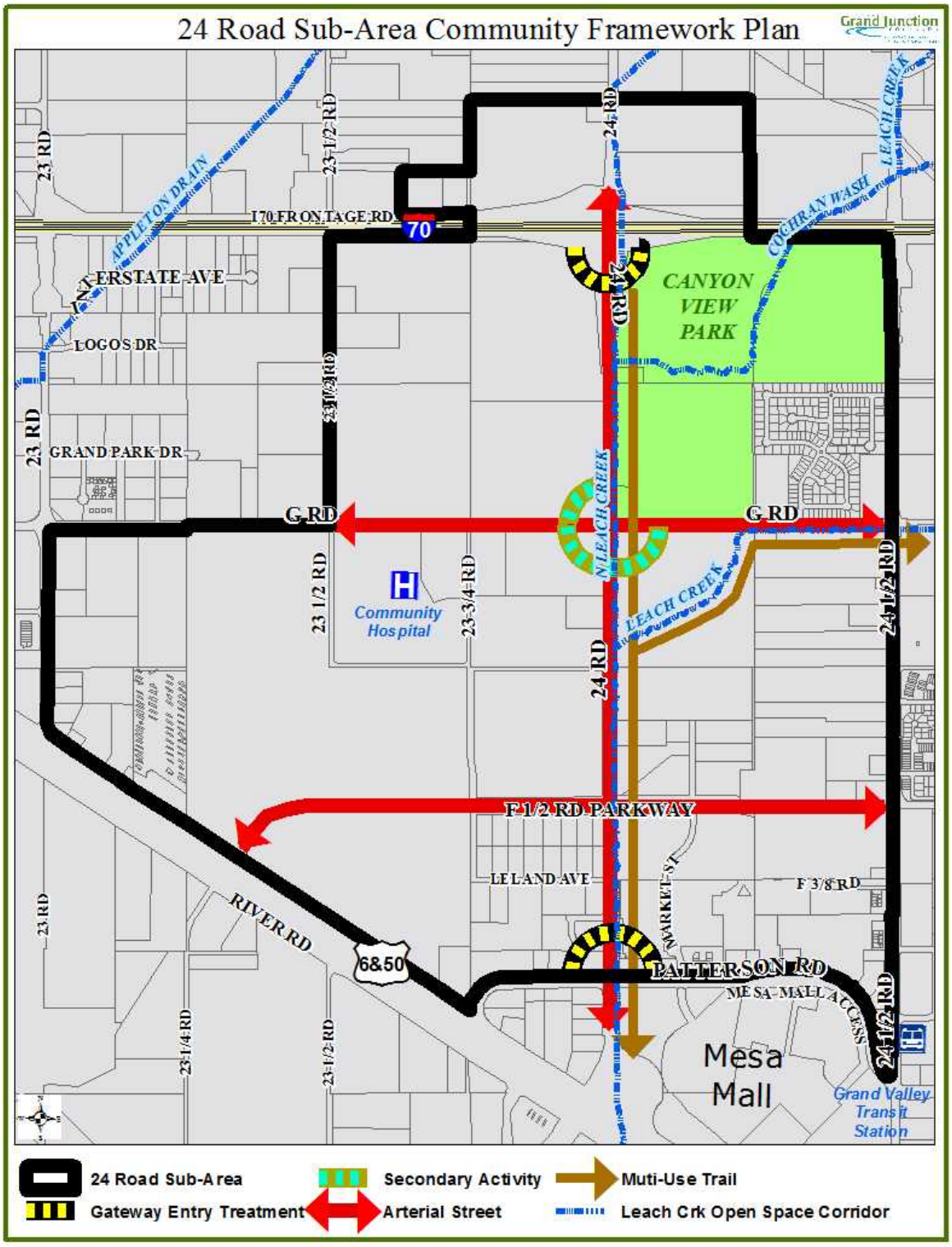
The location and design of buildings and site improvements are key to establishing the overall character and function of the 24 Road Corridor. Important site development considerations include large area development planning and coordination, the placement of buildings on the lot, relative amounts of area devoted to open space, buildings and parking areas, and vehicular and pedestrian circulation. With large undeveloped parcels such as those in the 24 Road Corridor, there is an opportunity to implement a "big picture" vision. The vision for the corridor is to increase pedestrian movement and encourage a mixture of development types integrating housing, commercial uses, neighborhood centers, shared parking, and other appropriate land uses within neighborhoods and within buildings in a flexible pattern of lots and blocks to allow site planning flexibility and consistency of development patterns.

(Ord. 4719, 9-21-16)

25.02.020 Community framework.

The overall planning concept for the 24 Road Corridor includes a community framework (Figure 2.1) that provides a distinctive image and organizing element for public and private development. The community framework includes public streets, parks, open spaces, natural drainages and future stormwater management facilities that serve and connect part or all of the corridor.

Figure 2.1: Community Framework Plan



(Ord. 4719, 9-21-16)

25.02.030 On-site open space.

On-site open space could be provided within areas that are also set aside for stormwater drainage, landscaped setbacks and other landscape areas associated with on-site buffer landscaping and amenities. Open space shall be provided on site so as to implement and comply with the following:

(a) Utilize well-defined natural and developed open spaces as features to serve as the focus of block, lot, and circulation patterns.

(b) Supplement public open space such as parks and drainage corridors with privately developed open space that helps complete linkages and organize development. (Refer to open space requirements of zoning and development code.)

(c) Open space, such as Leach Creek and developed parks and plazas, shall be used as a positive planning tool to organize and focus lot, block, and circulation patterns. Public access shall be provided to all public open space, natural and developed, directly from the public street/sidewalk system or through a public facility. Natural open space corridors and naturalized drainage ways (with trails) shall be publicly accessible at not less than 800-foot intervals.

(d) Buildings with frontage on open space shall provide windows, doors, plazas, or other amenities that encourage pedestrian activity and provide views onto and/or are oriented toward the open space.

Examples of privately developed and publicly developed open space amenities

Example of development oriented to open space

Organizing features provide a focus for development

(Ord. 4719, 9-21-16)

25.02.040 Organizing features.

(a) Purpose. An organizing feature is a public open space around which development is focused. Organizing features can utilize natural open space, creeks, formal public spaces, streets, parks, and parkways to organize and coordinate development patterns. Organizing features should reinforce the pattern and orientation of streets and buildings through orderly arrangements of landscaping, pedestrian circulation and amenities, such as might be typical of a town square or campus quadrangle. Prominent amenities could be developed within open space to link building groups.

(b) Standards.

(1) At least one central feature or gathering place shall be located within a geographically distinct neighborhood, e.g., a convenient outdoor open space or plaza with amenities such as benches, monuments, kiosks, or public art. These places may be located on "civic blocks," and may include buildings such as libraries, government offices, or public meeting places.

(2) Buildings shall not orient rear, blank, or service dominated facades toward an organizing feature and shall include an entry that is visible, convenient to use, and connected to a public sidewalk by a direct route. Facades facing an organizing feature shall be of at least comparable architectural quality to other primary building facades.

(3) Parking lots and parking spaces shall not be permitted within organizing features.

(4) Multi-building developments shall use an organizing feature to create an internal campus-like arrangement of buildings and open space; provided, that the organizing feature is bounded along at least one side by a public street.

(5) Organizing features shall utilize natural open space, creeks, formal public spaces, streets, parks, and parkways, where such are available on or adjacent to the site, to organize and coordinate development patterns.

Water features invite interaction

Fountain as an organizing feature

(Ord. 4719, 9-21-16)

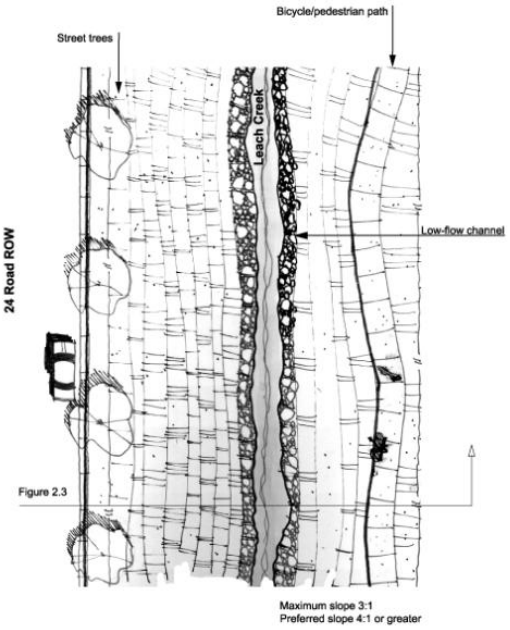
25.02.050 Site grading and drainage.

The site grading and drainage standards ensure that development fits within existing topography, reinforces the community open space framework, and effectively diverts and retains stormwater. In addition to other site grading and drainage requirements of the municipal code, the following standards shall apply in the 24 Road Corridor:

(a) Unless precluded by soil conditions, graded slopes shall not be steeper than 3:1 slope. Where space limitations demand, terracing with retaining walls is the preferred solution.

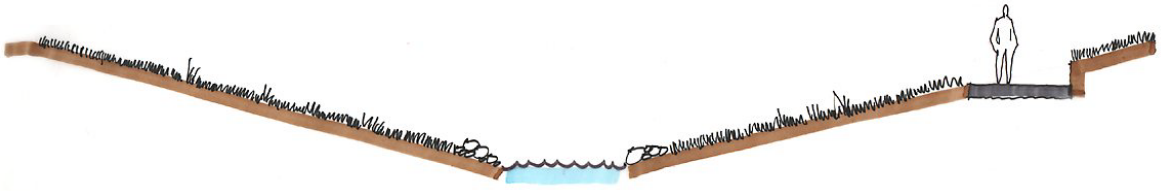
(b) Existing riparian areas and drainages, such as Leach Creek and its tributaries, shall be developed and maintained as natural open space corridors that provide surface drainage and developed pedestrian trails. The treatment of surface drainages shall be an open channel with gently sloping sides and naturalized landscape, except for the west bank of Leach Creek which is constrained by the 24 Road improvements. (See Figures 2.2 and 2.3.)

Figure 2.2: Natural Corridor Plan



Open space incorporates drainage facility and amenities

Figure 2.3: Natural Corridor Section



(Ord. 4719, 9-21-16)

25.02.060 Building and parking setbacks.

Building and parking setback standards establish a coordinated streetscape image and provide sufficient space between buildings, roads and parking areas for adequate light, privacy, views, sound control and landscaping. In order to establish additional open space and maintain views, building and parking setbacks shall be provided as specified in Table 3.1.

Table 3.1: Supplemental Building and Parking Setbacks

Frontage	Building Setback	Parking Setback
24 Road – west ROW	50'	25'
24 Road – east ROW	35' from edge of Leach Creek corridor	10' from edge of Leach Creek corridor
Patterson Road (F Road)	Per zoning	10'
F 1/2 Road	Per zoning	10'
G Road	Per zoning	10'

Notes:

(a) Width of Leach Creek drainage corridor to be determined and will include multi-use trail. (See Figure 2.3.)

(b) All measurements are from the right-of-way.

Coordinated landscaping in the building setback complements ROW landscaping

Buildings at the edges of project site with pedestrian connections through parking areas

(Ord. 4719, 9-21-16)

25.02.070 Building location and orientation.

To encourage the orientation of buildings toward the street, reinforce the character and quality of public streets and sidewalks, maximize useful interconnections, and enhance the appearance of properties from the street, the following standards shall apply:

(a) No development shall be permitted to place or orient buildings, parking, circulation, or service facilities on a lot in such a way as to treat primary street frontage(s) as a rear lot line. "Rear" shall be defined to mean a portion of the property lacking public access and containing a predominance of service functions and/or service facilities that significantly diminish the architectural or landscape quality of the development.

(b) All sides of a building that are visible from a street, residential area, public park or organizing feature shall have the equivalent architectural treatment of the primary building facade.

(c) All service and loading facilities that are visible from a street, public park, residential area or organizing feature shall be completely screened from view.

(d) Nonresidential uses located in the same block with residential uses shall be located on higher traffic streets and at the periphery or the end of each block having both uses and be effectively screened of light, noise, and pollution from service area or other incompatible activities.

(e) Large retail buildings (over 20,000 gross square feet) shall be located to minimize the impact of windowless walls and service areas on public streets. On sites that include large retail buildings, smaller buildings in-line or on pads shall be located to form edges that frame and reinforce the space and appearance of public streets. Pad buildings shall locate at least one facade including windows and similar architectural features within 35 feet of the public right-of-way. Pad buildings shall be located at site corners and entries.

(f) All sites abutting 24 Road shall treat 24 Road as a primary frontage with regard to the quality and orientation of buildings, site design, architectural features, and parking area design. This shall be in addition to any other required access and orientation. Primary frontage is intended to include landscape and building design that conveys the project identity and character and is of equal or superior quality to any other frontage of the project. No truck docks or service areas shall be permitted to face 24 Road.

(Ord. 4719, 9-21-16)

25.02.080 Parking, access, and circulation.

In order to provide for safe and convenient movement of pedestrians and motor vehicles, limit vehicular/pedestrian conflicts, reduce paved areas, provide screening for paved areas and soften the visual impact of parking lots by providing interior planting, the following standards shall apply:

(a) No more than two double-loaded bays of parking, with a maximum length of 125 feet, shall be allowed in front of buildings smaller than 20,000 square feet in size.

(b) For retail buildings 20,000 to 30,000 square feet in size, no more than 50 percent of the total surface parking area shall be located in the restricted area between the street and a building. For retail buildings larger than 30,000 square feet, no more than 60 percent of the total surface parking area shall be located in the restricted area. The restricted area is located between the front facade of the prin-

cipal structure and the primary abutting street. The restricted area shall be determined by drawing a line from the front corners of the building to the nearest property line as shown in the example.

Example of restricted area

(c) Service entrances, service yards and loading areas shall not be located on a side of any building that faces 24 Road, any arterial street, I-70, or residential uses.

(d) Opportunities for future auto, pedestrian, and bicycle connections to adjoining sites shall be considered in all site design. Such connections shall be provided where reasonably practicable.

Examples of pedestrian circulation systems within parking lots

Sidewalks and landscaping break up and soften the visual impact of large parking lots

(Ord. 4719, 9-21-16)

25.02.090 Auto-oriented uses.

To minimize impacts of auto circulation, queuing, drive-up facilities (including speaker systems and similar activities) and to promote street-oriented building design and pedestrian amenities, the following standards shall apply:

(a) Drive-up and drive-through facilities (order stations, pick-up windows, bank teller windows, money machines, car drop-off areas for auto service or rental, etc.) shall be located on the side or rear of a building and away from residential uses.

(b) For buildings greater than 100 feet from the street and with no intervening buildings, drive-through windows may be allowed to face a perimeter street, and drive-through lanes may be allowed with adequate landscaping buffer from the right-of-way line.

(Ord. 4719, 9-21-16)

25.02.100 Pedestrian and bicycle circulation.

To promote efficient and safe movement of pedestrians and bicyclists through the 24 Road Corridor, sidewalk and/or multi-use trail links shall be provided between development sites and open space including but not limited to an off-street multi-use trail connecting Canyon View Park and the Colorado River Trail.

Direct pedestrian access from sidewalk

Pedestrian circulation in retail area

(Ord. 4719, 9-21-16)

25.02.110 Sidewalks.

To provide opportunity for continuous pedestrian movement through the 24 Road Corridor, the following standards shall apply:

(a) A direct pedestrian connection to the building entry shall be provided from the public sidewalk.

(b) Development shall provide pedestrian circulation from public walks to parking areas, building entries, plazas, and open spaces. Walkways shall be provided to separate pedestrians and vehicles, and shall link ground level uses. Primary walks shall be a minimum of five feet wide.

(c) Clear and safe pedestrian routes shall be defined through parking areas to provide pedestrian access between buildings with minimum conflicts with vehicles. Walkways crossing drive aisles shall be clearly marked with signage, special paving, landscaping or other similar means of demarcation.

(d) Sidewalks at least eight feet wide shall be provided along all building facades that abut public parking areas and feature a public entrance.

(e) Pedestrian walks incorporating bicycle lanes shall be not less than 10 feet in width.

(f) All parking areas located between a street and building shall include a landscaped pedestrian walk linking the building with a public sidewalk.

(g) Physical barriers between contiguous development shall be prohibited unless necessary for safety or the mitigation of adverse impacts.

(h) Development shall provide pedestrian linkages between the Leach Creek trail corridor and other public ways and open space areas.

Shared plaza at building entries

Landscaped public sidewalk

(Ord. 4719, 9-21-16)

25.02.120 Bicycle circulation.

To provide a safe, direct, and attractive system of interconnected public bikeways and bike routes throughout the corridor and defined routes to primary building entries, the following standards shall apply:

(a) Bicycle parking shall be located in visible, active, and well-lit areas, near building entries, convenient to primary bicycling access, and not encroaching on pedestrian walkways. If possible, bike parking shall be located so it is visible from the inside of adjacent buildings.

(b) Bicycle circulation shall connect and align with pre-existing and planned off-site bicycle routes. Crossings at intervening streets shall be located where safe means for crossing can be provided.

Public bikeway provides an interconnected system

On-street bicycle route designation separate from the roadway

(Ord. 4719, 9-21-16)

Chapter 25.03

ARCHITECTURAL DESIGN

Sections:

25.03.010 Purpose.
25.03.020 Building form and scale (nonresidential and multifamily structures).
25.03.030 Building materials (nonresidential structures).
25.03.040 Multi-unit residential development (multifamily structures).
25.03.050 Fencing and walls (nonresidential and multifamily structures).
25.03.060 Service and storage areas (nonresidential and multifamily structures).

25.03.010 Purpose.

These architectural design standards are intended to:

(a) Encourage a consistent level of architectural quality throughout the 24 Road Corridor;

(b) Create a unified architectural character at the project level, addressing building form, scale and materials, including for walls, fencing and service and storage areas;

(c) Reinforce the urban character of streets and open spaces;

(d) Provide human scale and orientation;

(e) Define the base, body and top of building elevations through the use of color, materials and details;

(f) Ensure that the highest level of architectural detail occurs adjacent to areas of pedestrian activity;

(g) Ensure that service and storage areas are functional yet do not visually impact views from adjacent uses and public areas;

(h) Provide flexibility to allow for a number of design alternatives for different building types and to encourage design creativity.

Note: Additional standards for architectural design are included in GJMC Title 21, Zoning and Development Code.

Buildings in a variety of forms reinforce the pedestrian scale

(Ord. 4719, 9-21-16)

25.03.020 Building form and scale (nonresidential and multifamily structures).

The following standards shall apply to all building facades and exterior walls that are visible from adjacent public streets and other public spaces. These standards are intended to reduce the massive scale of large buildings, which, without application of these standards, may be incompatible with the 24 Road Corridor Overlay desired character.

(a) Facades greater than 150 feet in length, measured horizontally, shall incorporate wall plane projections or recesses having a depth of at least three percent of the length of the facade and extending at least 20 percent of the length of the facade. No uninterrupted length of any facade shall exceed 150 horizontal feet.

(b) Ground floor facades that face public streets shall have display windows, entry areas, awnings, or other such features along no less than 60 percent of their horizontal length. If the facade of the building facing the street is not the front, it shall provide the same features and/or landscaping in scale with the facade.

(c) Variation in roof lines/roof materials, in order to add interest to and reduce the massive scale of large buildings, is required. Roofs shall have no less than two of the following features:

(1) Parapets concealing flat roofs and rooftop equipment, such as HVAC units, from public view. Parapets shall not exceed one-third of the height of the supporting wall and shall not be of a constant height for a distance of greater than 150 feet;

(2) Overhanging eaves, extending no less than three feet past the supporting walls, for no less than 30 percent of the building perimeter;

(3) Sloping roofs that do not exceed an average slope greater than or equal to one foot of vertical rise for every three feet of horizontal run and less than or equal to one foot of vertical rise for every one foot of horizontal run; and

(4) Three or more roof slope planes.

(d) Primary building entries shall be connected to the public street sidewalk by the most direct route practical. Corner buildings need only provide public entry on one street-oriented facade.

(e) Ground floor retail shall have direct pedestrian entries onto public streets, parks, or plazas. Primary building entries must be easily and directly accessible from a street and shall be either oriented to or easily visible from the street.

(f) Entryway design elements and variations should give orientation and aesthetically pleasing character to the building. The following standards identify desirable entryway design features. Each principal building on a site shall have clearly defined, highly visible main entrances featuring no less than three of the following:

(1) Canopies or porticos;

(2) Overhangs;

(3) Recesses/projections;

(4) Arcades;

(5) Raised corniced parapets over the door;

(6) Peaked roof forms;

(7) Arches;

(8) Outdoor patios;

(9) Display windows;

(10) Architectural details such as tile work and moldings which are integrated into the building structure and design; and

(11) Integral planters or wing walls that incorporate landscaped areas and/or places for sitting.

(g) To the greatest extent possible, mechanical appurtenances shall be located within the structure. External mechanical appurtenances such as heating and air conditioning equipment shall be screened and finished to match the colors and materials of the building.

Primary building entrances present inviting facades along arterial streets

Retail development includes pedestrian-scale open space

(Ord. 4719, 9-21-16)

25.03.030 Building materials (nonresidential structures).

The following standards shall apply to nonresidential structures:

(a) All primary buildings shall use materials that are durable, economically maintained, and of a quality that will retain their appearance over time including but not limited to stone, brick, stucco, pre-cast concrete, and architectural metals.

(b) Facade colors shall be nonspecular, neutral or earth tone colors. Use of high intensity, metallic, black or fluorescent color is prohibited.

(c) Building trim and accent areas may feature brighter colors, including primary colors.

(d) Predominant exterior building materials shall not include smooth-faced concrete block, smooth-faced tilt-up concrete panels, or prefabricated steel panels.

(e) Ancillary buildings, enclosures and projected building elements shall be designed as an integral part of their primary facility. Where detached buildings are necessary, they shall be compatible to the main building in design, form, use of materials, and color.

(f) Building materials should be used in a manner that achieves a coordinated design on all building facades ("360-degree design").

(g) High quality, durable materials (brick and concrete masonry, pre-cast concrete, stone) should be the dominant treatment on all building facades facing 24 Road, Patterson Road/F Road, F 1/2 Road, and G Road.

(Ord. 4719, 9-21-16)

25.03.040 Multi-unit residential development (multifamily structures).

To ensure that multifamily residential architecture provides human scale and orientation and reinforces the urban character of streets and open spaces, the following standards shall apply to multifamily residential development in the 24 Road Corridor:

(a) Buildings shall be designed to provide human scale, interest, and variety. The following techniques may be used to meet this objective:

(1) Variation in the building form related to the scale of individual dwelling units or rooms such as recessed or projecting bays, shifts in massing, or distinct roof shapes.

(2) Diversity of window size, shape, or patterns that relates to interior functions.

(3) Emphasis of building entries through projecting or recessed forms, detail, color, or materials.

(4) Variations of material, material modules, expressed joints and details, surface relief, color, and texture to break up large building forms and wall surfaces. Such detailing could include sills, headers, belt courses, reveals, pilasters, window bays, or similar features. Changes in materials should generally occur at inside corners or where the transition is accommodated through an architectural detail such as a cap or belt course.

(b) Portions of buildings that are functionally limited from including significant window areas shall either be oriented away from public streets or shall make extensive use of the scaling methods defined above.

(c) Garages and carports shall either be integrated into the primary building form or shall be constructed of the same materials as the primary buildings.

Examples of multifamily housing that provides variety and human scale

(Ord. 4719, 9-21-16)

25.03.050 Fencing and walls (nonresidential and multifamily structures).

To provide for security, to screen unsightly areas, and to provide visual relief and buffers, the following standards shall apply to multifamily and nonresidential structures in the 24 Road Corridor:

(a) The design and materials for walls and fences shall be coordinated with the design and materials of the principal buildings in terms of color, quality, scale and detail. This is not intended to require identical materials and design.

(b) The combined height of walls and fences on top of an earth berm shall not exceed the maximum permitted height for the wall or fence alone.

(c) Fence and wall design shall not include long, unarticulated street fences facing walks and shall prevent "fence canyons."

(d) Chain link fencing in areas visible from nonindustrial properties, parking areas, public streets and pedestrian walkways shall be of a type and color that is aesthetically pleasing and complementary to the building and its surroundings.

(e) Chain link fencing shall be landscaped.

(Ord. 4719, 9-21-16)

25.03.060 Service and storage areas (nonresidential and multifamily structures).

To ensure that service and storage areas are functional while minimizing their visual impact on adjacent properties, parking and open space areas, public streets, walkways and trails, the following standards shall apply to nonresidential and multifamily structures in the 24 Road Corridor:

(a) Outdoor storage, loading and operations areas shall be attractively screened from adjacent parcels and streets.

(1) Outdoor storage, trash collection and/or compaction, loading or other such uses shall be located in the rear of the lot. If because of lot configuration the Director determines that such placement is not feasible, then the side yard may be used, but in no case shall such area be located within 20 feet of any public street, public sidewalk or on-site pedestrian way.

(2) Outdoor storage, HVAC equipment, trash collection, trash compaction and other service functions shall be designed so as to be visually incorporated into the overall site design and architecture of the building(s).

(3) Views of outdoor storage, trash collection and/or compaction, HVAC equipment, loading and other service facilities and functions shall be screened from visibility from all property lines and screened and separated from sidewalks and on-site pedestrian ways. Screening structures shall be made of the same materials as the principal structure.

(b) Rooftop mechanical equipment, including satellite dishes and antennas over 30 inches in diameter, shall be screened from the view of public streets and open space. Alternate structures housing such equipment or wall-mounted painted-to-match units in unobtrusive locations in lieu of traditional screening will be considered. In the discretion of the Director, visual simulation may be required to demonstrate visual impacts on surrounding properties, open spaces, trails, parks, streets or walkways.

(c) Utility connections to buildings, including but not limited to switch boxes, wires and electrical, gas and other meters, shall be screened or located out of view from public streets. All utilities and their connections shall be underground where permitted by the utility provider and other regulations.

(d) Loading doors shall be recessed from the building face to minimize their visual prominence.

(e) In nonindustrial areas, screen fences or walls shall be at least one foot higher than the materials or equipment being screened, and at least six feet tall.

Screening blocks views of loading and storage areas

Service areas incorporated into the architecture of the building

(Ord. 4719, 9-21-16)

Chapter 25.04

SITE LIGHTING

Sections:
25.04.010 Pedestrian, accent and security lighting.

25.04.010 Pedestrian, accent and security lighting.

In order to enhance vehicular and pedestrian visibility while minimizing lighting glare and contrast, prevent undesired off-site glare, emphasize attractive features, illuminate sites and attract visitors to destinations using the minimum amount of light needed to do so, the following standards in addition to the lighting regulations in the City of Grand Junction Zoning and Development Code (GJMC Title 21) shall apply to lighting within the 24 Road Corridor:

(a) All new development shall provide pedestrian lighting along public streets and pedestrian/bicycle trails.

(b) Lighting shall be designed to provide even and uniform light distribution without hot spots, dark spots, or glare.

(c) Lighting shall be designed to minimize dark areas that could pose a security concern near pedestrian areas.

(d) Pedestrian circulation systems shall be highlighted by visible light sources that clearly indicate the path of travel ahead.

(e) Accent fixtures providing direct illumination shall be in character with the architectural and landscape design character of the development.

(f) Architectural lighting shall not be used to draw attention to or advertise buildings or properties. Architectural lighting may be used to highlight specific architectural, artistic or pedestrian features with the intent of providing accent and interest or to help identify entryways.

(g) Accent lighting of landscape and/or pedestrian areas shall be mounted close to the ground and use a low level of illumination, such as bollard lighting or similar low mount fixtures used for illuminating landscaping and pedestrian areas.

(h) All accent and security lighting shall be shielded and downcast.

Examples of appropriate pedestrian lighting

Example of low level accent lighting

(Ord. 4719, 9-21-16)

Chapter 25.05

SIGNS

Sections:
25.05.010 Sign standards.

25.05.010 Sign standards.

In order to ensure that signs in the 24 Road Corridor communicate information for property owners, tenants and users without adding unnecessary visual pollution to the corridor, to encourage signage that is on a pedestrian scale, and to preserve and accentuate the views of the natural beauty of the Colorado National Monument and Colorado River corridor, and to ensure continuity of signs within a given project, the following standards, which include restrictions on sign size, height of freestanding signs and prohibition of billboards, shall apply to signage in the 24 Road Corridor, in addition to the sign regulations in the City of Grand Junction Zoning and Development Code (GJMC Title 21):

(a) Only the following sign types are permitted: freestanding monument signs, flush wall signs, exempt signs, and temporary signs as allowed/regulated by GJMC 21.06.070, Sign regulation, except as further restricted in this chapter.

(b) Freestanding signs shall not exceed 12 feet in height from finished grade.

(c) Sign face for freestanding and flush wall signs shall not exceed 100 square feet per sign.

(d) Temporary signs and exempt signs shall be permitted in accordance with GJMC 21.06.070.

(e) No billboards shall be permitted in the 24 Road Corridor. Billboards that were installed in accordance with a permit or planning clearance from the City prior to November 1, 2000, may remain, except that they may not be expanded, enlarged, converted to illuminated or changeable copy signage, or replaced once removed.

(f) Freestanding signage shall be placed perpendicular to approaching traffic.

(g) Signs within a development project shall be designed and installed with continuity by use of a coordinating scheme of color, typeface, materials, and construction details throughout the project area.

(h) On freestanding signs, only graphics and typography are to be illuminated.

(i) Freestanding signs shall be single- or double-faced and constructed of a metal panel with stone or veneer base. If the sign is single-faced, the backside shall be painted the same color as the cabinet and poles.

(j) Flush wall signs shall not be illuminated externally; they may be either non-illuminated or internally illuminated.

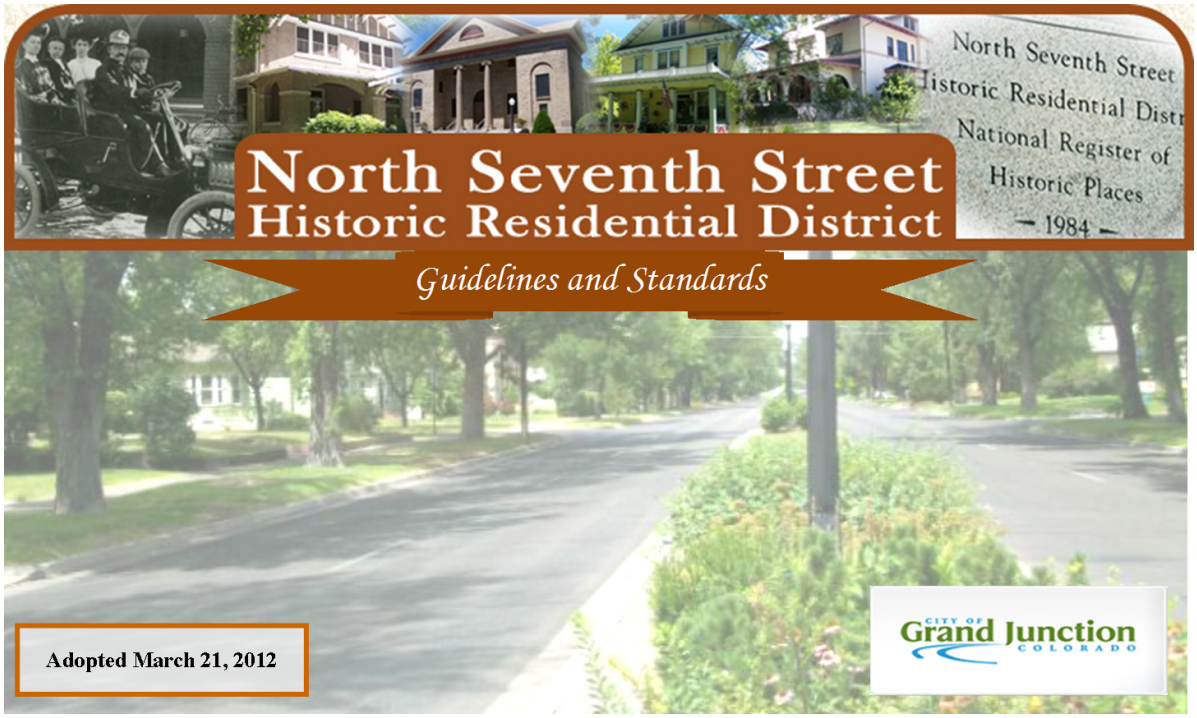
(k) Trail route identification signs shall be placed at critical locations which shall be determined by the Director during site plan review.

Signs should communicate information and not add to visual pollution

(Ord. 4890, 11-20-19; Ord. 4719, 9-21-16)

Title 26

NORTH SEVENTH STREET HISTORIC RESIDENTIAL DISTRICT GUIDELINES AND STANDARDS



Chapters:

26.04	**General Provisions**
26.08	**How to Use This Title**
26.12	**Land Use and Zoning**
26.16	**Review Process**
26.20	**District-Wide Design Guidelines and Standards**
26.24	**Contributing Structures, Noncontributing Structures and New Construction**
26.28	**Contributing Structures Guidelines and Standards**
26.32	**Demolition of All or Part of All Structures Within the North Seventh Street Historic Residential District**
26.36	**Appendices**

Chapter 26.04

GENERAL PROVISIONS

Sections:
26.04.010 Acknowledgements.
26.04.020 History.
26.04.030 Project background.

26.04.010 Acknowledgements.

We would like to acknowledge the fine residents of the North Seventh Street Historic Residential District for all their input and dedication to a continued vision and belief in a prosperous and enduring Historic District. We would also like to thank all the residents who attended the neighborhood meetings and gave their input while this document was drafted.

These Guidelines and Standards were made possible because of the hard work, guidance, and vision of the residents and the support of City staff.

First Edition: December 2011

Owner: City of Grand Junction, Colorado

SPECIAL APPRECIATION TO

Paul and Nicole Sizemore

Teddy and Kathy Jordan

Joe Hatfield

Bennett Boechenstein

Peter Robinson

City of Grand Junction Historic Preservation Board

City of Grand Junction Public Works and Planning Department Staff

Special recognition to Teddy Jordan for his photography.

(Ord. 4508, 3-21-12)

26.04.020 History.

The North Seventh Street Historic Residential District is the heart of the original square mile for the City of Grand Junction. Seventh Street was intended to be a park-like residential area where prosperous residents, who were instrumental in the development of a young city out west, built their homes.

North Seventh Street was a two-lane street with parking for vehicles in the front of their homes. Some of the homes still have a walk across the grass to access Seventh Street.

It has always been the showcase for all the City. Seventh Street was the route chosen for President George H.W. Bush and his wife, Barbara, to travel from the airport to the courthouse for the Education 2000 tour in 1991.

In spite of the traffic now impacting the area, it remains a close-knit neighborhood where neighbors visit neighbors on their front porches. Daughters or sons still get married in the family home or have their wedding receptions there.

Over the years, however, some homes on North Seventh Street have fallen victim to "progress," sacrificing historic preservation to modern expediencies.

The Grand Junction Town Company officers did more than develop lots and provide street names. They had great expectations for Grand Junction. They set aside parks in each quarter of the town, and developed certain areas with hallmarks of beauty, elegance and exceptional quality. Main Street and Grand and Gunnison Avenues were wider than other streets, and the lots facing those streets were deeper than most residential lots. Seventh Street was a fine boulevard, with landscaping in the center, and it was the only street with lots facing east-west rather than north-south. In harmony with the town officials' plan the homes on Main, Grand, Gunnison and especially Seventh Street were larger and more stately.

C.D. Smith

In 1923, C.F. Martin and C.D. Smith petitioned the Grand Junction City Council to have electric street lights installed on the parkway in the middle of Seventh Street. The City agreed. These lights were removed in 1965.

As a Bicentennial project Kathy Jordan, a North Seventh Street resident, petitioned the Grand Junction City Council for help in having lights of the period re-installed in the parkway. Neighbors on Seventh Street and many business people in Grand Junction donated time, money and materials. In December of 1975, Kathy, along with City Council members, flipped the switch to turn the lights back on.

In 1984 Kathy Jordan was instrumental in getting the area placed on the National Register of Historic Places with the U.S. Department of the Interior. The goal was to preserve the vision that the founding fathers had for this neighborhood.

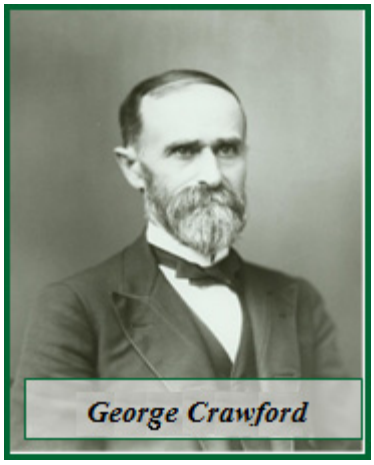
A cluster of the first homes on Seventh Street were constructed by members of the same family, starting with Cyrus "Doc" Shores. Shores built his home at 427 North Seventh Street in 1893.

Franklin I. Lee built his home at 402 North Seventh Street in 1903. His wife, Laura, was the daughter of M.M. (Marcus Morton) Shores, the brother of "Doc" Shores. Franklin's father, W.H. Lee, built the house at 406 North Seventh Street in 1906.

418 North Seventh Street was also built by Franklin I. Lee in 1904. 428 North Seventh Street was built by Allison "Roe" Monroe in 1900. His wife's sister was married to Doc Shores.

520 North Seventh was built by Mr. and Mrs. O.H. Ellison in 1924. Mrs. Ellison was the daughter of M.M. and Laura Shores.

The White House at 337 North Seventh Street (the green house at the corner of Seventh and Grand) was built by W.F. White who owned the White Mercantile Co. at Fifth and Main. Claims have been made that this home was built for George Crawford; however, Mesa County records show that the house was built in 1893, two years after Crawford's death. Crawford's name is on record showing he owned the land, but his name is on most of the property deeds for the original square mile because he was the developer. George Crawford lived in the Hotel Brunswick, a hotel he built, or on his Rapid Creek Ranch when in Grand Junction. Crawford's niece, Josephine Rich, did build a home in the 500 block of North Seventh Street in 1892.


George Crawford

Eight homes were built from 1883 to 1899. Of those eight structures, only six remain.

The years 1900 to 1909 showed the largest growth on Seventh Street with 18 homes constructed. Of those 18 homes, 16 remain. From 1910 to 1919 four homes and one church were built and they are all still standing.

From 1920 to 1970 six homes, one school, one duplex and one church were built. They are all still standing. Currently, there are 35 structures in the District.

(Ord. 4508, 3-21-12)

26.04.030 Project background.

The City of Grand Junction's Comprehensive Plan (adopted February 17, 2010, pp. 108 – 109), Title 31 GJMC, states:

> ***Retaining our Heritage***
>
> ***Historic Buildings and Neighborhoods***
>
> Many communities have started to capitalize on their best assets such as historic buildings. Grand Junction has, like most cities, seen many of its historic buildings replaced with new construction. Appropriate historic buildings should be preserved to the extent possible. Modifications and additions to historic buildings are acceptable if the alterations are constructed to complement the original character. The neighborhood just north of the Downtown retains the original grid pattern of tree-lined streets and many older homes. To allow the Downtown to grow but not disturb the character of this neighborhood, the Plan recommends that increased density be allowed in this neighborhood through Accessory Dwelling Units.
>
> ***Individual Neighborhood Character***
>
> The Community has expressed the desire to foster neighborhood identity. This can be accomplished through many elements and aspects such as parks, schools, signage, architecture and streetscape that become specific to that neighborhood. Many strategies to foster neighborhood identity, as well as specific land use issues and goals, are addressed in the various neighborhood and area plans adopted by the City and County. The Comprehensive Plan supports these individual neighborhood and area plans of the region. Several of the plans were incorporated into the 2009 Comprehensive Plan. However, others are out of date and need revision. During the revisions, these neighborhood and area plans are to adapt the Comprehensive Plan to each neighborhood at a finer, more detailed level. *(Housing Variety Recommendations and Grand Valley Housing Strategy)*

On February 17, 2010, a public hearing was held for the adoption of Ordinance 4403 to replace Ordinance 2211 that was adopted in 1984. At that meeting, the City Council requested that the City of Grand Junction Planning staff work with the neighborhood on specific historic preservation guidelines and standards for the North Seventh Street Historic Residential District.

The Grand Junction Historic Preservation Board has agreed to be responsible for preserving the historical value and character of the District's structures by reviewing and deciding development applications through use of these design guidelines and standards. The City Council will hear appeals.

If properly adopted, administered and adhered to, the North Seventh Street Historic Residential District Guidelines and Standards will result in appropriate improvements that achieve a common level of quality in terms of allowed land uses, site design, architectural design, landscaping and other site improvements.

The general purposes of the North Seventh Street Historic Residential District Guidelines and Standards are:

(a) To preserve and protect the single-family residential character of the District.

(b) To preserve the historical and/or architectural value of buildings.

(c) To create an aesthetic appearance of the properties and the streetscape within the District that complements the historic buildings.

(d) To stabilize property values.

The North Seventh Street Historic Residential District Guidelines and Standards are based upon an analysis of the existing character of the North Seventh Street Historic Residential District. The Guidelines and Standards were developed through a collaborative neighborhood-based process. Property owner surveys, public meetings, and guideline development exercises were coordinated by Seventh Street residents and this document is the final result of these efforts.

(Ord. 4508, 3-21-12)

Chapter 26.08

HOW TO USE THIS TITLE

Sections:
26.08.010 Getting started.
26.08.020 How this title relates to other City regulations.
26.08.030 How to determine the guidelines and standards that apply to a particular property.
26.08.040 Contributing and noncontributing structures.
26.08.050 Guidelines and Standards supplement other development regulations.

26.08.010 Getting started.

If you are thinking about developing or redeveloping property in the North Seventh Street Historic Residential District, you should contact the City Planning Division. They can provide an overview of the planning process and answer any questions you may have.

The North Seventh Street Historic Residential District Guidelines and Standards will provide the site and building design vision that is appropriate for all property in the District. The intent of this title is to provide a template for development and redevelopment within the District. Each standard is drafted to provide a maximum degree of flexibility and creativity in design, while conforming to a consistent and well-planned vision for the District. The architecture of your project must be of a valid recognized style as described in this title. Site design, streetscape, landscape and other elements will be consistent with the architectural style of each property.

(Ord. 4508, 3-21-12)

26.08.020 How this title relates to other City regulations.

The North Seventh Street Historic Residential District Guidelines and Standards provide the ultimate vision and patterning for development and redevelopment of the District. They are to be used in conjunction with GJMC Title 21, Zoning and Development Code, to guide development according to the principles of historic preservation. They include specific materials, styles, orientation, and other design criteria which, when in conflict with another adopted standard, the more restrictive provision shall apply. Interpretation of the application of regulations, performance standards, criteria, definitions, procedures or any other provision of this title shall be the responsibility of the City of Grand Junction Historic Preservation Board.

(Ord. 4508, 3-21-12)

26.08.030 How to determine the guidelines and standards that apply to a particular property.

Structures within the North Seventh Street Historic Residential District are divided into two categories: contributing and noncontributing structures. GJMC 26.08.040 has a detailed definition of each term as well as a list of all the properties in the district and how they relate to these terms.

A contributing structure is a structure that already adheres to and/or complies with these Guidelines and Standards in their entirety at the time of adoption. The Guidelines and Standards that are applicable to contributing structures are found in Chapters 26.20, 26.24, 26.28 and 26.32 GJMC.

A noncontributing structure is a structure that does not adhere to and/or comply with these Guidelines and Standards in their entirety at the time of adoption. The Guidelines and Standards that are applicable to noncontributing structures are found in Chapters 26.20, 26.24 and 26.32 GJMC.

Continued alteration of structures over time can lead to the District being reevaluated for its designation status on the National Register of Historic Places by the National Trust of Historic Preservation and the Department of the Interior. If alterations to the exterior of a structure have degraded its historic integrity, a structure may be determined to no longer be a contributing structure. If too many structures are altered,

the District may lose its designation status due to no longer having enough contributing structures. Similarly, alterations that enhance a noncontributing structure may result in the structure becoming contributing. The intent of these Guidelines and Standards is to maintain and enhance the existing structures in order to maintain the designation status on the National Register of Historic Places.

(Ord. 4508, 3-21-12)

26.08.040 Contributing and noncontributing structures.

Properties within a historic district fall into one of two types of property: contributing and noncontributing.

A contributing building, site, structure or object adds to the historic architectural qualities, historic associations, or archeological values for which a property is significant because:

(a) It was present during the period of significance and possesses historic integrity reflecting its character at that time or is capable of yielding important information about the period; or

(b) It individually meets the National Register eligibility criteria. For inventory purposes, "primary" shall be used synonymously with "contributing."

This classification has been designated through a survey and a formal hearing process. Contributing structures were identified on North Seventh Street when the National Register Historic District was formed in 1984.

A noncontributing building, site, structure or object is located within the historic district but does not meet the requirements in subsection (a) or (b) of this section.

CONTRIBUTING STRUCTURES

327 North Seventh Street – Doc Shores House
337 North Seventh Street – White House
407 North Seventh Street – Bull House
433 North Seventh Street – Moore House
445 North Seventh Street – Martin House
505 North Seventh Street – Sampliner House
515 North Seventh Street – Sampliner House
535 North Seventh Street – First Church of Christ, Scientist
605 North Seventh Street – Brainerd House
611 North Seventh Street – Blackstone House
621 North Seventh Street – Honeymoon Cottage
625 North Seventh Street – Wilson House
639 North Seventh Street – Murr House
707 North Seventh Street – Wickersham House
727 North Seventh Street – Sinclair House
731 North Seventh Street – Lough House
739 North Seventh Street – Houskins House
750 North Seventh Street – Akers House
712 & 714 North Seventh Street – Home Loan Duplex
706 North Seventh Street – Pabor House/Pansy Cottage
640 North Seventh Street – Ferbrache House
620 North Seventh Street – Moyer House

CONTRIBUTING STRUCTURES (Continued)

604 North Seventh Street – Talbert House
536 North Seventh Street – Smith/Schmidt House
520 North Seventh Street – Ellison House
710 Ouray Avenue – Sickenberger House
440 North Seventh Street – Smith/Jordan House
428 North Seventh Street – Allison House
720 Grand Avenue – First Baptist Church
310 North Seventh Street – Lowell School

NONCONTRIBUTING STRUCTURES

417 North Seventh Street – Waren House
522 North Seventh Street – Brunner House
626 North Seventh Street – Barkuloo
715 North Seventh Street – Day Care
726 North Seventh Street – Davis House

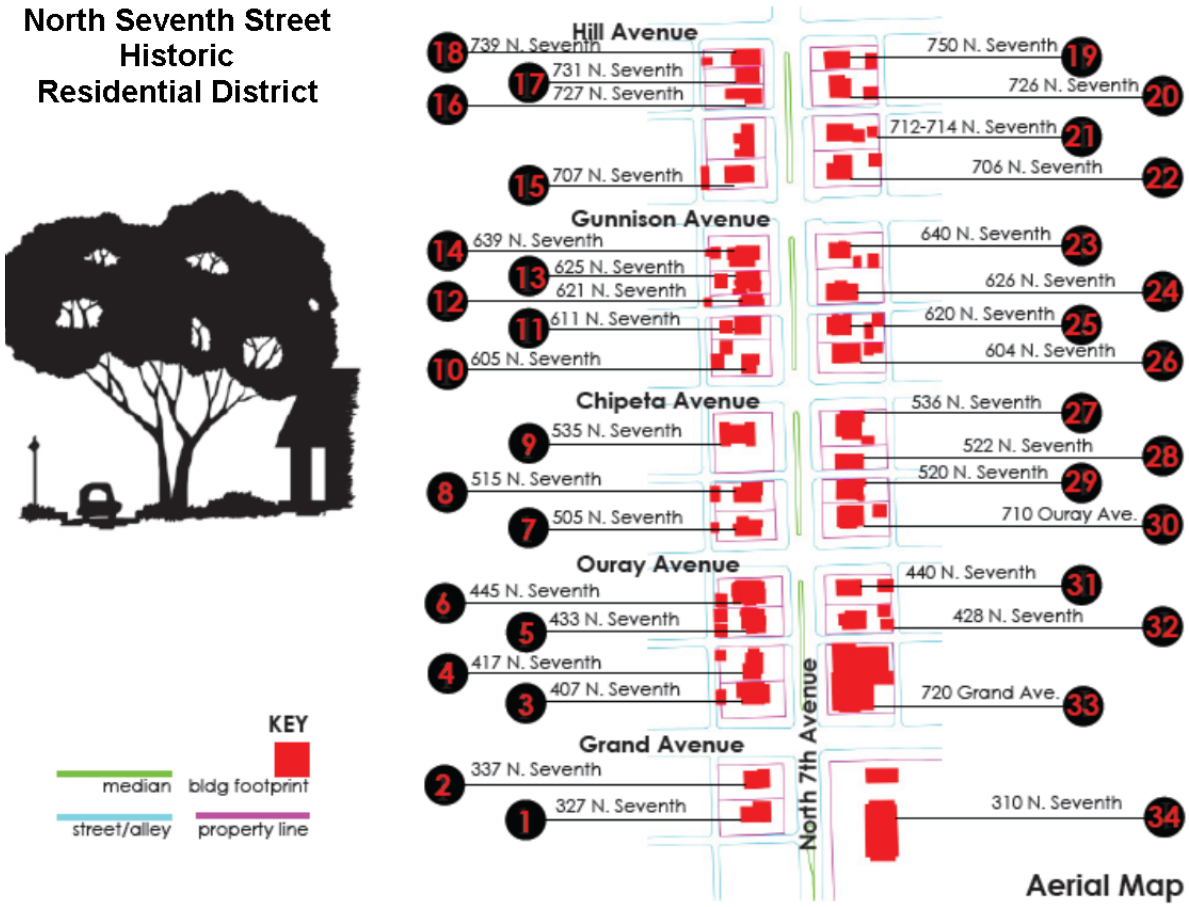
(Ord. 4508, 3-21-12)

26.08.050 Guidelines and Standards supplement other development regulations.

(a) These Guidelines and Standards supplement other development regulations such as GJMC Title 21, Zoning and Development Code, which includes detailed criteria by zone district, planned development regulations, design and improvement standards, supplemental use regulations, sign regulations, and GJMC Title 24, Transportation Engineering Design Standards (TEDS). The Guidelines and Standards identify design alternatives and specific design criteria for the visual character and physical treatment of restoration within the North Seventh Street Historic Residential District.

(b) A complete inventory of all the properties and the site characteristics in the North Seventh Street Historic Residential District at the time this document was adopted is included in GJMC 26.36.010, Appendix A. This inventory is intended to serve as one resource to assist in the review of development applications. There may be additional historical information or archeological resources that should be taken into account when determining historical appropriateness.

(c) North Seventh Street Historical Residential District. The North Seventh Street Historic Residential District is Grand Junction's only Nationally Registered historic neighborhood. Below is an aerial map of the District. A detailed inventory depicting the architectural styles of the 35 structures is included in GJMC 26.36.010, Appendix A – Property inventory.



(Ord. 4508, 3-21-12)

Chapter 26.12

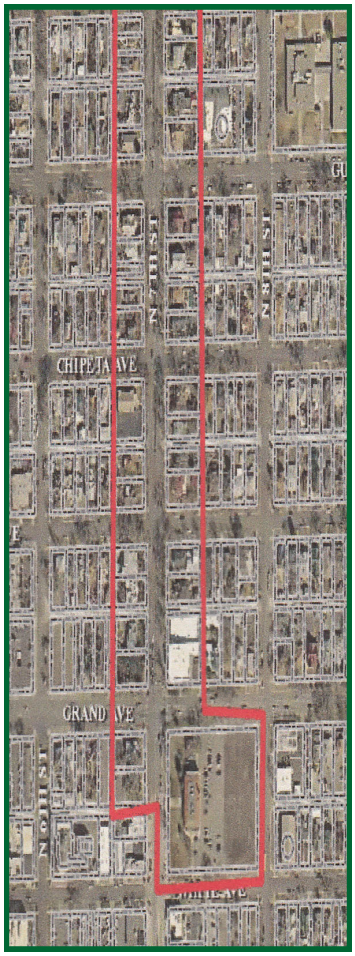
LAND USE AND ZONING

Sections:
26.12.010 Land use and zoning.

26.12.010 Land use and zoning.

The zoning for the majority of the North Seventh Street Historic Residential District is Planned Development Residential, with a default Residential 8 (R-8) zone. These Guidelines and Standards do not affect allowable uses or zoning.

Included in the North Seventh Street Historic Residential District are three properties south of Grand Avenue: two converted houses on the west side of Seventh Street and the R-5 High School on the east. The houses are zoned Downtown Business (B-2) and the school is zoned Community Services and Recreation (CSR). For more information refer to GJMC Title 21, Zoning and Development Code.



(Ord. 4508, 3-21-12)

Chapter 26.16

REVIEW PROCESS

Sections:
26.16.010 Review process.

26.16.010 Review process.

(a) All applications for alterations, new construction or site improvements within the North Seventh Historic Residential District shall be reviewed through the following process:

(b) Preexisting Nonconforming Structures – Grandfathering. Structures and uses which exist at the time of the adoption of these regulations and which do not meet the requirements of these regulations at the time of adoption are considered legal and may continue indefinitely as long as they maintain their current size and scope as legally nonconforming uses and structures. Such nonconforming uses and structures may not be expanded or enlarged without meeting the requirements of the Guidelines and Standards.

(c) Guidelines and Standards Defined.

Guidelines are permissive statements intended to be used as recommendations by homeowners and boards in making decisions.

Standards are mandatory statements that are required and must be met.

(Ord. 4508, 3-21-12)

Chapter 26.20

DISTRICT-WIDE DESIGN GUIDELINES AND STANDARDS

Sections:

26.20.010 Minimum bulk requirements/standards.
26.20.020 Vistas.
26.20.030 Landscaping in the public right-of-way.
26.20.040 Residential landscaping.
26.20.050 Landscaping for nonresidential uses.
26.20.060 District identification.
26.20.070 Building identification.
26.20.080 Utility systems.
26.20.090 Fencing.
26.20.100 Parking for multifamily and nonresidential uses.
26.20.110 Individual building signage for nonresidential uses.

26.20.010 Minimum bulk requirements/standards.

(a) Guideline. Consistent setbacks and placement of buildings on lots will maintain the cohesive character within each block and within the North Seventh Street Historic Residential District.

(b) Standards.

(1) Setbacks for primary structures within the District shall be as follows:

(i) Front setback, Seventh Street: 25 feet.

(ii) Front setback, side street: 10 feet.

(iii) Side setback: five feet.

(iv) Rear setback: 10 feet.

(v) Maximum height: 35 feet.

(2) Setbacks for accessory structures within the District shall be as follows:

(i) Front setback, Seventh Street: 30 feet.

(ii) Front setback, side street: 10 feet.

(iii) Side setback: three feet.

(iv) Rear setback: five feet.

(v) Maximum height: 35 feet.

(Ord. 4508, 3-21-12)

26.20.020 Vistas.

(a) Guideline. The unique buildings of the District are bordered by a mature, tree-lined street, which creates an extended horizontal view. These open views give the buildings visibility and provide safety. Through application of the North Seventh Street Historic Residential District Guidelines and Standards the City and all new development and redevelopment will maintain these vistas. One important way to accomplish this goal is to minimize visual clutter and distractions at street corners.

(b) Standards.

(1) Maintain the direct visual line of sight up and down the corridor and at the cross-street corners by adhering to front setbacks.

(Ord. 4508, 3-21-12)

26.20.030 Landscaping in the public right-of-way.

(a) The North Seventh Street Historic Residential District's unique streetscape has historical significance in its own right. Through application of the North Seventh Street Historic Residential District Guidelines and Standards the City and residents will adhere to the standards of this section. New nonresidential uses shall also implement the mandatory standards of this section as a part of the required site landscaping.

(b) Standards.

(1) Maintain, and restore where missing, the historic spacing of street trees along the North Seventh Street Historic Residential District corridor. Street trees along North Seventh Street Historic Residential District provide full canopy coverage shade for residents and pedestrians. Street trees should remain intact, with new trees planted to fill in where they may be missing or as aging trees are replaced. Trees in the park strip shall be spaced 25 to 35 feet apart, depending on the tree species.

(2) Maintain and enhance the historic character of landscaping in the median and the park strip between the curb and sidewalk along North Seventh Street Historic Residential District. Materials should be primarily grass, street trees, flowers and low ornamental plants. Landscaping these areas with nonliving material is prohibited.

(3) Park strips shall not be planted with dense, tall materials as they detract from the overall character of the streetscape and impede visibility and safety for pedestrians and vehicles.

(Ord. 4508, 3-21-12)

26.20.040 Residential landscaping.

(a) Guidelines.

(1) Property owners should maintain and enhance historically appropriate landscaping in front yards and park strips.

(2) Materials should be primarily grass, flowers, trees and low ornamental plants. Refer to the overall district character inventory form in GJMC 26.36.010, Appendix A – Property inventory, and the historical plantings listed in GJMC 26.36.060, Appendix F – Authentic plants for late 19th/early 20th century period landscaping.

(3) A minimum of 40 percent of front yard areas (not counting planting beds) should be maintained as grass or other low, living green ground cover.

(4) Hedges and other landscaping materials should not impede the views of the primary buildings from North Seventh Street.

(Ord. 4508, 3-21-12)

26.20.050 Landscaping for nonresidential uses.

(a) Guidelines. Applications for nonresidential land uses within the District will comply with the City's landscape regulations. In addition, landscape choices should be sensitive to the unique context of the District's primarily residential character. All required landscape plans are to be signed with a seal by a registered landscape architect. Lots containing nonresidential uses should be landscaped, with appropriate foundation plants, shrubs, ground cover beds, hedges and fences to frame the architecture of buildings.

(1) Maintenance of all plantings, including watering, mowing, weeding, edging, fertilizing, pruning, insect control, removal and replacement of dead or damaged plant materials is encouraged for properties within the Historic District.

(2) The landscape should be covered by an automatic irrigation system.

(3) All lawn areas should be sodded. Planting drought tolerant turf varieties is encouraged.

(4) Ground cover beds should be mulched or graveled as necessary.

(Ord. 4508, 3-21-12)

26.20.060 District identification.

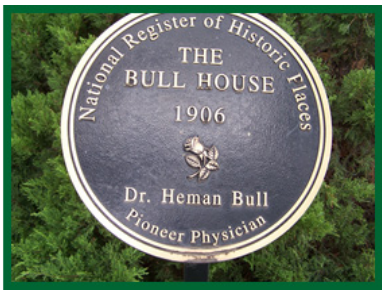
(a) Guideline. Identification of the boundaries of the District is an important means of enhancing its recognition as an historical and cultural resource to the community. The City should endeavor to replace historic street names in the sidewalk at all cross-street intersections within the District. Historic street name signs with a distinctive logo are encouraged to replace the standard street name

signs. Signage indicating the northern and southern limits of the District should be maintained and enhanced as necessary.

(Ord. 4508, 3-21-12)

26.20.070 Building identification.

(a) Guideline. Through application of these Guidelines and Standards the City, in cooperation with the Seventh Street residents, should develop signage which is compatible with existing signage documenting the history of significant properties within the North Seventh Street Historic Residential District. This will provide downtown walking traffic the opportunity to learn about the unique historical background of significant residences within the North Seventh Street Historic Residential District.



(Ord. 4508, 3-21-12)

26.20.080 Utility systems.

(a) Guidelines.

(1) Energy and water system improvements serving a greater efficiency are encouraged; provided, that they do not adversely impact the historic integrity of a building or the District, by being generally placed out of view from the North Seventh Street public right-of-way.

(2) The more common utilities serving properties in the District are telephone and electrical lines, gas meters, air conditioners, evaporative coolers, and telecommunication systems. However, other systems are becoming more economically viable and accepted for use such as solar panel devices and rain water harvesting systems. Visual impacts associated with utility systems should be minimized.

(b) Standards.

(1) Systems shall be designed to be unobtrusive and not in view of the North Seventh Street public right-of-way.

(2) Alternative roofing materials such as photovoltaic panels shall be located on the side and back elevations of the building.

(3) Utility systems shall not be constructed into the front elevation of roof line of the building.

(4) Satellite dishes shall not be placed in view of the North Seventh Street public right-of-way.

(Ord. 4508, 3-21-12)

26.20.090 Fencing.

(a) Guideline. Fencing materials and styles should complement the character of the District. Fence styles, particularly in front yards, should be similar to those from the restoration era of the buildings on site. In addition to the regulations for fences applicable to the R-8 zone, fences in the District shall adhere to the requirements of this section.

(1) Front yard fences should be a maximum height of 48 inches measured from the street side.

(2) Maximum opacity for front yard fences should be 60 percent.

(3) Side and rear yard fences should be a maximum of six feet high measured from the street side of the fence. They should be between 60 percent and 100 percent opaque. They may extend to and be placed on property lines.

(4) The transition between front yard fences and side and rear yard fences should occur five feet behind the front building setback line or three feet behind the front facade line, whichever is greater.

(5) Chain link, split rail and wire mesh fencing should not be used within the District.

(b) Standard. Vinyl or plastic fencing is not appropriate on any part of a property within the North Seventh Street Historic Residential District and use of such fencing is not allowed.

(Ord. 4842, 3-20-19; Ord. 4508, 3-21-12)

26.20.100 Parking for multifamily and nonresidential uses.

(a) Guideline. Parking for uses other than single-family residences should be accommodated primarily on site and to the rear of lots in order to maintain the residential character of the neighborhood. In

addition to other parking standards of GJMC Title 21, Zoning and Development Code, the guidelines and standards of this section shall apply.

(b) Standards.

(1) Parking shall be placed to the rear of the lot in relation to Seventh Street.

(2) Parking adjacent to a side street shall be screened from view with a 42-inch tall fence and minimum three-foot landscape buffer area with planting height no less than 42 inches tall.

(3) Parking adjacent to another lot shall be screened with a fence or a continuous hedge of at least 42 inches in height planted at a minimum three-gallon/30 inches on center or a six-foot tall opaque fence.

(Ord. 4508, 3-21-12)

26.20.110 Individual building signage for nonresidential uses.

(a) Guideline. The overall visual impression and ability for one to find his or her way can be significantly impacted by the collective image projected by local signs. It is the intent of this section to promote the concept that signage is subservient to architecture and should be understated. To prevent the confusion and clutter that can result from unrestricted signage, specific criteria have been developed. Signage in the District should be discreet and maintain the residential character of the neighborhood. Generally, signage should reflect styles and materials that are consistent with the restoration era.

Below are some examples of signage that would be consistent with architecture and style in an historic area.

Inappropriate Signage

(b) Standards. Please refer to the City's sign regulations, GJMC 21.06.070.

(Ord. 4508, 3-21-12)

Chapter 26.24

CONTRIBUTING STRUCTURES, NONCONTRIBUTING STRUCTURES AND NEW CONSTRUCTION

Sections:

26.24.010 General guidelines.
26.24.020 Building proportions, mass and form.
26.24.030 Orientation and lot coverage.
26.24.040 Alignment, rhythm, and spacing.
26.24.050 Exterior materials.
26.24.060 Porches, stairs, entries and doors.
26.24.070 Accessibility and fire escapes.
26.24.080 Windows and facade treatments.
26.24.090 Roof forms and materials.
26.24.100 Trim and details.
26.24.110 Additions.

26.24.010 General guidelines.

New construction in the North Seventh Street Historic Residential District is allowed, as long as the design, siting, and construction are congruous with the character of the District. It is preferable to design congruous contemporary structures rather than duplicate or mimic the design of historic buildings in the District. Siting is critical due to various lot configurations and in considering the overall appearance within the context of neighboring buildings set within the immediate block.

Important design considerations for new buildings include height, massing, scale, form, texture, lot coverage, setbacks, spacing of buildings, orientation, and alignment. Congruousness of proposed foundations, porches, landscaping, utility systems, and other site features is also important.

(Ord. 4508, 3-21-12)

26.24.020 Building proportions, mass and form.

(a) Guideline. Maintaining a building's historical massing, scale and height gives the North Seventh Street Historic Residential District a unique appearance that helps preserve its historical character and reinforces the North Seventh Street Historic Residential District's architectural period and style.

The arrangement of building components or volumes into a whole structure constitutes its mass and scale. Typically, simple rectangular solid forms are appropriate. The building's overall massing and

form shall honor its historical style. In the North Seventh Street Historic Residential District, the building forms have historically reflected a human scale.

(b) Standards.

(1) Buildings shall be similar in height and width to buildings on adjacent sites and block. Two alternatives to this standard are:

(i) New buildings that are wider than the buildings on adjacent sites may be constructed by breaking the building mass or dividing the mass of the building width in appearance to conform to building widths on neighboring properties.

(ii) A new building which is wider and higher than buildings on adjacent sites may be constructed if the new building is broken up into smaller segments that are more similar to adjacent buildings and if the height of the building at the street facade and at the sides facing adjacent sites is similar to the height of buildings on those sites. This is achieved by placing the taller masses away from the street and adjacent buildings to either side.

(2) Foundation height shall be similar in proportion and appearance to neighboring buildings.

(3) Buildings shall not be constructed which do not maintain or blend with the heights of buildings on adjacent sites.

(4) Buildings shall not be constructed which do not maintain or suggest the widths of buildings on adjacent sites.

(5) New buildings shall reinforce a pedestrian-friendly character from the front elevation by maintaining the similarity of building, roof form, and front porches traditionally found on the block when appropriate.

(6) New buildings shall use massing and form similar to neighboring buildings. Design shall convey a human scale through the use of traditional mass, sizes, materials, and window openings.

(7) New construction shall incorporate design elements such as roof forms, lines, openings, and other characteristics commonly found in the District.

(8) New construction may have a building form which is unique in the District but relates to the neighboring buildings and to the neighborhood through its overall massing.

(9) New construction shall not use massing and building forms which are foreign to the Historic District as determined by the Historic Preservation Board.

(Ord. 4508, 3-21-12)

26.24.030 Orientation and lot coverage.

(a) Guidelines. New buildings should be oriented parallel to the street and provide visual continuity with proportional lot coverage similar to other buildings on the same block. The principal facades of new buildings within the District should be oriented to the street. Main entryways should be located along these principal facades. This is a consistent pattern throughout the District which should be preserved to maintain the prevailing visual continuity. When this pattern of primary facades and entryways is moved from the street side of the building, the activity along the street is lost and the character of the District changes. General proportions of buildings-to-lot areas should remain consistent with their historic appearance. Lot coverage should be similar in proportion to the lot coverage of neighboring lots. Side and rear setbacks will be governed by zoning and will limit the minimum spacing between buildings; however, the overall proportions of building-to-lot area should remain consistent from lot to lot along the block.

(b) Standards.

(1) Accessory dwelling units, accessory buildings, and garages shall be subordinate to the primary residential building on the site by placing the structure to the rear of the lot.

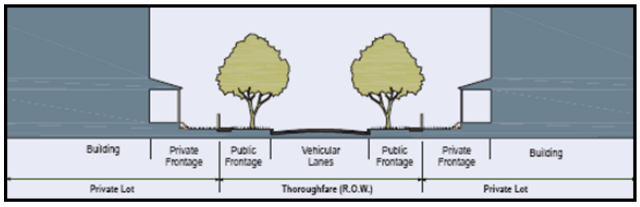
(2) Primary facades of a new building shall be oriented parallel to the street.

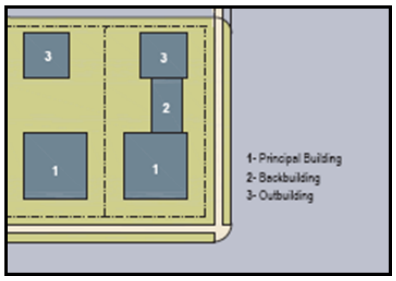
(3) Primary entrances shall be provided on the street facade.

(4) The primary entrance shall be enhanced through the use of steps, functional porches, stoops, porticos or other design features appropriate to the architectural style of the building.

(5) New construction shall maintain proportional lot coverage as found on the neighboring properties of the same block.

(6) Garages shall not be constructed as part of the primary building. Garages shall be accessed from the alley.





(Ord. 4508, 3-21-12)

26.24.040 Alignment, rhythm, and spacing.

(a) Guidelines. Proportions of the facades and the spacing of the buildings should be consistent along the streets of the District. Along a block, the uniformity of the proportions of the facades and the spacing of the buildings must be considered in new construction to achieve harmony along the streetscape. Spacing between buildings should be consistent along the street in order to maintain the rhythm that is traditionally prevalent on the street in the District. Houses built up until the mid-1930s tend to have substantial front porches and often rear or side porches as well. Porches, projecting bays, balconies, and other facade elements are encouraged and should be aligned with those of existing buildings along the street. This alignment creates harmony and maintains the rhythm of facade proportions along the block length. Front widths of new buildings should correspond with existing building widths; however, a wider facade can be broken into separate elements that suggest front widths similar to those of neighboring buildings. Where lots are combined to create a larger development, the building-to-lot proportions should visually suggest a relationship with adjacent buildings by breaking large building masses into smaller elements. Where a building site is comprised of multiple lots, the new building should be clearly of similar proportion to other buildings on the same block.

(b) Standards.

(1) New building facades shall align with the facades of existing buildings on adjacent sites.

(2) New buildings shall be constructed with similar spacing relative to other buildings along that street.

(3) Buildings shall not contain a primary entrance that is simply a door and provides little or no transition from outside to inside.

(4) Primary entrances shall not be at-grade as virtually all existing homes with historic significance provide a "stepping up" to the front entrance.

(Ord. 4508, 3-21-12)

26.24.050 Exterior materials.

(a) Guidelines. Use similar building materials as those found within the District. Prevalent styles found within the District use a variety of common building materials. Clapboard or shiplap wood siding (two to six inches wide), brick, stucco and sandstone are dominant exterior materials. Sandstone blocks are generally relied upon for foundations. Stucco, rusticated concrete block and stone were sometimes used solely as wall materials or for ornamentation. In new construction, the use of the historic building materials is favored. Several common materials to choose from include wood siding, composite wood-resin and fiber cement siding, among others. As historic homes age, exterior materials inevitably need replacement, repair or restoration. Whether scientific advancement has deemed a certain material unsafe or a material is simply worn, it is important to replace these materials in a manner that reflects the building's historical style in order to preserve the North Seventh Street Historic Residential District's overall character.

(1) Exterior surfaces should be replaced with historically accurate materials.

(2) If it is not possible to replace materials with like materials, exterior wall surfaces, foundation, roofing, trim, gutters, downspouts, exterior lighting and other unique detailing may be replaced with modern materials with an appearance similar to original materials.

(3) Hazardous materials that do not pose a threat may remain a part of the structure.

(b) Standards (Applies to Contributing Structures Only).

(1) Exterior wall materials shall be those that are commonly present in the District.

(2) The predominant texture of the new building shall be consistent with the texture of historic materials in the District.

(3) Allowable siding materials for new construction include, but are not limited to, wood, painted composite wood-resin or fiber cement siding.

(4) Prefabricated or metal buildings are prohibited.

(5) New vinyl and aluminum exterior siding materials are prohibited, except as replacement material on noncontributing structures.

(6) Exterior insulation and finish system (E.I.F.S.) or similar is prohibited.

(Ord. 4508, 3-21-12)

26.24.060 Porches, stairs, entries and doors.

(a) Guidelines.

(1) Front porches are common in the District and are strongly encouraged on new principal structures.

(2) A key characteristic of many of the buildings in the North Seventh Street Historic Residential District is the pattern and prominence of the raised first floor front porches, regardless of the architectural style or period. This important element of the streetscape and its components of construction should be maintained.

(3) The buildings in the North Seventh Street Historic Residential District were designed to face North Seventh Street. This is Grand Junction's only downtown residential example where entire blocks of houses face a north-south street. This detail is a defining characteristic for most of the North Seventh Street Historic Residential District and should be maintained. Modification of the size and/or location of the doorway changes the overall style of a building's facade.

(b) Standards (Applies to Contributing Structures Only).

(1) Front porches shall be maintained as integral parts of the overall building character and style.

(2) The ground plane of any new entry platform or stairs shall stand no higher than one-half a story from the base of the structure.

(3) An open porch shall be enclosed with screening providing the original lines of the porch roof, eaves and supports are preserved. Enclosure of any porch with a material other than screening is prohibited.

(4) Buildings' entrances shall be maintained in their historical location.

(5) Doorway materials and design shall be consistent with the architectural style of the building.

(6) Door cases shall be designed with depth and visual relief.

(7) Doors shall be of overall proportions similar to those used on buildings on adjacent sites.

(8) Screen doors that are simple in design and blend with the design of the inner door and the house shall be used.

(9) Aluminum doors with mill, brush or polished finish or metal louvered doors shall not be used.

(Ord. 4508, 3-21-12)

26.24.070 Accessibility and fire escapes.

(a) Guidelines.

(1) The materials and design of ADA accessible ramps should be compatible with the architectural style of the building. The ramp must provide a nonskid surface and have no greater than a one to 12 slope.

(2) The addition of a fire access should reflect design elements of the building.

(3) For uses that are subject to the Americans with Disabilities Act, all ADA requirements will be honored.

(Ord. 4508, 3-21-12)

26.24.080 Windows and facade treatments.

(a) General Guidelines.

(1) Maintain similar solid-to-void ratios of a new building to those of buildings on adjacent sites within the block with overall proportions of windows, doors, and front facades. The front facades of buildings within the District vary in style and detail; however, certain proportional relationships exist among buildings in the immediate setting. The importance of the relationship between the width and height of the front elevation of buildings on the block has already been discussed. Beyond that, the proportion of openings on the street-side facade, or, more specifically, the relationship of width to height of windows and doors and their placement along the facade should reflect the same relationships along the street.

(2) Driving or walking down Seventh Street, a pattern of window and door openings becomes evident along the block. This rhythm of solids to voids, walls to windows, and juxtaposition of stronger and less dominant elements should be reflected in the facade of a new building. Windows give scale to buildings and visual attention to the composition of individual facades. Many historic building styles have distinctive window designs. Historic windows are generally inset into relatively deep openings or surrounded by casings and sash components that cast shadows and provide depth and relief. Windows in new construction should have similar characteristics.

(3) Windows are an important design element as they are able to establish the scale and character of the building. Windows and window patterns in new construction should be of similar proportion and size to the windows of the other buildings within the neighborhood. For the major-

ity of neighborhoods developed prior to the 1940s, the rule of thumb for windows is generally vertical, double-hung or casement and wood-framed. When placed in pairs or in groups of three, as in many Craftsman houses, these create a horizontal impression. Historic architecture styles display a thoughtful use of natural lighting, often with numerous and well placed arrangement of windows. Doors are also important character-defining features of buildings throughout the District. Original doors on houses from historic styles are generally divided into wood panels and glass. Many doors also have glass side lights and transoms. New doors should reflect these patterns.

(4) New buildings should have double- or single-hung sash windows and provide windows of overall proportions similar to those used on buildings on surrounding sites within the block.

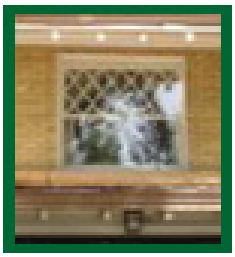
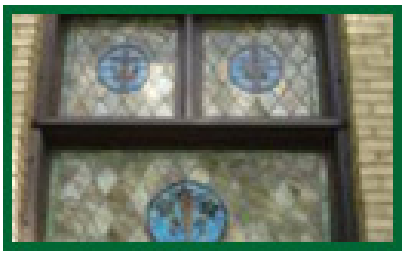
(5) New buildings should have a ratio of wall-to-window or solid-to-void that is similar to that found on other historic buildings within the block and found throughout the District. They should provide a pattern of windows and doors on the facade which recalls similar patterns on facades of other buildings in the District.

(6) Window cases should be designed with depth and visual relief.

(7) It is appropriate to use wood or similar looking materials such as aluminum clad or vinyl windows that provide depth and texture similar in appearance to historic wood windows on the primary facade. Other window materials may be considered on the secondary elevations of the new building.

(8) It is appropriate to use removable storm windows that blend the texturing and match sash styles so they do not appear obtrusive or out of place.

(9) Multiple window styles should not be used throughout a new building.

(b) Standards (Applies to Contributing Properties Only).

(1) Window shape, alignment and style shall be protected to preserve the building's historic character.

(2) Window materials shall be maintained in a historically accurate manner.

(3) Any alteration of windows shall maintain the historic pattern of their vertical and horizontal rhythms.

(4) Openings shall not be enlarged, closed off, or otherwise altered in form.

(5) Shade structures such as awnings may be appropriate additions to windows provided the design and materials are consistent with the architectural style. Primary materials shall be cloth and wood. Plastic, vinyl and metal shade structures are not allowed.

(Ord. 4508, 3-21-12)

26.24.090 Roof forms and materials.

(a) Guidelines. Use similar roof forms, slope ratios and materials drawn from historic structures in the District. Roofs are major features of most historic buildings and when repeated along a street contribute toward a visual continuity. The architectural character of older buildings is generally expressed in roof forms and materials. Roofs in the North Seventh Street Historic Residential District are simple in form and are gabled, hipped or occasionally a combination of the two. Roofs purposely extend beyond the building walls to protect the window and door openings and provide shade. These eaves are sometimes enclosed with wood soffits (the underside of a roof overhang) which are vented. Various materials are used for the roofs of buildings throughout the District, but shingles of varying materials predominate. Some of the more common materials are wood shingle, clay tile, composition material such as asphalt or asbestos shingles, tin and slate. The design of roofs for new buildings should be congruous to the size, shape, slope, color and texture of other roofs on the block.

(1) The roof on a new building should relate to the overall size, shape, slope, color, and texture of roofs on adjacent sites or in other areas of the District. Special consideration shall be given to front-facing facades.

(2) Gable and hipped roofs should be used as primary roof forms that may protrude beyond the plane of the building walls.

(3) The majority of the roof should be of a pitch of 6:12 or greater. Shed roofs may be appropriate for some porch additions.

(4) Roofs should include eaves and decorative elements such as corner boards and brackets shall be used under the eaves to provide depth and relief.

(5) The visual impact of skylights and other rooftop devices visible to the public should be minimized; these should be located toward the rear of a house.

(b) Standards (Applies to Contributing Properties Only).

(1) Materials on a new roof or replacement roof should be similar to materials found on roofs in the District.

(Ord. 4508, 3-21-12)

26.24.100 Trim and details.

(a) Guidelines.

(1) Exterior trim details on new construction should provide a visual link between the old and new buildings. New construction should not necessarily copy every detail of a style or period of architecture found in the District; rather, new construction should be congruous. Using similar forms such as those found in windows, doors, parapets, rooflines, and other facade elements without replicating them can help establish continuity and compatibility within the block and the District. The trim and details of new buildings offer a way to link to the past while still acknowledging a clear differentiation in the present. New details and trim should be well integrated into the design and used to accomplish functional as well as decorative purposes, such as: to express a change of plane; to finish what would otherwise be a ragged edge; to act as a transition between different materials; or even the simple function of shedding water. Detail should be functional with a high level of craftsmanship, rather than simply applied decoration.

(2) Whenever possible, windowsills, moldings, and eave lines should be aligned with similar elements on adjacent buildings within the block.

(3) It is not appropriate to use architectural details in ornamentation that confuse the history or style of a building. For example, do not use Victorian details on minimal traditional homes.

(Ord. 4508, 3-21-12)

26.24.110 Additions.

(a) Guidelines. The landmark structures along North Seventh Street historically define the North Seventh Street Historic Residential District. Each landmark structure should be maintained and each building's historical form should not be altered in order to preserve the character of the North Seventh Street Historic Residential District.

(1) Additions should not exceed 35 percent of the gross square footage of the principal structure and not be visually prominent from North Seventh Street. The appearance of additions should be subordinate to the principal structure and should not alter the original proportions of the front facade.

(2) Additions should not alter the historical alignment of structures in relation to North Seventh Street.

(3) The setback of the addition should preserve the historic eave or roof line of the original structure.

(4) The height of the addition should not exceed the overall height (roof peak) of the original structure.

(5) The materials used for additions should be similar to materials used in the original construction.

(Ord. 4508, 3-21-12)

Chapter 26.28

CONTRIBUTING STRUCTURES GUIDELINES AND STANDARDS

Sections:

26.28.010 Overall guiding principles.
26.28.020 Secretary of the Interior's Standards for Rehabilitation of Historic Structures.

26.28.010 Overall guiding principles.

Building permits for alteration of contributing structures shall be reviewed according to the process described in Chapter 26.16 GJMC. Exterior modifications that do not require a building permit shall obtain a certificate of appropriateness from the Public Works and Planning Department. All modifications that will affect the historical integrity of the structure shall consider the Secretary of the Interior's Standards for the Rehabilitation of Historic Structures. The Secretary of the Interior's Standards should be applied to individual rehabilitation projects taking into consideration technological and economic feasibility, and should be considered as general guidance to supplement the specific guidelines and standards of this title. It should be noted that some of the specific guidelines and standards of this title are less restrictive than the general guidance of the Secretary of the Interior's Standards.

(Ord. 4508, 3-21-12)

26.28.020 Secretary of the Interior's Standards for Rehabilitation of Historic Structures.

(a) A property shall be used for its historic purpose or be placed in a new use that requires minimal change to the defining characteristics of the building and its site and environment.

(b) The historic character of a property shall be retained and preserved. The removal of historic materials or alteration of features and spaces that characterize a property shall be avoided.

(c) Each property shall be recognized as a physical record of its time, place, and use. Changes that create a false sense of historical development, such as adding conjectural features or architectural elements from other buildings, shall not be undertaken.

(d) Most properties change over time; those changes that have acquired historic significance in their own right shall be retained and preserved.

(e) Distinctive features, finishes, and construction techniques or examples of craftsmanship that characterize a property shall be preserved.

(f) Deteriorated historic features shall be repaired rather than replaced. Where the severity of deterioration requires replacement of a distinctive feature, the new feature shall match the old in design, color, texture, and other visual qualities and, where possible, materials. Replacement of missing features shall be substantiated by documentary, physical, or pictorial evidence.

(g) Chemical or physical treatments, such as sandblasting, that cause damage to historic materials shall not be used. The surface cleaning of structures, if appropriate, shall be undertaken using the gentlest means possible.

(h) Significant archaeological resources affected by a project shall be protected and preserved. If such resources must be disturbed, mitigation measures shall be undertaken.

(i) New additions, exterior alterations, or related new construction shall not destroy historic materials that characterize the property. The new work shall be differentiated from the old and shall be compatible with the massing, size, scale, and architectural features to protect the historic integrity of the property and its environment.

(j) New additions and adjacent or related new construction shall be undertaken in such a manner that, if removed in the future, the essential form and integrity of the historic property and its environment would be unimpaired.

(Ord. 4508, 3-21-12)

Chapter 26.32

DEMOLITION OF ALL OR PART OF ALL STRUCTURES WITHIN THE NORTH SEVENTH STREET HISTORIC RESIDENTIAL DISTRICT

Sections:

26.32.010 Review criteria.
26.32.020 Submittal requirements.
26.32.030 Procedure.
26.32.040 Penalty.

26.32.010 Review criteria.

Any applicant/owner requesting demolition of part or all of a structure within the North Seventh Street Historic Residential District shall demonstrate that the demolition is warranted. Approval of a certificate of appropriateness for the demolition may only be issued upon consideration by the City Council of the following:

(a) Whether the applicant has made a good-faith effort to pursue reasonable, cost effective alternatives to demolition.

(b) Whether the loss of part or all of the subject property would be detrimental to the quality and continuity of the site, District or surrounding neighborhood.

(c) Whether denial of the application would result in an undue economic hardship for the owner/applicant. Based on a thorough analysis of the financial, economic, and engineering information described below, the City Council may determine that there is an undue economic hardship if the following criteria are met:

(1) No economically viable use consistent with zoning of the property will exist unless the demolition is approved. (Note: inability to put the property to its most profitable use does not constitute an undue economic hardship.)

(2) The hardship is peculiar to the building or property in question and must not be in common with other properties.

(3) The hardship is not self-imposed, caused by action or inaction of the owner, applicant or some other agent.

(4) The applicant/owner has attempted and exhausted all reasonable alternatives which would eliminate the hardship, such as offering the property for sale.

(Ord. 4508, 3-21-12)

26.32.020 Submittal requirements.

The applicant/owner for demolition of part or all of a structure shall provide information including but not limited to the following items in order for the City Council to evaluate the application:

(a) An estimate of the cost of the proposed demolition or removal and an estimate of any additional cost that would be incurred to comply with recommendations of the Historic Preservation Board.

(b) A report from a licensed engineer or architect with experience in rehabilitation as to the structural soundness of the structure and its suitability for economic rehabilitation.

(c) Estimated current market value of the property by a licensed real estate appraiser of the property both in its current condition and after completion of the proposed demolition or removal and all appraisals obtained within the previous two years by the applicant or owner in connection with the purchase, financing or ownership of the property.

(d) An estimate of the cost of restoration prepared by an architect, developer, real estate consultant, appraiser or other real estate professional experienced in rehabilitation or reuse of like structures in the District.

(e) Amount paid for the property, the date of purchase and the party from whom purchased, including a description of the relationship, if any, between the owner of record or applicant and the person from whom the property was purchased and any terms of financing between the seller and buyer.

(f) If the property is income-producing, the annual gross income from the property for the previous two years; and the depreciation deduction and annual cash flow before and after debt service, if any, during the same period.

(g) Remaining balance on the mortgage or other financing secured by the property owner and annual debt service, if any, for the previous two years.

(h) All appraisals obtained within the previous two years by the owner or applicant in connection with the purchase, financing or ownership of the property.

(i) Any listing of the property for sale or rent, price asked and offers received, if any, within the previous two years.

(j) Assessed value of the property according to the two most recent Mesa County assessments.

(k) Real estate taxes for the previous two years.

(l) Form of ownership or operation of the property, whether sole proprietorship, for-profit or nonprofit corporation, limited partnership, joint venture, etc.

(m) Current photographs of the building and land from the front street showing as much of the land and building as possible.

(n) Current photographs of all exterior elevations from rooftop to ground.

(o) Current photographs of all interior rooms.

(p) A narrative summary of all special architectural features and details and materials used throughout the interior and exterior of the structure.

(Ord. 4508, 3-21-12)

26.32.030 Procedure.

(a) Upon submittal of the application for a certificate of appropriateness for demolition to the City, the Public Works and Planning Department shall review all the documentation submitted for completeness. The Department staff shall prepare a report with findings. The Historic Preservation Board will then review the report and make a recommendation to City Council.

(b) The application, with the findings and recommendations of the Department and the Historic Preservation Board, shall be presented to the City Council in accordance with the administrative procedures and notice requirements. The City Council will have 90 calendar days to consider and render its decision. If approved, the Public Works and Planning Department shall issue a certificate of appropriateness in order for the applicant/owner to obtain a building permit for the demolition.

(c) If the City Council finds that all reasonable possibilities for saving a part or all of the structure have been exhausted and approves the demolition, all salvageable building materials shall be collected and then the waste should be removed as provided by the permit and asbestos or other hazardous material disposal procedures. The site shall then be planted and maintained until a new use goes into effect.

(Ord. 4508, 3-21-12)

26.32.040 Penalty.

If the applicant/owner of a structure within the North Seventh Street Historic Residential District abates or demolishes part or all of a building without first obtaining the certificate of appropriateness by following the procedures detailed herein, the applicant/owner shall pay a fine of $250.00 per square foot of the affected area.

(Ord. 4508, 3-21-12)

Chapter 26.36

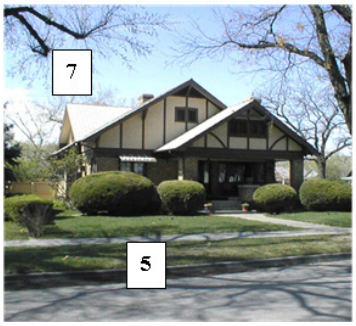
APPENDICES

Sections:

26.36.010 Appendix A – Property inventory.
26.36.020 Appendix B – Terms and definitions.
26.36.030 Appendix C – Incentives for historic preservation in Grand Junction.
26.36.040 Appendix D – Frequently asked questions.
26.36.050 Appendix E – Sample certificate of appropriateness.
26.36.060 Appendix F – Authentic plants for late 19th/early 20th century period landscaping.

26.36.010 Appendix A – Property inventory.

(a) District Character Inventory.



(1) The District is within a grid street pattern forming rectangular blocks, bisected by east-west and north-south alleys.

(2) Visual cohesiveness is created by the natural setting which includes a strong pattern of evenly spaced street trees, an abundance of mature vegetation and a center landscaped median on North Seventh Street.

(3) Within blocks, the lots are approximately the same size and structures are placed on lots in a similar manner. Uniform side and front yard setbacks give the street visual unity.

(4) Buildings are of compatible size and scale, with the majority of buildings in the District having one and one-half to two and one-half stories.

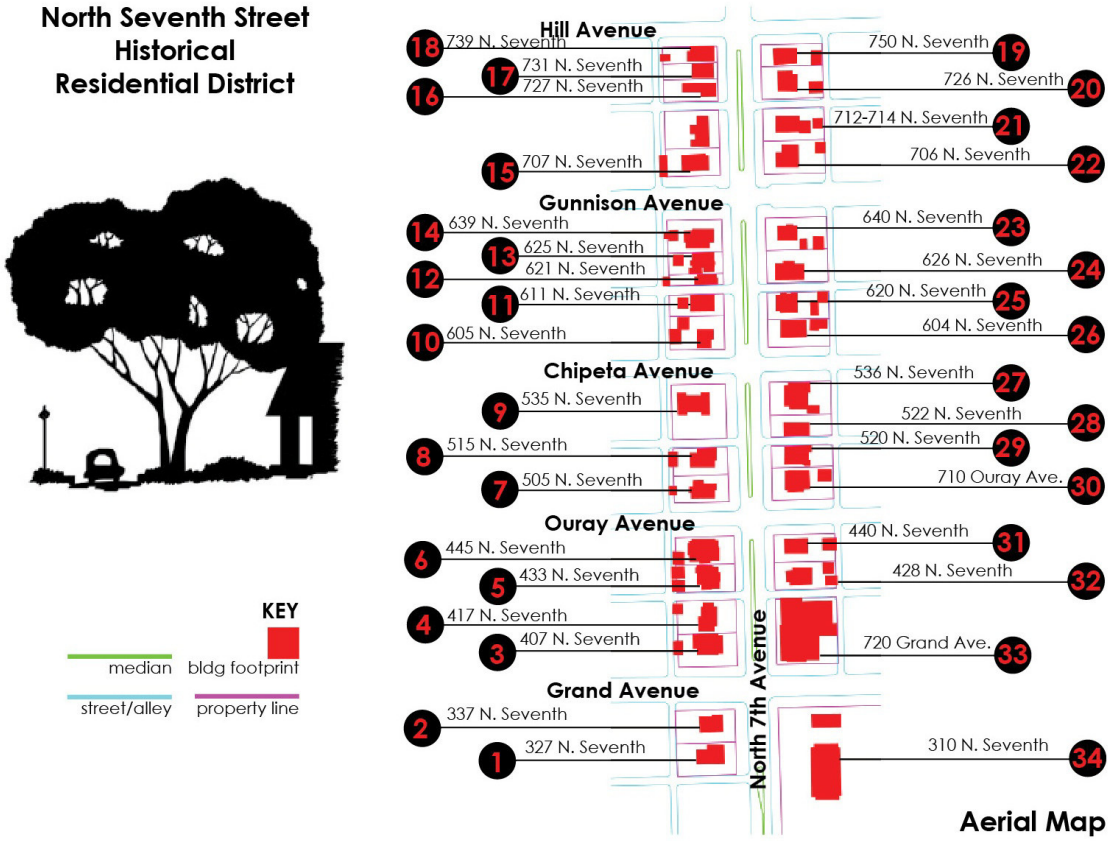
(5) Although varied in architectural style, almost every building has a porch. Altogether, the porches form a uniform horizontal line on the streetscape.

(6) The buildings have prominent triangular roof forms that are primarily oriented with the ridge-line perpendicular to North Seventh Street.

(7) Siding and trim materials create strong horizontal patterns.

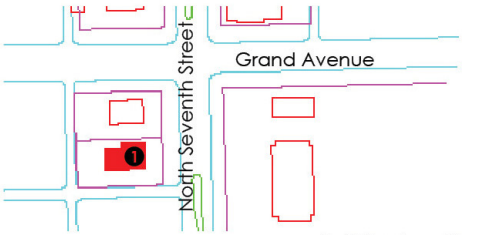
(8) Unique details highlight the District's character including some yards set off by wrought iron, picket or brick-pilaster fencing and a variety of architectural ornamentation.

(b) North Seventh Street Historical Residential District. The North Seventh Street Historic Residential District is Grand Junction's only Nationally Registered historic neighborhood. Below is an aerial map of the District and following is a collection of profile cards depicting the unique architectural stylings of all 35 structures in the District.



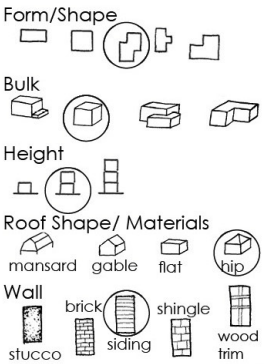
(1) Doc Shores House.

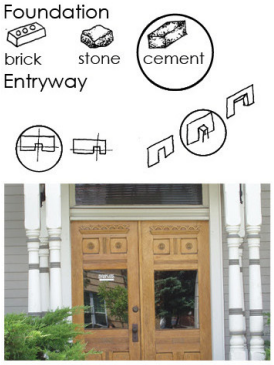
1. Doc Shores House



Building Location

Address: 327 North Seventh Street
Zone District: B-2, downtown business
Principal Use: office space
Original Owner: Cyrus "Doc" Shores
Date of Construction: 1893



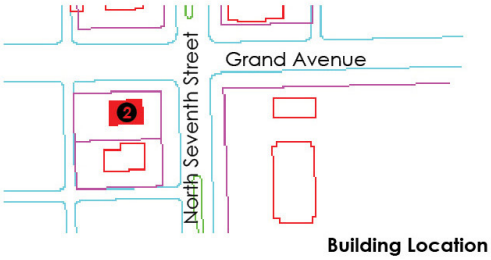


Style: Italiante
Platforms: side porch
Additions/Alterations: yes
Accessory Structures: none
Fencing/Walls: none
Landscaping: minimal
Signage: stand alone
Unique/Distinguishing Elements: unique columns and trim
Is Property a Focal Point or Orientation Landmark? yes

North Seventh Street Historic Residential District

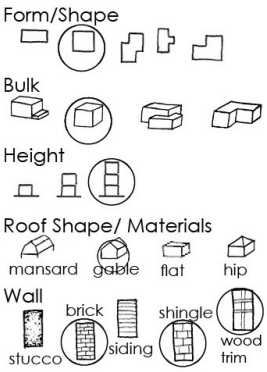
(2) White House.

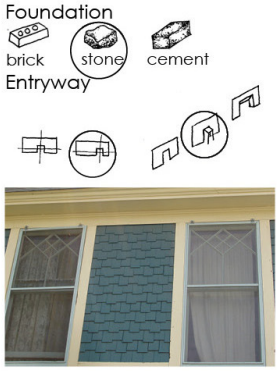
2. White House



Building Location

Address: 337 North Seventh Street
Zone District: B-2, downtown business
Principal Use: office space
Original Owner: W. F. White
Date of Construction: 1893



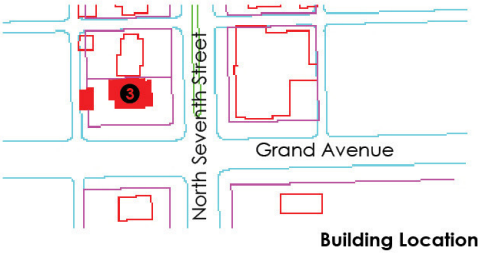


Style: Colonial Revival, Tudor Revival, Queen Ann
Platforms: small covered entrance
Additions/Alterations: yes
Accessory Structures: none
Fencing/Walls: none
Landscaping: minimal
Signage: stand alone
Unique/Distinguishing Elements: unique columns and windows
Is Property a Focal Point or Orientation Landmark? yes

North Seventh Street Historic Residential District

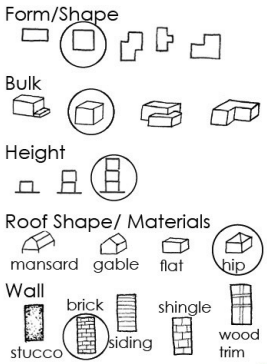
(3) Heman Bull House.

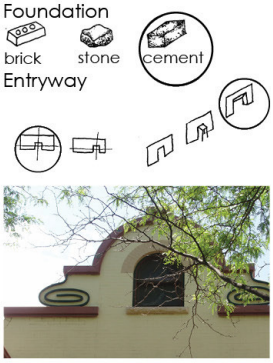
3. Heman Bull House



Building Location

Address: 407 North Seventh Street
Zone District: Planned Residential Development
Principal Use: residence
Original Owner: Dr. Heman Bull
Date of Construction: 1906

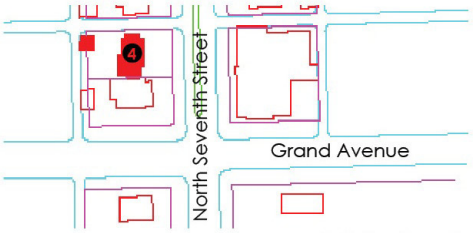




Style: Spanish
Platforms: glassed front porch
Additions/Alterations: no
Accessory Structures: garage
Fencing/Walls: stone
Landscaping: Colorado
Signage: 1 stand alone
Unique/Distinguishing Elements: decorative arched parapets, arch motif
Is Property a Focal Point or Orientation Landmark? yes

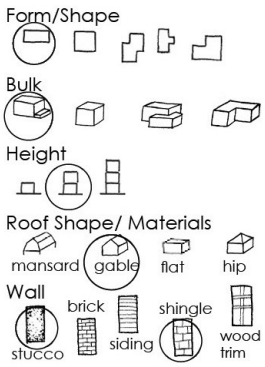
(4) Waren House.

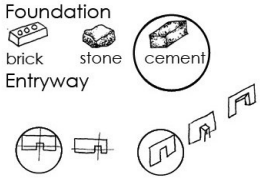
4. Waren House

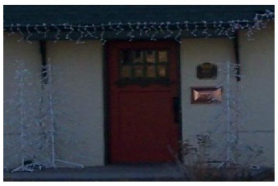


Building Location

Address: 417 North Seventh Street
Zone District: Planned Residential Development
Principal Use: residence
Original Owner: Dr. George and Nettie Waren
Date of Construction: 1902







Style: Eclectic
Platforms: back balcony
Additions/Alterations: yes
Accessory Structures: garage
Fencing/Walls: wood and metal
Landscaping: flowering
Signage: none
Unique/Distinguishing Elements: double chimney, flowering landscape
Is Property a Focal Point or Orientation Landmark? no

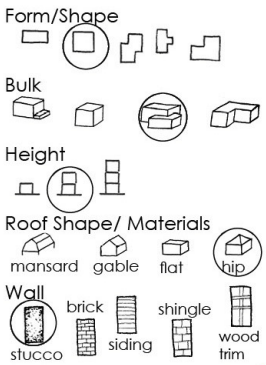
North Seventh Street Historic Residential District

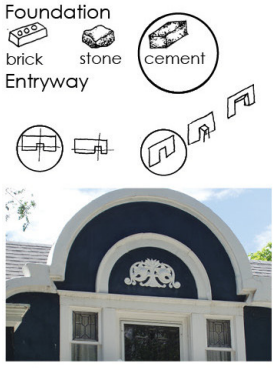
(5) Moore House.

5. Moore House

Building Location

Address: 433 North Seventh Street
Zone District: Planned Residential Development
Principal Use: residence
Original Owner: John F. " Pony" and Irene Moore
Date of Construction: 1910





Style: Eclectic
Platforms: none
Additions/Alterations: no
Accessory Structures: two garages
Fencing/Walls: brick, wrought iron
Landscaping: Colorado
Signage: none
Unique/Distinguishing Elements: hipped roof dormers, palladian windows, bracketed gutters, ornamentation
Is Property a Focal Point or Orientation Landmark? yes

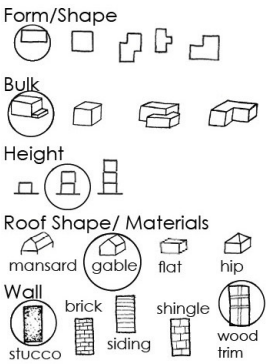
North Seventh Street Historic Residential District

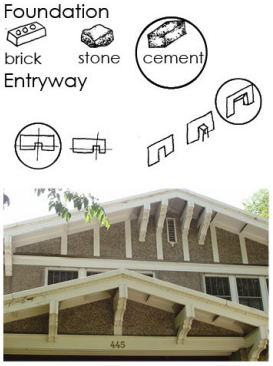
(6) Martin House.

6. Martin House

Building Location

Address: 445 North Seventh Street
Zone District: Planned Residential Development
Principal Use: residence
Original Owner: F.C. "Clyde" and Carrie Martin
Date of Construction: 1923



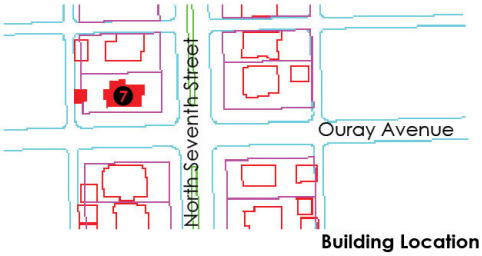


Style: Craftsman
Platforms: front and back porch
Additions/Alterations: no
Accessory Structures: garage
Fencing/Walls: wood
Landscaping: Colorado
Signage: none
Unique/Distinguishing Elements: Kellistone stucco, low pitched roofs
Is Property a Focal Point or Orientation Landmark? yes

North Seventh Street Historic Residential District

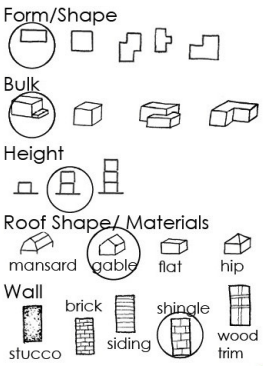
(7) Sampliner House.

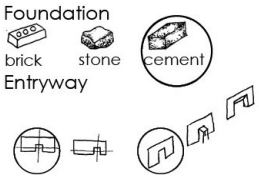
7. Sampliner House



Building Location

Address: 505 North Seventh Street
Zone District: Planned Residential Development
Principal Use: residence
Original Owner: Joseph M. Sampliner
Date of Construction: 1895



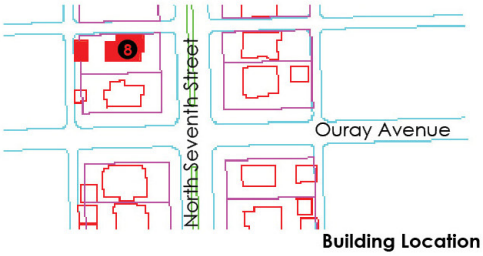


Style: Queen Anne, Tudor Revival
Platforms: none
Additions/Alterations: yes
Accessory Structures: garage
Fencing/Walls: wood
Landscaping: flowering
Signage: none
Unique/Distinguishing Elements: striped shingle siding
Is Property a Focal Point or Orientation Landmark? no

North Seventh Street Historic Residential District

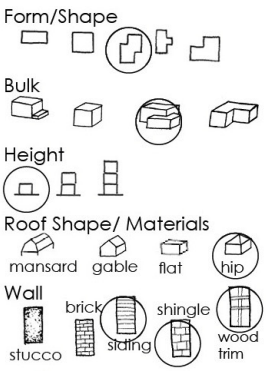
(8) Sampliner House.

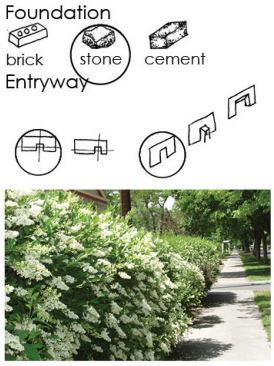
8. Sampliner House



Building Location

Address: 515 North Seventh Street
Zone District: Planned Residential Development
Principal Use: residence
Original Owner: Albert "Bert" Sampliner
Date of Construction: 1895

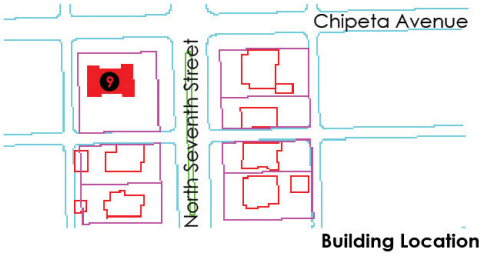




Style: Queen Anne
Platforms: enclosed front porch
Additions/Alterations: no
Accessory Structures: garage
Fencing/Walls: stone, wood
Landscaping: screened, flowering
Signage: none
Unique/Distinguishing Elements: sunburst moulding, stained glass window
Is Property a Focal Point or Orientation Landmark? yes

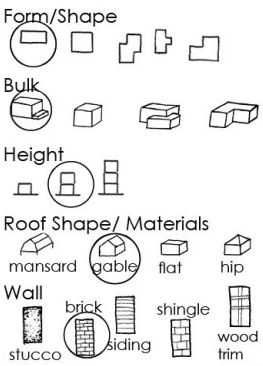
(9) First Church of Christ, Scientist.

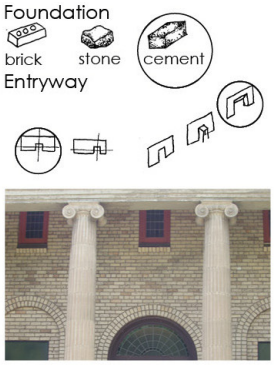
9. First Church of Christ, Scientist



Building Location

Address: 535 North Seventh Street
Zone District: Planned Residential Development
Principal Use: church
Original Owner: First Church of Christ, Scientist
Date of Construction: 1929



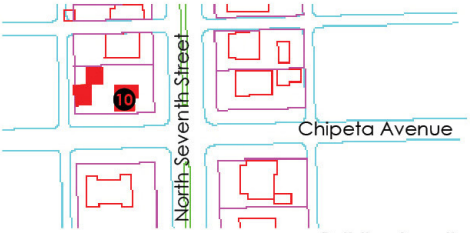


Style: Romanesque, Colonial Revival
Platforms: none
Additions/Alterations: no
Accessory Structures: none
Fencing/Walls: chain link
Landscaping: Colorado
Signage: stand alone
Unique/Distinguishing Elements: rounded arch, symmetry
Is Property a Focal Point or Orientation Landmark? yes

North Seventh Street Historic Residential District

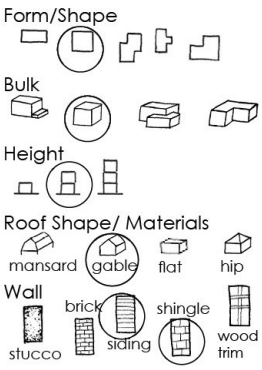
(10) Brainerd House.

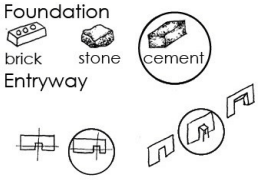
10. Brainerd House



Building Location

Address: 605 North Seventh Street
Zone District: Planned Residential Development
Principal Use: residential
Original Owner: John and Maud Brainerd
Date of Construction: 1900





Style: Dutch Colonial
Platforms: none
Additions/Alterations: no
Accessory Structures: cottage
Fencing/Walls: wood, brick
Landscaping: flowering, pergola
Signage: none
Unique/Distinguishing Elements: gambrel roof, formal entrance, striped shingle siding
Is Property a Focal Point or Orientation Landmark? yes

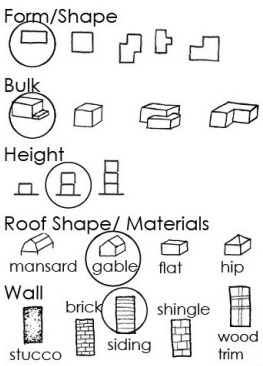
North Seventh Street Historic Residential District

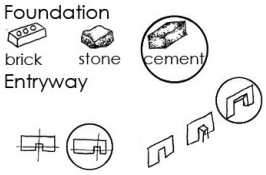
(11) Blackstone House.

11. Blackstone House

Building Location

Address: 611 North Seventh Street
Zone District: Planned Residential Development
Principal Use: residential
Original Owner: Leamon E. Blackstone
Date of Construction: 1904



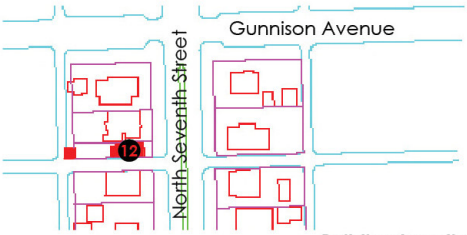


Style: Colonial Revival
Platforms: front porch
Additions/Alterations: no
Accessory Structures: garage
Fencing/Walls: wood
Landscaping: minimal
Signage: none
Is Property a Focal Point or Orientation Landmark? no

North Seventh Street Historic Residential District

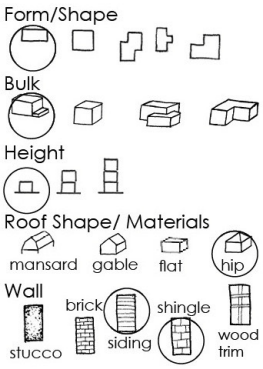
(12) Honeymoon Cottage.

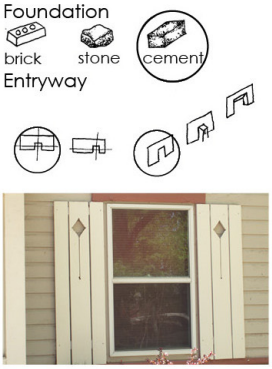
12. Honeymoon Cottage



Building Location

Address: 621 North Seventh Street
Zone District: Planned Residential Development
Principal Use: residential
Original Owner: **Albert A. Miller**
Date of Construction: 1904



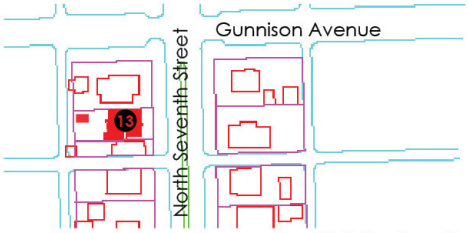


Style: Arts and Crafts Bungalow
Platforms: glassed front porch
Additions/Alterations: no
Accessory Structures: garage
Fencing/Walls: wood
Landscaping: deciduous
Signage: none
Is Property a Focal Point or Orientation Landmark? no

North Seventh Street Historic Residential District

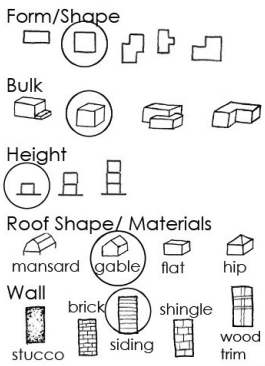
(13) Wilson House.

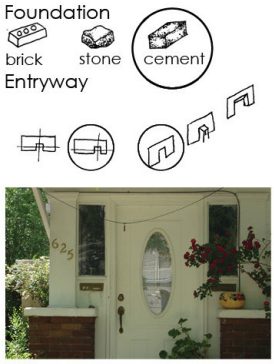
13. Wilson House



Building Location

Address: 625 North Seventh Street
Zone District: Planned Residential Development
Principal Use: residential
Original Owner: Julia Wilson
Date of Construction: 1922



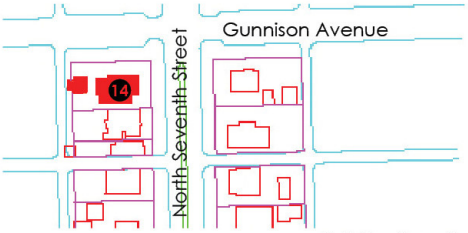


Style: Arts and Crafts Bungalow
Platforms: none
Additions/Alterations: no
Accessory Structures: two sheds
Fencing/Walls: none
Landscaping: Colorado
Signage: none
Is Property a Focal Point or Orientation Landmark? no

North Seventh Street Historic Residential District

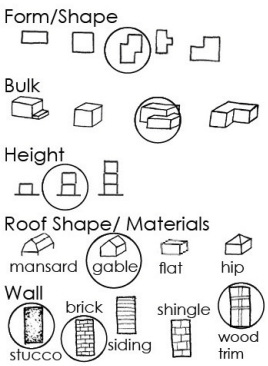
(14) Murr House.

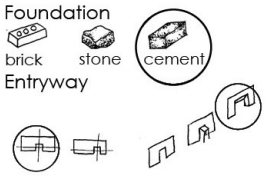
14. Murr House



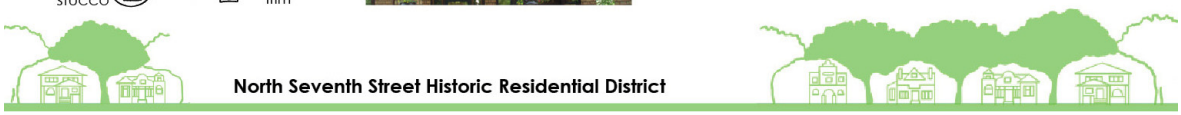
Building Location

Address: 639 North Seventh Street
Zone District: Planned Residential Development
Principal Use: residential
Original Owner: William and Hatti G. Murr
Date of Construction: 1926 by Winterburn and Lumsden





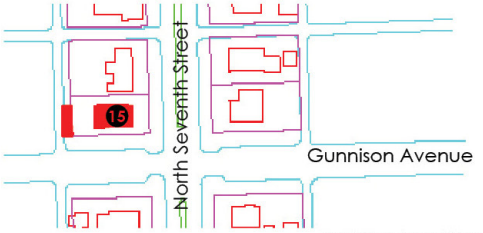
Style: Bungalow Arts and Crafts
Platforms: front porch
Additions/Alterations: no
Accessory Structures: garage
Fencing/Walls: wood
Landscaping: flowering, Colorado
Signage: none
Unique/Distinguishing Elements: wood and stucco gables, facade color palette
Is Property a Focal Point or Orientation Landmark? yes



North Seventh Street Historic Residential District

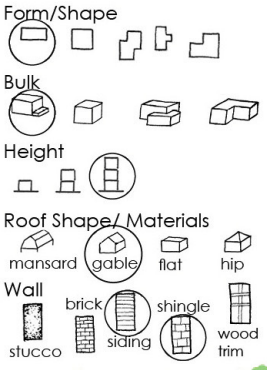
(15) Wickersham House.

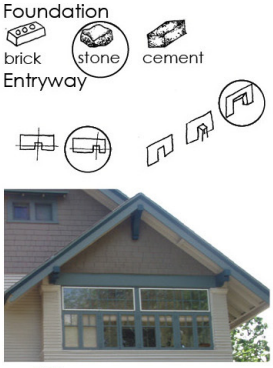
15. Wickersham House



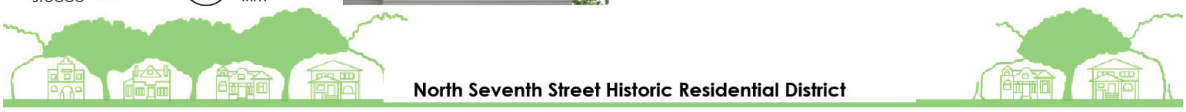
Building Location

Address: 707 North Seventh Street
Zone District: Planned Residential Development
Principal Use: residential
Original Owner: Lincoln and Ruth Wickersham
Date of Construction: 1910



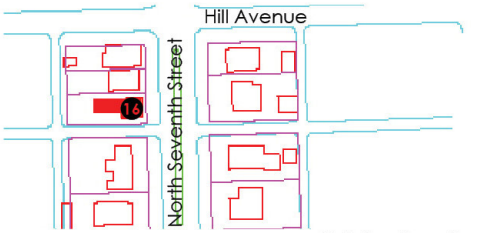


Style: Craftsman
Platforms: front porch
Additions/Alterations: no
Accessory Structures: garage
Fencing/Walls: wood
Landscaping: flowering
Signage: none
Unique/Distinguishing Elements: fenestration, simplicity
Is Property a Focal Point or Orientation Landmark? yes



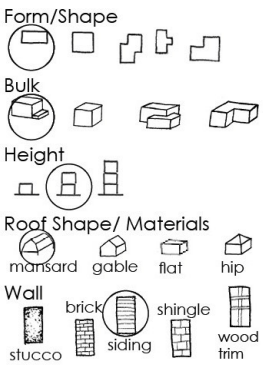
(16) Sinclair House.

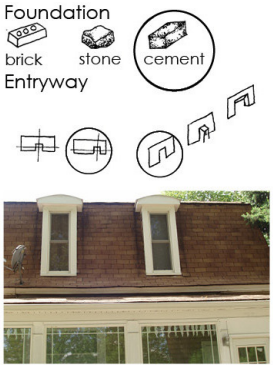
16. Sinclair House



Building Location

Address: 727 North Seventh Street
Zone District: Planned Residential Development
Principal Use: day care
Original Owner: James W. Sinclair
Date of Construction: 1895





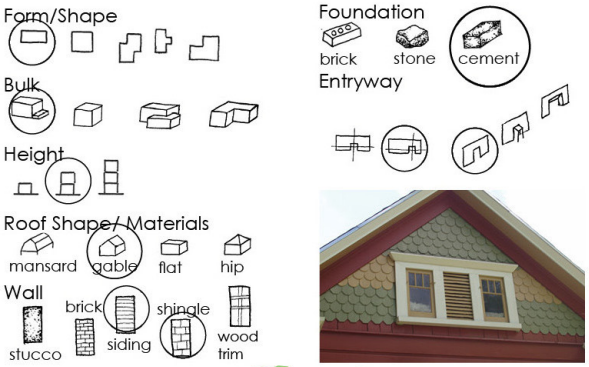
Style: Eclectic
Platforms: none
Additions/Alterations: no
Accessory Structures: none
Fencing/Walls: chain link
Landscaping: sparse
Signage: none
Unique/Distinguishing Elements: mansard roof
Is Property a Focal Point or Orientation Landmark? no

(17) Lough House.

17. Lough House

Building Location

Address: 731 North Seventh Street
Zone District: Planned Residential Development
Principal Use: day care
Original Owner: Clarence Lough
Date of Construction: 1909



Style: Queen Anne
Platforms: none
Additions/Alterations: no
Accessory Structures: shed
Fencing/Walls: chain link
Landscaping: minimal
Signage: attatched
Unique/Distinguishing Elements: near mirror image layout to 739 North Seventh
Is Property a Focal Point or Orientation Landmark? no

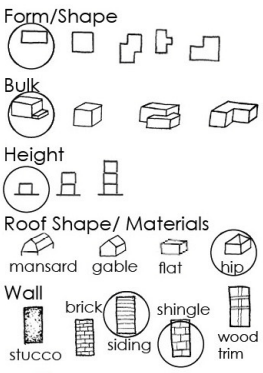
North Seventh Street Historic Residential District

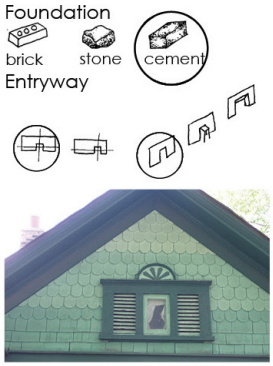
(18) Houskins House.

18. Houskins House

Building Location

Address: 739 North Seventh Street
Zone District: Planned Residential Development
Principal Use: residential
Original Owner: Owen W. Houskins
Date of Construction: 1909





Style: Queen Anne
Platforms: glassed front porch
Additions/Alterations: no
Accessory Structures: garage
Fencing/Walls: brick, wood
Landscaping: sparse
Signage: none
Unique/Distinguishing Elements: near mirror image layout to 731 North Seventh
Is Property a Focal Point or Orientation Landmark? no

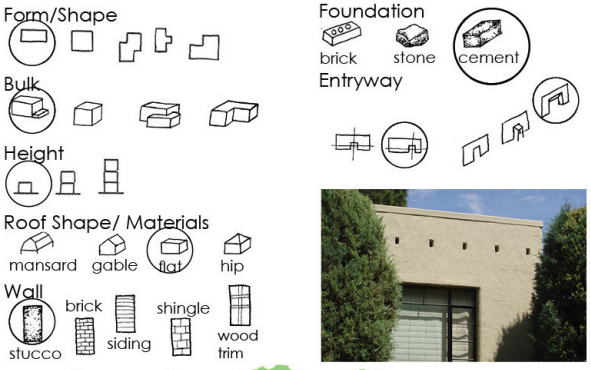
North Seventh Street Historic Residential District

(19) Akers House.

19. Akers House

Building Location

Address: 750 North Seventh Street
Zone District: Planned Residential Development
Principal Use: residential
Original Owner: Donald D. Akers
Date of Construction: 1952

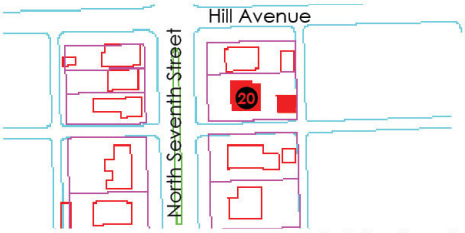


Style: Spanish
Platforms: front porch
Additions/Alterations: no
Accessory Structures: garage
Fencing/Walls: stone
Landscaping: screened, Colorado
Signage: no
Is Property a Focal Point or Orientation Landmark? yes

North Seventh Street Historic Residential District

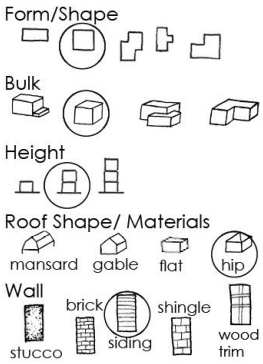
(20) Davis House.

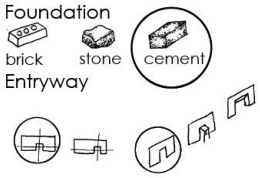
20. Davis House



Building Location

Address: 726 North Seventh Street
Zone District: Planned Residential Development
Principal Use: residential
Original Owner: Alfred H. Davis
Date of Construction: 1909



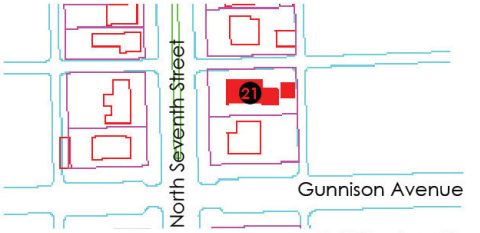


Style: Eclectic
Platforms: enclosed front porch
Additions/Alterations: yes
Accessory Structures: garage *
Fencing/Walls: stone *
Landscaping: minimal
Signage: no
Is Property a Focal Point or Orientation Landmark? no

* Stone work done by well known western slope mason Nunzio Grasso

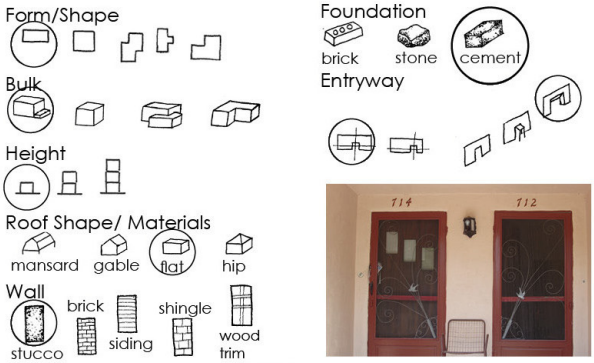
(21) Home Loan Duplex.

21. Home Loan Duplex



Building Location

Address: 712 and 714 North Seventh Street
Zone District: Planned Residential Development
Principal Use: residential
Original Owner: Home Loan and Investment Co.
Date of Construction: 1931

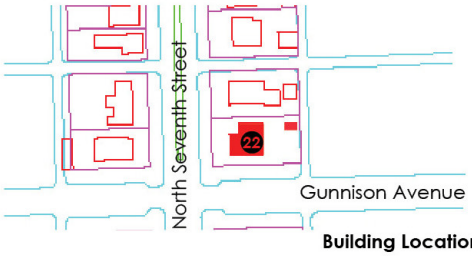


Style: Southwestern
Platforms: none
Additions/Alterations: no
Accessory Structures: garage
Fencing/Walls: chain link
Landscaping: Colorado
Signage: no
Unique/Distinguishing Elements: first duplex built in Grand Junction
Is Property a Focal Point or Orientation Landmark? no

North Seventh Street Historic Residential District

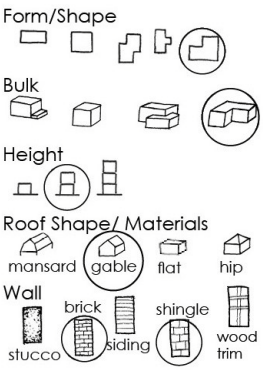
(22) Pabor House/Pansy Cottage.

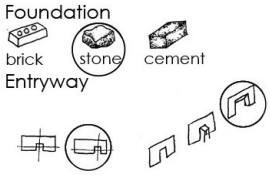
22. Pabor House/Pansy Cottage



Building Location

Address: 706 North Seventh Street
Zone District: Planned Residential Development
Principal Use: residential
Original Owner: William and Emma Pabor
Date of Construction: 1909





Style: Queen Anne
Platforms: front porch
Additions/Alterations: yes, second story
Accessory Structures: two sheds
Fencing/Walls: wood
Landscaping: deciduous
Signage: no
Is Property a Focal Point or Orientation Landmark? yes

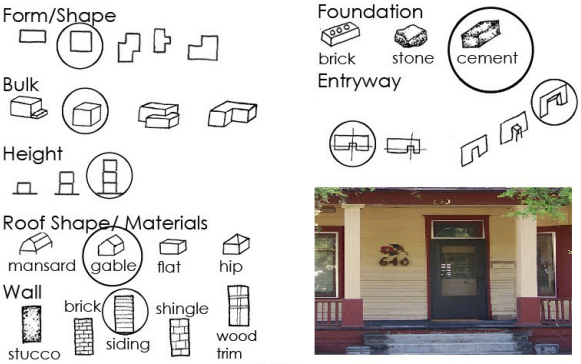
North Seventh Street Historic Residential District

(23) Ferbrache House.

23. Ferbrache House

Building Location

Address: 640 North Seventh Street
Zone District: Planned Residential Development
Principal Use: residential
Original Owner: C.F. Ferbrache
Date of Construction: 1905

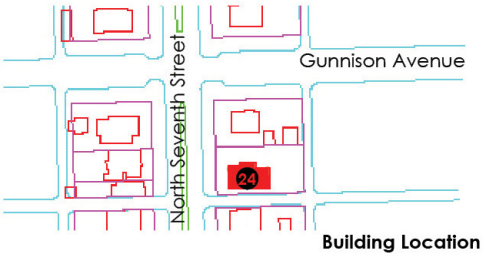


Style: Colonial Revival
Platforms: front porch
Additions/Alterations: no
Accessory Structures: garage, shed
Fencing/Walls: wood, chain link
Landscaping: screened, Colorado
Signage: no
Unique/Distinguishing Elements: color palette, heavily shaded
Is Property a Focal Point or Orientation Landmark? yes

North Seventh Street Historic Residential District

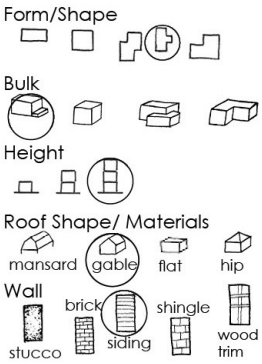
(24) Barkuloo House.

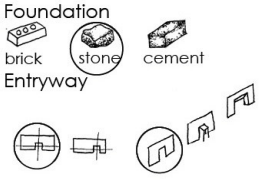
24. Barkuloo House



Building Location

Address: 626 North Seventh Street
Zone District: Planned Residential Development
Principal Use: residential
Original Owner: Henry S. Barkuloo
Date of Construction: 1900



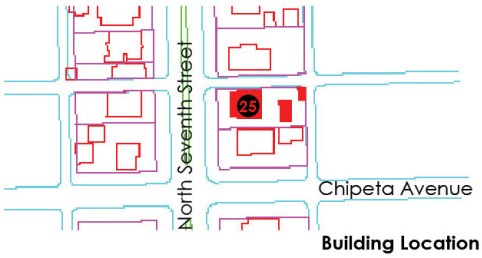


Style: Colonial Revival
Platforms: none
Additions/Alterations: yes
Accessory Structures: none
Fencing/Walls: none
Landscaping: none
Signage: no
Is Property a Focal Point or Orientation Landmark? no

North Seventh Street Historic Residential District

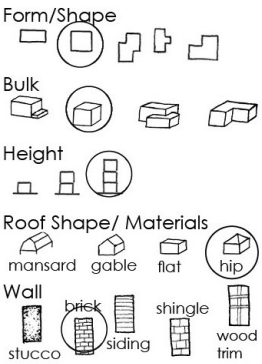
(25) Moyer House.

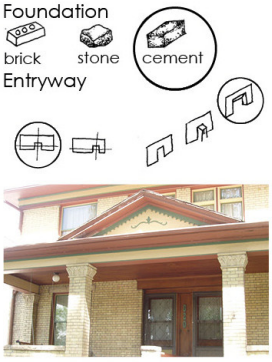
25. Moyer House



Building Location

Address: 620 North Seventh Street
Zone District: Planned Residential Development
Principal Use: residential
Original Owner: William J. and Ida Moyer
Date of Construction: 1905



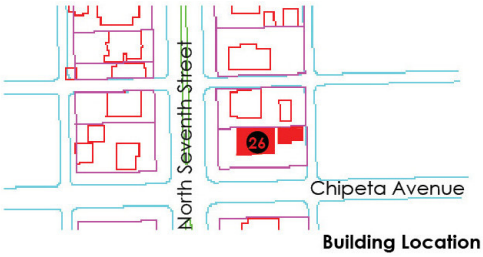


Style: Tudor Revival, Craftsman
Platforms: front porch
Additions/Alterations: yes
Accessory Structures: cottage / garrage and 2nd garage
Fencing/Walls: brick
Landscaping: Colorado
Signage: no
Unique/Distinguishing Elements: wall built down the middle to become a duplex
Is Property a Focal Point or Orientation Landmark? yes

North Seventh Street Historic Residential District

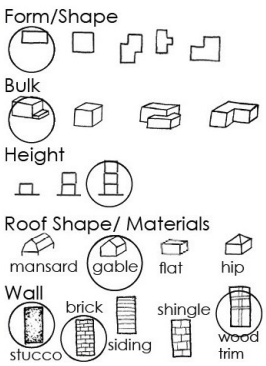
(26) Talbert House.

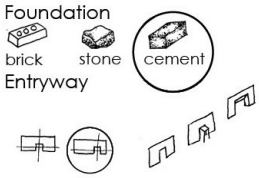
26. Talbert House



Building Location

Address: 604 North Seventh Street
Zone District: Planned Residential Development
Principal Use: residential
Original Owner: Vernon C. Talbert
Date of Construction: 1906



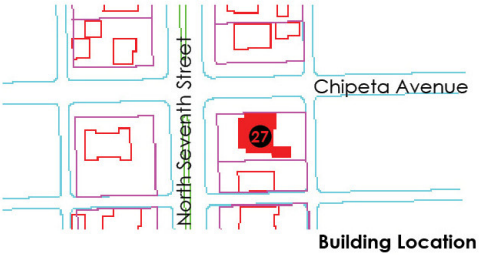


Style: Tudor Revival
Platforms: covered side porch
Additions/Alterations: no
Accessory Structures: garage
Fencing/Walls: wood
Landscaping: flowering, Colorado
Signage: no
Unique/Distinguishing Elements: stucco and stained timber gables
Is Property a Focal Point or Orientation Landmark? yes

North Seventh Street Historic Residential District

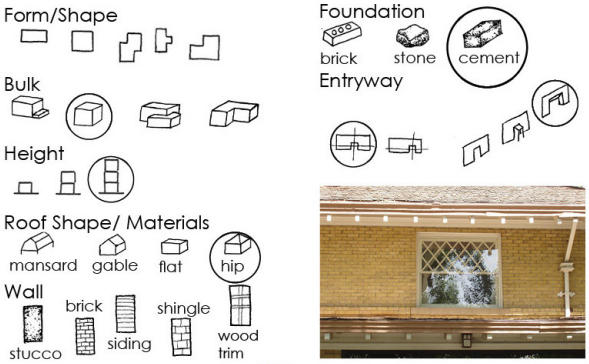
(27) Smith-Schmidt House.

27. Smith-Schmidt House



Building Location

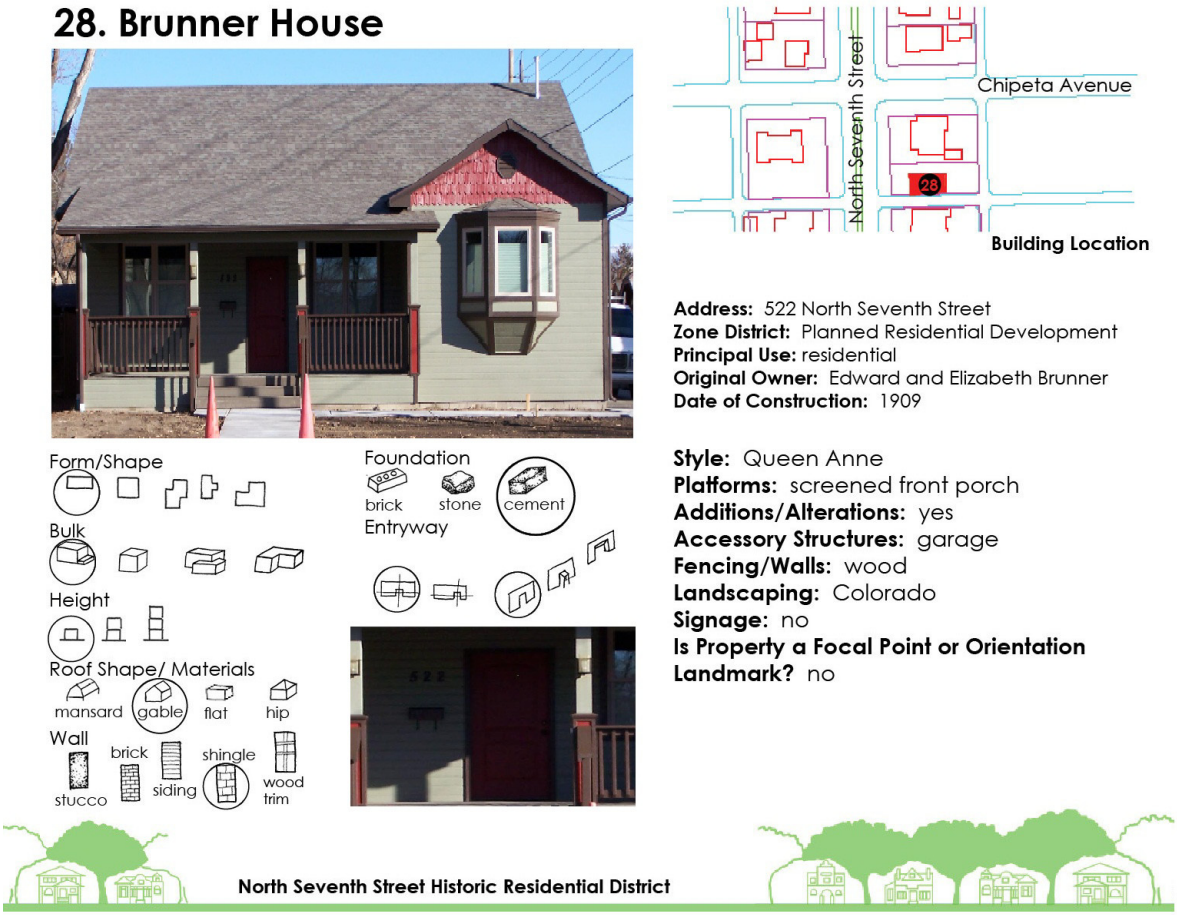
Address: 536 North Seventh Street
Zone District: Planned Residential Development
Principal Use: residential
Original Owner: Henry Barkuloo
Date of Construction: 1912



Style: Tudor Revival, Craftsman
Platforms: glassed front porch
Additions/Alterations: no
Accessory Structures: none
Fencing/Walls: wood
Landscaping: Colorado
Signage: no
Unique/Distinguishing Elements: unique fenestration and bracketed gutters
Is Property a Focal Point or Orientation Landmark? yes

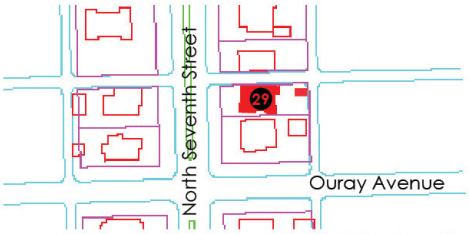
North Seventh Street Historic Residential District

(28) Brunner House.



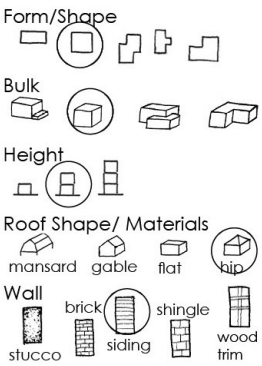
(29) Ellison House.

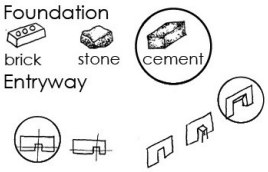
29. Ellison House



Building Location

Address: 520 North Seventh Street
Zone District: Planned Residential Development
Principal Use: residential
Original Owner: Orloff H. Ellison
Date of Construction: 1924



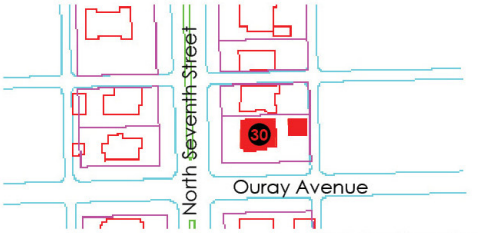


Style: Arts and Crafts Bungalow
Platforms: front porch
Additions/Alterations: yes
Accessory Structures: garage
Fencing/Walls: wood
Landscaping: flowering, Colorado
Signage: no
Unique/Distinguishing Elements: strong Bungalow elements
Is Property a Focal Point or Orientation Landmark? yes

North Seventh Street Historic Residential District

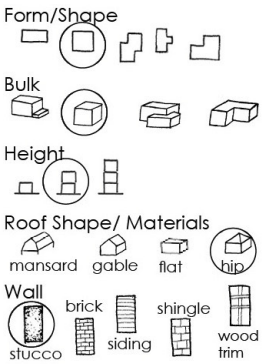
(30) Sickenberger House.

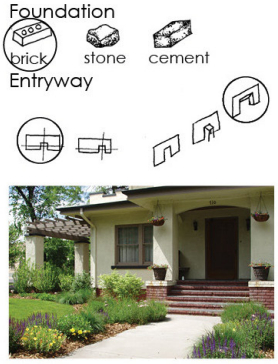
30. Sickenberger House



Building Location

Address: 710 Ouray Street
Zone District: Planned Residential Development
Principal Use: residential
Original Owner: Jesse Urban Sickenberger
Date of Construction: 1923





Style: Spanish, Craftsman
Platforms: covered entry
Additions/Alterations: no
Accessory Structures: garage
Fencing/Walls: chain link
Landscaping: flowering, Colorado
Signage: no
Unique/Distinguishing Elements: strong horizontal lines
Is Property a Focal Point or Orientation Landmark? yes

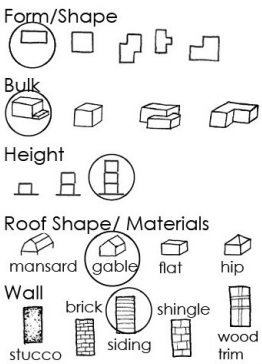
North Seventh Street Historic Residential District

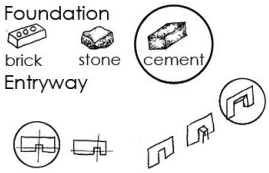
(31) Smith-Jordan House.

31. Smith-Jordan House

Building Location

Address: 440 North Seventh Street
Zone District: Planned Residential Development
Principal Use: residential
Original Owner: Wiliam and Eva Smith
Date of Construction: 1902





Style: Colonial Revival
Platforms: front porch
Additions/Alterations: no
Accessory Structures: garage, cottage
Fencing/Walls: wrought iron, brick
Landscaping: flowering, Colorado
Signage: no
Unique/Distinguishing Elements: color palette, front door detailing, yard sculptures
Is Property a Focal Point or Orientation Landmark? yes

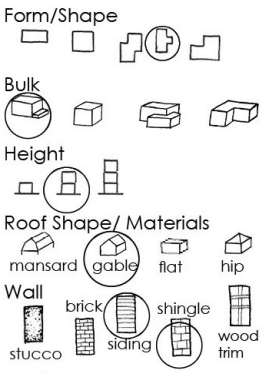
North Seventh Street Historic Residential District

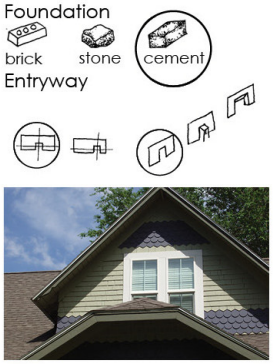
(32) Allison House.

32. Allison House

Building Location

Address: 428 North Seventh Street
Zone District: Planned Residential Development
Principal Use: residential
Original Owner: Monroe "Roe" and Redie Allison
Date of Construction: 1900



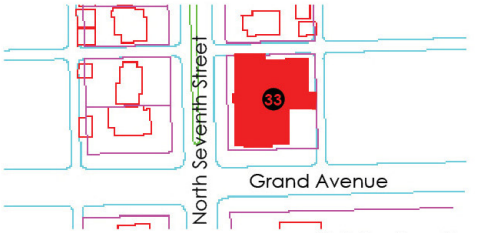


Style: Eclectic
Platforms: front porch
Additions/Alterations: yes
Accessory Structures: garage and work-shop
Fencing/Walls: wrought iron, brick, wood
Landscaping: Colorado
Signage: no
Is Property a Focal Point or Orientation Landmark? no

North Seventh Street Historic Residential District

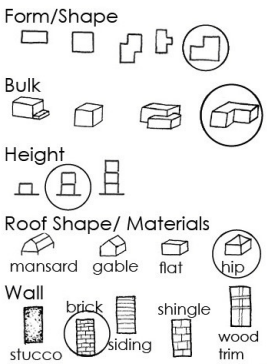
(33) First Baptist Church.

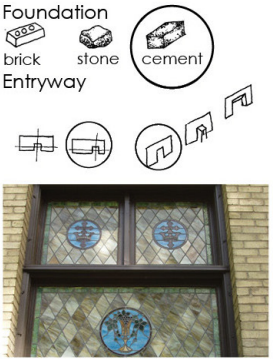
33. First Baptist Church



Building Location

Address: 720 Grand Avenue
Zone District: Planned Residential Development
Principal Use: church
Original Owner:
Date of Construction: 1912 - 1929

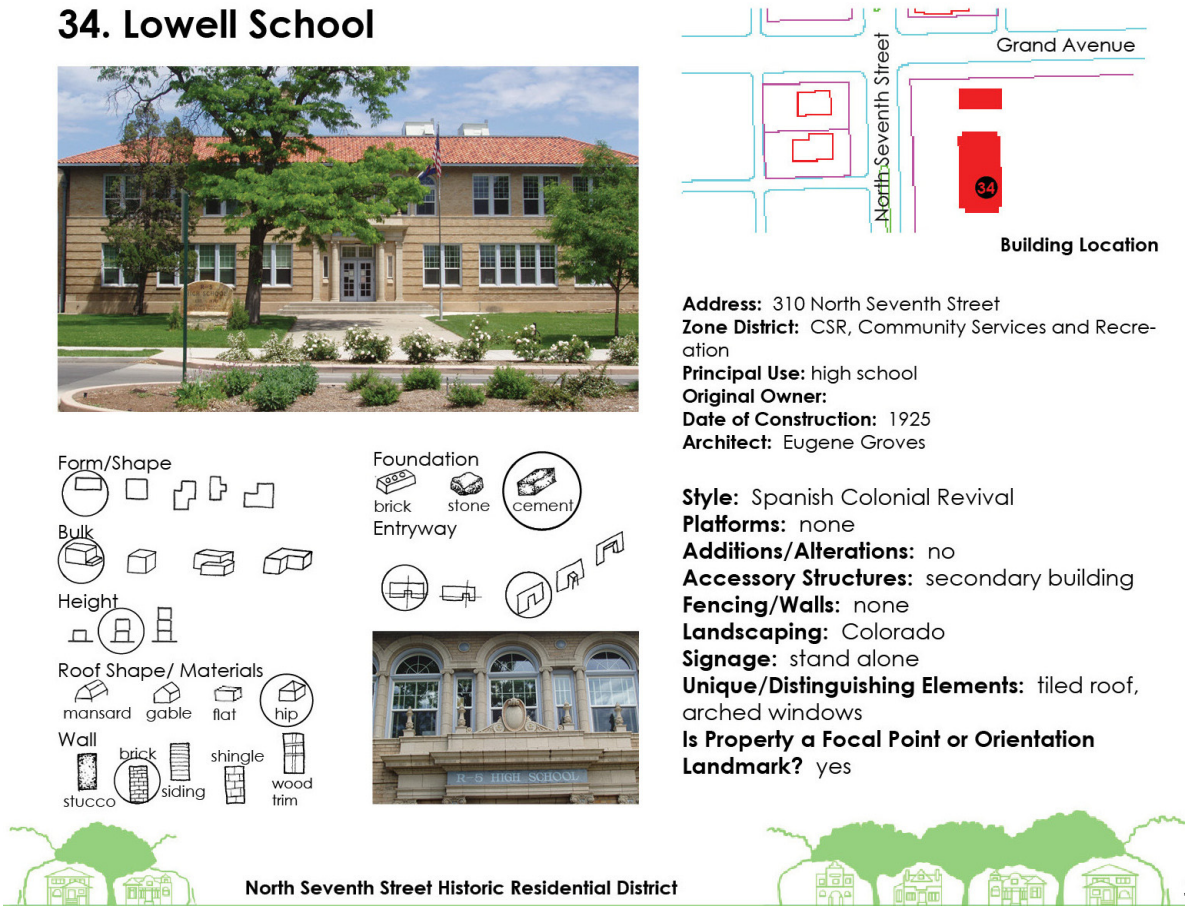




Style: Colonial Revival
Platforms: none
Additions/Alterations: yes
Accessory Structures: none
Fencing/Walls: none
Landscaping: Colorado
Signage: wall sign
Unique/Distinguishing Elements: Greek columns, stained glass windows
Is Property a Focal Point or Orientation Landmark? yes

North Seventh Street Historic Residential District

(34) Lowell School.



(Ord. 4508, 3-21-12)

26.36.020 Appendix B – Terms and definitions.

Accessory dwelling unit means a dwelling unit which is secondary to a principal dwelling unit and which may be attached to the principal structure or freestanding.

Accessory structure means a detached subordinate structure, the use of which is customarily incidental to, and supportive of, the principal structure or the principal use of the land, and which is located on the same parcel of ground with the principal structure or use.

Addition means:

(1) A structure added to the original structure at some time after certificate of occupancy has been issued for the original structure;

(2) An extension or increase in floor area or height of a building or structure.

Adjacent means property or use, any portion of which is within a 100-foot radius. Public right-of-way, easements, canals or waste ditches, and waterways are not counted when deciding if one property or use is adjacent to another.

Alignment means the arrangement of objects along a straight line.

Alley setback means the minimum distance from the alley property line that any permanent construction can be built. See also rear yard setback in GJMC Title 21, Zoning and Development Code.

Alter or *alteration* means any proposed modification to a designated historic site, structure or district which could have an effect on the character of the historic resource relative to the criteria by which it was designated. Examples of alterations for structures may include additions or any exterior modifications, including signage to be affixed to the facade.

At-grade means level of a road, building, or other structure at the same grade or level as the adjoining property (as opposed to a depressed or elevated road, building, or other facility).

Banner means any sign intended to be hung, either with or without frames, possessing characters, letters, illustrations or ornamentations applied to paper, plastic or fabric of any kind.

Example of Banner

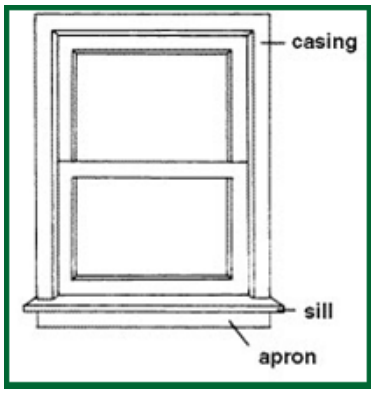
Building means any structure used or intended for supporting or sheltering any use or occupancy.

Building footprint means the portion of a lot covered by a building or structure at the surface level, measured on a horizontal plane.

Building mass means the three-dimensional bulk of a building: height, width, and depth.

Building placement means the location of the structure in relation to property lines.

Casings means the framework around a door or window.



Example of Casings

Cohesiveness means:

(1) The state of cohering or sticking together.

(2) Causing symmetry and balance through design.

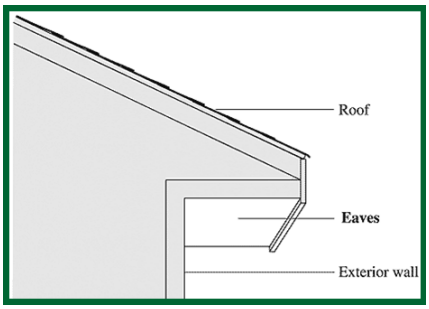
Congruous means corresponding in character or kind; appropriate or harmonious.

Contiguous means next to, abutting, or touching and having a boundary, or portion thereof, that is coterminous.

Contributing structure means a structure that already adheres to and/or complies with these Guidelines and Standards in their entirety at the time of adoption.

Design means a visual arrangement or disposition that indicates a signature motif.

Eaves means the lowest, overhanging part of a sloping roof.



Example of Eaves

Exterior features include the architectural style, general design and general arrangement of the exterior of a building or other structure, including the color, the kind and texture of the building material and type and style of the windows, door, light fixtures, signs, other appurtenant fixtures and natural features such as trees and shrubbery.

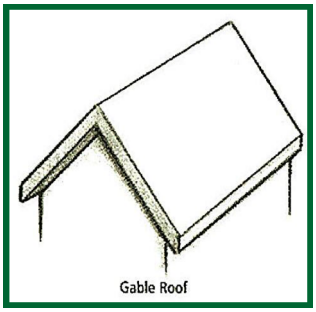
Facade means the exterior walls of a building exposed to public view or that wall viewed by persons not within the building.

Feeling, integrity. *Historic integrity* is the ability of a site to retain its identity and, therefore, convey its significance in the history of Grand Junction, Colorado.

Form means the overall shape of a structure.

Gable means the vertical triangular portion of the end of a building having a double-sloping roof, from the level of the cornice or eaves to the ridge of the roof.

Gabled roof means a roof having a gable at one or both ends.



Example of Gabled Roof

Grandfathering/grandfathered describes the status accorded certain properties, uses, and activities that are legally existing prior to the date of adoption of the zoning ordinance or provisions of the zoning ordinance.

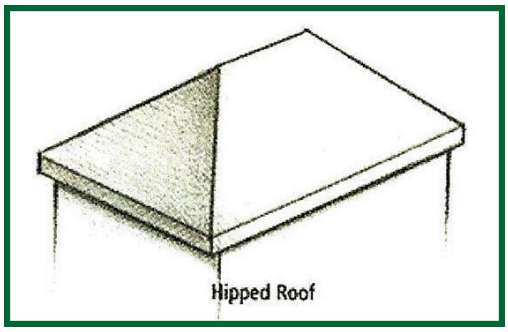
Ground plane means the level of an entry platform into a building.

Guidelines are permissive statements intended to be used as recommendations by homeowners and boards in making decisions.

Height of structure means the vertical distance from the grade to the highest point of any portion of a structure.

Height-width ratio means the ratio of the height of the structure to the width of the structure.

Hipped roof means a roof that slopes upward from all four sides of a building, requiring a hip rafter at each end.



Example of Hipped Roof

Historic property means the research, protection, restoration and rehabilitation of buildings, structures, landmarks, signs, appurtenances, objects, districts, areas and sites significant in the history, archeology, education or culture of the City, State or nation.

Horizontal rhythm means the pattern of shapes, spaces and textures of a structure across a horizontal plane.

Inset means

(1) Something inserted; insert.

(2) A small picture, map, etc., inserted within the border of a larger one.

(3) To set in or insert.

Integrity. A property retains its *integrity* if a sufficient percentage of the structure dates from the period of significance. The majority of a building's structural system and materials should date from the period of significance and its character-defining features also should remain intact. These may include architectural details, such as dormers and porches, ornamental brackets and moldings and materials, as well as the overall mass and form of the building.

Lot coverage means that area of the lot or parcel which may be occupied by principal and accessory structures, and other impervious surfaces.

Mass means the physical size and bulk of a structure.

Massing means the bulk or size of a structure.

Materials, as related to the determination of "integrity" of a property, refers to the physical elements that were combined or deposited in a particular pattern or configuration to form an historic property.

Median means an area in the approximate center of a City street or State highway that is used to separate the directional flow of traffic, may contain left-turn lanes, and is demarcated by curb and guttering, having painted or thermally applied stripes or other means of distinguishing it from the portion of the roadway used for through traffic.

Metal louvered door means a metal door with fitted or fixed horizontal slats for admitting air and light and shedding rain.

Example of Metal Louvered Door

Mill. A mill finish is the natural appearance of the aluminum as it comes from the rolling mill or the extrusion mill. Often this finish is dull, grainy and without luster.

New construction means any construction of an entirely new structure, construction of an addition to an existing structure or an exterior alteration to an existing structure.

Nonconforming means a legal use, structure, and/or development which existed prior to the adoption of this code or any amendment thereto, which does not presently conform to this code or its amendments.

Nonconforming structure or building means a structure or building, the size, dimension, or location of which was lawful prior to the adoption, revision, or amendment to the zoning ordinance but that fails by reason of such adoption, revision, or amendment to conform to the present requirements of the zoning district.

Nonconforming use means a use or activity that was lawful prior to the adoption, revision or amendment of the zoning ordinance but that fails by reason of such adoption, revision, or amendment to conform to the present requirements of the zoning district.

Noncontributing structure means:

(1) A structure that has undergone significant alterations.

(2) A noncontributing building, site, structure or object does not add to the historic architectural qualities, historic associations, or archeological values for which a property is significant because (i) it was not present during the period of significance and does not possess historic integrity reflecting its character at that time or is not capable of yielding important information about the period, or (ii) it does not individually meet the National Register eligibility criteria.

Opacity means:

(1) The screening effectiveness of a buffer yard or fence expressed as the percentage of vision that the screen blocks.

(2) The degree to which a material blocks light.

Ordinance means an authoritative rule or law; a public injunction or regulation.

Orientation. Generally, *orientation* refers to the manner in which a building relates to the street. The entrance to the building plays a large role in the orientation of a building; whereas, it should face the street.

Overhang means a projection of the roof or upper story of a building beyond the wall of the lower part.

Parapet means a low guarding wall at any point of sudden drop, as at the edge of a terrace, roof, balcony, etc.

Example of a Parapet

Park strip means the space in the public right-of-way between the back of the curb and the sidewalk.

Photovoltaic panel means a solar panel or solar collectors designed to absorb solar radiation and convert it into electricity.

Portico means a walkway or porch with a roof supported by columns, often at the entrance of a building.

Example of a Portico

Principal structure means the structure in which the principal use of a property is conducted. This shall include any buildings which are attached to the principal structure by a covered structure.

Projecting bay. A *bay window* is a window space projecting outward from the main walls of a building and forming a bay in a room, either square or polygonal in plan.

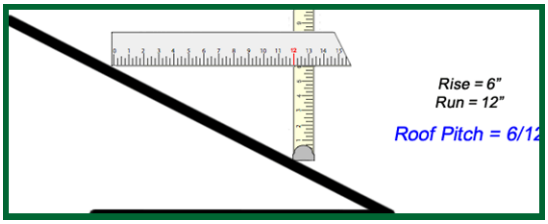
Example of Projecting Bay

Public hearing means a public meeting of a board, Planning Commission, City Council or their representatives where the public may attend.

Public right-of-way means any street, road, highway, alley, pedestrian/bicycle way or other special purpose way or utility installation owned by, or reserved to, the public for present or future public use.

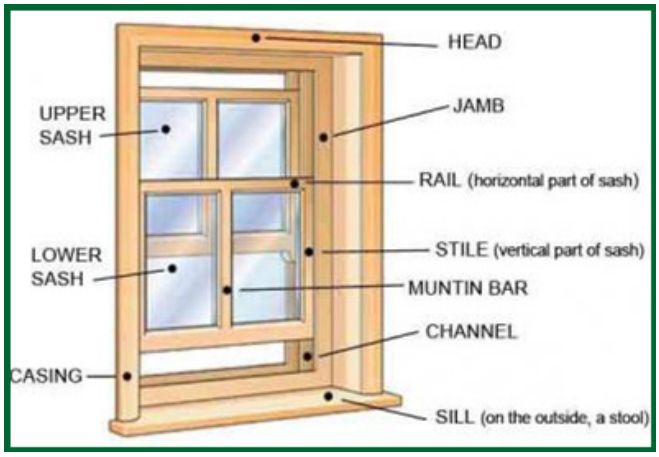
Rhythm means orderly reoccurrence of elements of design with possible variety and variation.

Roof pitch means the amount of slope of the roof in terms of angle or other numerical measure; one unit of vertical rise for three units of horizontal shelter is expressed as "1 in 3."



Example of Roof Pitch

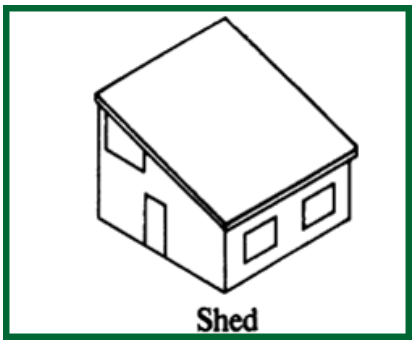
Sash means the movable part of a window holding the glass.



Example of Sash

Setback means the minimum distance between a structure and a property line of a parcel of land or other established reference point.

Shed roof means a flat roof that slopes in one direction and may lean against another wall or building. Also known as lean-to roof.

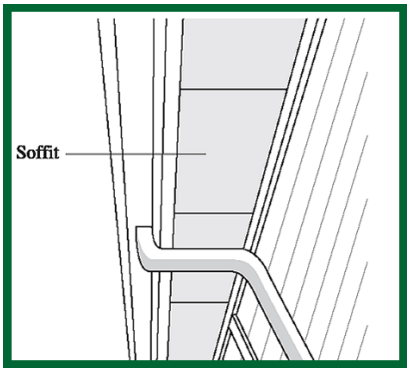


Example of Shed Roof

Siting means the position or location of a town, building, etc., especially as to its environment.

Slope ratio means the same as *roof pitch*. The amount of slope of the roof in terms of angle or other numerical measure; one unit of vertical rise for three units of horizontal shelter is expressed as "1 in 3."

Soffit means the underside of an architectural feature, as a beam, arch, ceiling, vault, or cornice.



Example of Soffit

Solid-to-void ratio means, on a building facade, the ratio of solid space to voids, such as windows, door and other openings.

Standard means a mandatory provision of a development regulation.

Streetscape means the landscaping and other manmade objects located within the public right-of-way which add variety and are placed for aesthetic purposes as well as functional, pedestrian guidance and traffic control.

Subservient means serving or acting in a subordinate capacity; subordinate.

Transom means:

(1) A small, hinged window above another window or a door; the horizontal crosspiece to which such a window is hinged.

(2) A window or group of windows located above a door or larger window.

Example of Transom

Vertical rhythm means the pattern of shapes, spaces and textures of a structure across a vertical plane.

Vista means a view or prospect, especially one seen through a long, narrow avenue or passage, as between rows of trees or houses.

Xeriscape means environmental design of residential and park land using various methods for minimizing the need for water use.

Example of Xeriscape

Zoning means a mapped area with a particular set of rules and regulations which limits the types of uses.

(Ord. 4508, 3-21-12)

26.36.030 Appendix C – Incentives for historic preservation in Grand Junction.

(a) The State Historical Fund. The State Historical Fund is a statewide grants program that was created by the 1990 constitutional amendment allowing limited gaming in the towns of Cripple Creek, Central City and Black Hawk. The amendment directs that a portion of the gaming tax revenues be used for historic preservation throughout the state.

Competitive grants (aka general grants) are made for any of the three project types: acquisition and development, education and survey and inventory.

There are three essential elements to applying for a competitive State Historical Fund Grant:

(1) You need to be or work with an eligible grant applicant.

(2) If you are planning to do physical work on a structure, building, site or object, the resource must be historically designated. If this is a survey and planning, archaeological survey or education project, the focus of your project must be directly related to historic preservation.

(3) You need to apply for projects, activities and costs that qualify for assistance from the State Historical Fund.

Additional information concerning the selection process is available in the "Grant Program Guidelines" section of the Colorado State Historic Society web site:

http://www.historycolorado.org/grants/grants

(b) Tax Incentives for Historic Preservation. Federal and State tax laws provide tax incentives for historic preservation projects that follow the Secretary of the Interior's Standards for Rehabilitation. The federal government offers a 20 percent investment tax credit for the approved rehabilitation of certified historic buildings used for income-producing purposes as well as a 10 percent credit for certain other older buildings. The State offers a similar 20 percent state income tax credit based on $5,000 or more of approved preservation work on designated properties. Applicants are urged to contact Office of Archaeology and Historic Preservation (OAHP) at the State Historic Society as early as possible when considering an application for either federal or State tax credits. OAHP provides advice to property owners, developers and architects concerning appropriate preservation and rehabilitation measures. OAHP staff review applications for tax incentives and make recommendations for approval.

In 2008 the Colorado Legislature extended the State tax credit through 2019.

(c) Housing Rehabilitation and Weatherization Through Housing Resources of Western Colorado. Housing rehabilitation and weatherization projects in Grand Junction which meet low income guidelines are eligible for assistance through Housing Resources of Western Colorado:

http://www.housingresourceswc.org/

(Ord. 4508, 3-21-12)

26.36.040 Appendix D – Frequently asked questions.

(a) Do the North Seventh Street Historic Residential District Guidelines and Standards force me to make changes in my house?

No, there will not be a requirement to change anything in your house, exterior or interior, unless you are doing a remodel or new construction.

(b) Do the North Seventh Street Historic Residential District Guidelines and Standards affect new construction or remodels?

The North Seventh Street Historic Residential District Guidelines and Standards will give guidance to homeowners and land owners who wish to remodel or do new construction on the exterior of their houses and structures. It does not affect changes you make in the interior of your house.

(c) What land uses will be allowed in the Historic District?

All of the land uses allowed in the R-8 residential zone will be allowed.

(d) What incentives are there to homeowners to comply with these regulations?

There are several incentives to homeowners including:

(1) Grants under the State of Colorado Historic Fund;

(2) Tax incentives under federal and State tax laws for historic preservation projects that follow the Secretary of the Interior's Standards for Rehabilitation;

(3) Housing rehabilitation and weatherization projects in Grand Junction which meet low income guidelines are eligible for assistance through Housing Resources of Western Colorado.

(Contact the City of Grand Junction's Neighborhood Services Division or Housing Resources of Western Colorado.)

(e) Will the North Seventh Street Historic Residential District Guidelines and Standards tell me what I can plant in my yard?

No, there are no requirements for what you can plant in your yard; however, there are suggestions and recommendations for landscaping that are compatible with the District. The proposed Seventh Street Historic District regulations suggest contacting Colorado State University Tri River Extension Service in Grand Junction for landscaping recommendations.

(http://www.coopext.colostate.edu/TRA/PLANTS/index.shtml)

(f) Will the North Seventh Street Historic Residential District Guidelines and Standards mean that it will take longer to get approval of my project?

Probably not. With the new North Seventh Street Historic Residential District Guidelines and Standards in place, most minor projects, which meet the requirements, can be approved at staff level or by the Grand Junction Historic Preservation Board and will not require a full public hearing with the City Council (as is now the case).

(g) What will be the effect of the proposed North Seventh Street Historic Residential District Guidelines and Standards on my property value?

National studies have shown that property values increase in historic districts faster than in nonhistoric districts and that rehabilitation of historic districts adds a positive stimulus to economic development. ("The Economics of Rehabilitation," by Donovan Rypkema; The National Trust for Historic Preservation)

(Ord. 4508, 3-21-12)

26.36.050 Appendix E – Sample certificate of appropriateness.

CITY OF Grand Junction COLORADO
PUBLIC WORKS & PLANNING

Certificate of Appropriateness

North Seventh Street Historic Residential District

This box for office use only

File Number:_____ **Review Fee:** _____

This application is a request to construct, add, change or demolish a property within the North Seventh Street Historic Residential District as follows:

_____

_____

_____

APPLICANT INFORMATION

Applicant Name: _____

Are You? ___Owner ___ Buyer ___Lessee

Applicant's Mailing Address: _____

_____

Applicant's Phone: _____ **Email Address:** _____

Representative/Contact Person: _____

Representative/Contact Person Mailing Address: _____

_____

Rep/Contact Phone: _____ **Email Address:** _____

Address of Subject Property: _____ **Tax Parcel Number:** _____

Have you reviewed the North Seventh Street Historic Residential District Guidelines and Standards?

Yes _____ No _____

PROPOSAL AND PROPERTY INFORMATION

This application is a request to construct, add or change the following (check all that apply):

	Add	Change	Demolish	N/A
Roof/Chimney				
Walls/Siding				
Fascia/Other Trim				
Windows/Doors				
Porch				
Other (describe below)				

Fully explain the nature of your request:

_____

_____

_____

Number of Structures on Property: _____ Residential _____ Outbuildings

Total Gross Square Footage of Existing Structures (all floors): _____

Total Gross Square Footage of Proposed Structures or Additions (all floors): _____

Total Gross Square Footage of Existing Structures to be removed (all floors): _____

Existing Height to Building Eave: _____ **Existing Height to Building Peak:** _____

Proposed Height to Building Eave: _____ **Proposed Height to Building Peak:** _____

The existing building is a: _____ Single-Family Dwelling _____ Duplex

Other Multi-Unit_____ Other (specify): _____

Exterior Building Materials:

	Existing	Proposed
Roof	_____	_____
Walls/Siding	_____	_____
Doors	_____	_____
Fascia, Trim, Etc.	_____	_____
Other	_____	_____

Existing Windows:

Existing Material: _____

Existing Sill Depth: _____

Existing Window Type: Casement ____ Slider ____ Double-Hung ____ Single-Hung _____

Fixed _____ Divided Light _____How many? _____ (e.g. 4 over 1, 3 over 1)

Proposed Windows:

Proposed Material: _____

Proposed Sill Depth: _____

Proposed Window Type: Casement ____ Slider ____ Double-Hung ____ Single-Hung _____

Fixed____ Divided Light ____ How many? _____ (e.g. 4 over 1, 3 over 1)

For proposed divided lights, please describe grid, including width, whether it is flat or contoured:

Will the exterior trim remain on the replacement windows? _____ Yes _____ No

SITE AND LANDSCAPE INFORMATION

Fencing:

	Existing	**Proposed**
Type	_____	_____
Size/Height	_____	_____
Location	_____	_____

Are there any prominent trees or areas of vegetation on the property? If yes, what are the type, size and general location? _____

_____

_____

Does this application propose to remove or alter any of these prominent trees or vegetation areas? If so, which ones? And describe proposed change:

_____

_____

_____

_____

ADDITIONAL INFORMATION:

Are there other proposed changes not yet covered in the application? _____ Yes _____ No

If yes, please explain: _____

_____

_____

_____

_____

Signatures:

_____ _____

Property Owner Date

_____ _____

Representative Date

City Approval:

_____

Printed Name and Title

_____ _____

Signature Date

(Ord. 4508, 3-21-12)

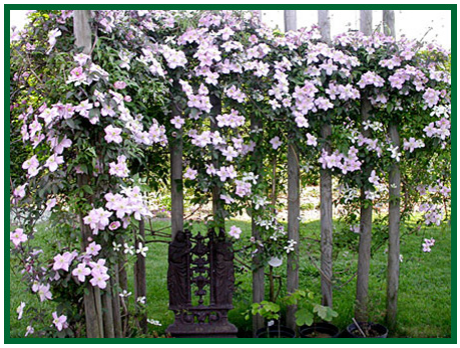
26.36.060 Appendix F – Authentic plants for late 19th/early 20th century period landscaping.

Authentic Plants for Late 19th/Early 20th Century Period Landscaping

Shrubs, trees and vines

American Hornbeam
Asiatic Bittersweet Vine
Bittersweet
Flowering Quince
American Yellow-wood

Common Laburnum



Clematis

Weeping Willow
Blue Spruce
Mugho Pine
Dwarf Scotch Pine
Red-Twigged Dogwood
Rock-Spray
Cock-Spur Thorn
Tulip Tree
Sycamore
Double Flowering Plums
Sargent Cherry
Crabapple

Slender Deutzia

Scarlet Firethorn

Euonymus
American or European Beech
Ginkgo
Honey Locust
Kentucky Coffee Tree
European Ash
Amur Privet
Leatherleaf Mahonia
Fragrant Sumac
Cut-Leaved Sumac
Rose

Authentic Plants for Late 19th/Early 20th Century Period Landscaping

Rock Spirea

Golden Rain Tree
Honeysuckle

Japanese Spurge

Virginia Creeper
Boston Ivy, Japan Ivy
Mockorange
Ninebark
Golden Rain Tree
Oregon Grape Holly

Hydrangea

Mountain Ash
Spirea
Snowberry Waxberry
Indian Currant, Coral-Berry
Lilac
Linden
Rosy Weigela

Wisteria

Tree of Heaven
Maple, except sugar or silver
Horse Chestnut
Barberry

Trumpet Creeper

(Ord. 4508, 3-21-12)

Title 27

(Reserved)

Title 28

STORMWATER MANAGEMENT MANUAL

Chapters:

28.04 Introduction
28.08 General Provisions
28.12 Drainage Planning Submittal Requirements
28.16 Drainage Policy
28.20 (Reserved)
28.24 Rainfall
28.28 Storm Runoff
28.32 Open Channels
28.36 Additional Hydraulic Structures
28.40 Storm Drain Systems
28.44 Streets
28.48 Culverts and Bridges
28.52 Irrigation/Drainage Structures
28.56 Detention and Retention
28.60 Construction Site Stormwater Runoff Control
28.64 Post-Construction Stormwater Management
28.68 Standard Forms
28.72 References
28.76 Drainage Law
28.80 Excerpts from UDSCD Volume 3
28.84 Cross-Reference Table

Prior legislation – Res. 68-94.

Chapter 28.04

INTRODUCTION

Sections:

28.04.010 General index.
28.04.020 Purpose and intent.
28.04.030 Amendments to this manual.
28.04.040 Purchase of a copy of the manual codified in this title.
28.04.050 Acknowledgement.
28.04.060 Updating and revisions.

28.04.010 General index.

Chapter 28.04 – Introduction
Chapter 28.08 – General Provisions
Chapter 28.12 – Drainage Planning Submittal Requirements
Chapter 28.16 – Drainage Policy
Chapter 28.20 – Reserved
Chapter 28.24 – Rainfall
Chapter 28.28 – Storm Runoff
Chapter 28.32 – Open Channels
Chapter 28.36 – Additional Hydraulic Structures
Chapter 28.40 – Storm Drain Systems
Chapter 28.44 – Streets
Chapter 28.48 – Culverts and Bridges
Chapter 28.52 – Irrigation/Drainage Structures
Chapter 28.56 – Detention and Retention
Chapter 28.60 – Construction Site Stormwater Runoff Control
Chapter 28.64 – Post-Construction Stormwater Management
Chapter 28.68 – Standard Forms
Chapter 28.72 – References
Chapter 28.76 (Appendix A) – Drainage Law
Chapter 28.80 (Appendix B) – Excerpts from USDCM Volume 3

Each chapter of this title is numbered separately. All sections are numbered in such a way as to allow additions and deletions with ease. All figures and tables are numbered and are placed either within the text or at the end of respective sections. The figure and table numbers are bold faced in the text for their ease of finding.

(Res. 40-08 (§ 101), 3-19-08)

28.04.020 Purpose and intent.

The purpose of this manual is to promote public health, safety, and general welfare and to minimize public and private losses due to flooding by adopting policies, procedures, standards, and criteria for storm drainage.

All new development and redevelopment, building permits for commercial and industrial uses, or any other proposed construction submitted for acceptance under the provisions of the Stormwater Management Manual shall include adequate storm drainage system analysis and appropriate drainage system design. Such analysis and design shall meet or exceed the criteria set forth herein.

(Res. 40-08 (§ 102), 3-19-08)

28.04.030 Amendments to this manual.

These policies, procedures, standards and criteria may be amended as new technology is developed and/or if experience gained in the use of the manual indicates a need for revision.

(a) Mesa County. Amendments and revisions will be adopted by the Board of County Commissioners.

(b) City of Grand Junction. Amendments and revisions may be made administratively by the City Manager or the City Manager's designee and shall have the same authority as the original document adopted by the City Council. Amendments and revisions may also be made by City Council by ordinance.

(c) Other Jurisdictions. Amendments and revisions may be made by the City of Fruita, the Town of Palisade, and the Grand Junction Drainage District, in accordance with their procedures.

(Res. 40-08 (§ 103), 3-19-08)

28.04.040 Purchase of a copy of the manual codified in this title.

Any party desiring to purchase a copy of the manual, provided such copies are available, may contact the City of Grand Junction Public Works Department at 970-244-1555.

(Res. 40-08 (§ 104), 3-19-08)

28.04.050 Acknowledgement.

This manual was prepared by WRC Engineering, Inc., working under the direction of Mesa County. Representatives from the Cities of Grand Junction and Fruita, Town of Palisade and Grand Junction Drainage District participated and provided valuable input during the preparation of the manual.

We wish to acknowledge and thank the following individuals and organizations for their participation and contribution to the preparation of this manual:

MESA COUNTY

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Mr. Bill Frazier, P.E.

CITY OF FRUITA

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GRAND JUNCTION DRAINAGE DISTRICT

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TOWN OF PALISADE

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Mr. Mark A. Stacks, E.I.
Ms. Miriam A. Gaines

(Res. 40-08 (§ 105), 3-19-08)

28.04.060 Updating and revisions.

This manual was prepared in accordance with existing engineering methodologies and applicable criteria at the time of publication. The field of stormwater management has experienced rapid and extensive changes in recent years. Therefore, periodic review and revision of all material contained herein is recommended.

Users of this manual are encouraged to notify Mesa County and/or local jurisdictions of any errors or omissions in this document. Comments and questions relating to the manual may also be directed to the entities listed below.

Please submit input to:

Mesa County Engineering Department
c/o Ms. Julie Constan, P.E. (or successor)
P.O. Box 20,000
Grand Junction, CO 81502-5013

or

Trent Prall, P.E.
City Engineering Manager
City of Grand Junction Public Works Department
250 North 5th Street
Grand Junction, CO 81501

or

Applicable Local Jurisdiction(s)

(Res. 40-08 (§ 106), 3-19-08)

Chapter 28.08

GENERAL PROVISIONS

Sections:
28.08.010 Title.
28.08.020 Jurisdiction.
28.08.030 Adoption authority.
28.08.040 Enforcement responsibility.
28.08.050 Review and acceptance.
28.08.060 Interpretation.
28.08.070 Deviation/variance procedures.
28.08.080 Acronyms.
28.08.090 Definitions.

28.08.010 Title.

This manual and design standards with all future amendments and revisions shall be known as the Stormwater Management Manual (herein referred to as the manual or SWMM).

(Res. 40-08 (§ 201), 3-19-08)

28.08.020 Jurisdiction.

This manual and design standards shall apply to all new development and redevelopment within the boundaries of Mesa County, including any public lands, facilities constructed on rights-of-way, easements dedicated for public use, and to all privately owned and maintained drainage facilities, including but not limited to detention ponds, storm drains, inlets, manholes, culverts, swales, channels and water quality facilities.

(a) Mesa County. Chapter 7.7 of the Mesa County Land Development Code (Code) requires that "Drainage facilities shall be designed and installed in accordance with the Mesa County Stormwater Management Manual."

(b) City of Grand Junction. The City of Grand Junction Zoning and Development Code (GJMC Title 21) requires that "All proposed development must provide for on-site runoff collection and conveyance in accordance with the Stormwater Management Manual (SWMM) and applicable federal and State laws."

The City of Grand Junction adopted stormwater pollution prevention Ordinance Number 3824 (Chapter 13.28 GJMC), which requires that: "All proposed development … must provide for on-site erosion and sediment control, control of illegal discharges, and runoff collection and conveyance in accordance with the Stormwater Management Manual and applicable federal and State laws."

(c) Other Jurisdictions. The City of Fruita, the Town of Palisade, and the Grand Junction Drainage District may adopt the Stormwater Management Manual in whole or in part.

(Res. 40-08 (§ 202), 3-19-08)

28.08.030 Adoption authority.

(a) Municipality. Powers to regulate land use activities, including drainage, are granted to a municipality under Colorado Revised Statutes as noted below:

§ 31-15-701, C.R.S. et seq. grants municipalities the power to establish, improve, and regulate such improvements as streets and sidewalks, water and water works, sewers and sewer systems, and water pollution controls. In addition, a municipality may, among other powers, deepen, widen, pipe, cover, wall, alter or change the channel or watercourses.

§ 31-25-501, C.R.S. et seq. authorizes municipalities to construct local improvements and assess the cost of the improvements wholly or in part upon property specially benefited by such improvements. By ordinance, a municipality may order construction of district sewers for storm drainage in districts called storm sewer districts. (For the City of Grand Junction, see People's Ordinance No. 33.)

§ 31-25-601, C.R.S. et seq. authorizes municipalities to establish improvement districts as taxing units for the purpose of constructing or installing public improvements.

§ 31-35-401, C.R.S. et seq. authorizes municipalities to operate, maintain, and finance water and sewage facilities for the benefit of users within and without their territorial boundaries. Sewerage facilities are defined as "any one or more of the various devices used in the collection, treatment or disposition of sewerage or industrial wastes of a liquid nature or storm, flood or surface drainage waters…."

(b) County. Powers to regulate land use activities, including drainage, are granted to a county under Colorado Revised Statutes as noted below:

§ 24-67-101, C.R.S. et seq. (Planned Unit Development Act of 1972) power to encourage more efficient and innovative use of the land for public services and encourages integrated planning.

§ 29-20-101, C.R.S. et seq. (Local Government Land Use Control Enabling Act of 1974) clarifies and provides broad authority to local governments to plan for and regulate the use of land within hazardous and environmentally sensitive areas.

§ 30-20-401, C.R.S. et seq. authorizes construction, maintenance, improvements and financing of water and sewerage facilities for the County's own use and for the use of the public and private consumers and users within and without the County's territorial limit.

§ 30-20-501, C.R.S. et seq. (County Public Improvement District Act of 1968) authorizes creation of public improvement districts within any county as taxing units and for the purpose of implementing public improvements.

§ 30-20-601, C.R.S. et seq. authorizes a county by resolution to construct local improvements and to assess the costs to properties especially benefited by improvements.

§ 30-28-101, C.R.S. et seq. provides the County with planning authority, such as development of master plans and adoption of such plans by resolution; creation of a regional planning commission; and regulation of development density.

§ 30-30-101, C.R.S. et seq. (control of stream flow) provides power to remove any obstruction to the channel of any natural stream which causes a flood hazard and provides a right of access to any such natural stream.

§§ 37-20-101 and 37-33-101, C.R.S. et seq. authorizes the owner of agricultural lands susceptible to drainage problems from the same general system to petition the Board of County Commissioners to set up a drainage district.

(Res. 40-08 (§ 203), 3-19-08)

28.08.040 Enforcement responsibility.

(a) Mesa County. The Director or an authorized representative is responsible for enforcing the provisions of this manual.

(b) City of Grand Junction. The City Manager or the City Manager's designee is responsible for enforcing the provisions of this manual.

(c) Other Jurisdictions. Contact the City of Fruita, the Town of Palisade, or the Grand Junction Drainage District for information.

(Res. 40-08 (§ 204), 3-19-08)

28.08.050 Review and acceptance.

All drainage submittals will be reviewed for general compliance with this manual. An acceptance does not relieve the owner, engineer, or designer from responsibility of ensuring that the calculations, plans, specifications, construction, and record drawings comply with this manual.

Adequate time must be allocated in development planning to permit a complete review. The intent of this manual is to more clearly define the requirements and reduce the time and effort required to develop an acceptable drainage design.

(a) Mesa County. Acceptance of final drainage report and drainage facility construction plans shall be valid for two years. Documents with approvals more than two years old may require revision prior to development to comply with the provisions of the manual in effect at that time. Amendments to this manual will apply to all drainage reports submitted after the effective date of the amendment. Final drainage reports are exempt from an amendment provided they are submitted for approval within 60 days after the effective date of an amendment.

(b) City of Grand Junction. Drainage submittals shall contain all information required by this manual but the review process will be in accordance with the City's Submittal Standards for Improvements and Development (SSID) and the Zoning and Development Code (GJMC Title 21).

(c) Other Jurisdictions. Contact the City of Fruita, the Town of Palisade, or the Grand Junction Drainage District for information.

(Res. 40-08 (§ 205), 3-19-08)

28.08.060 Interpretation.

In the interpretation and application of the provisions of the manual, the following shall govern:

(a) Minimum Standards. This manual shall be regarded as the minimum requirements for analysis and design of storm drainage facilities. Special site conditions or mitigation for potential impacts from new development or redevelopment may result in more stringent standards.

(b) Higher Standards. For Mesa County if provisions of the code, any law, ordinance, resolution, rule, or regulation contains restrictions covering the same subject matter, the more stringent standards or requirements shall govern. For the City of Grand Junction if provisions of the Zoning and Development Code (GJMC Title 21), any law, ordinance, resolution, rule, or regulation contains restrictions covering the same subject matter, the more stringent standards or requirements shall govern.

(c) Flexibility. There may on occasion be need for site-specific application and interpretation of this manual. The Director in Mesa County or the City Manager or the City Manager's designee in the City of Grand Junction may deviate from the requirements of this manual; provided, that the approved plan is compatible with surrounding in-place improvements and is sufficiently protective. The burden of responsibility shall be on the applicant to show that the requested deviation/variance from standards does not create a public hazard.

(d) Abrogation. This manual shall not abrogate or annul any permits or approved drainage reports, construction plans, easements, or covenants issued before the effective date of this manual.

(Res. 40-08 (§ 206), 3-19-08)

28.08.070 Deviation/variance procedures.

(a) Deviations/variances from specific standards, procedures, or criteria in this manual may only be requested for:

    (1) Unusual situations where strict compliance with the manual may not protect the public health and safety; or

(2) Unusual situations which require additional analysis outside the scope of the manual for which the additional analysis shows that strict compliance with the manual may not protect the public health and safety; or

(3) Unusual hydrologic and/or hydraulic conditions which cannot be adequately addressed by strict compliance with the manual.

(b) Mesa County. A variance from the technical provision of this manual may be granted by the Director. All requests for variances shall be submitted in writing (normally with the drainage report, see Chapter 28.12 GJMC), shall state the provision for which the variance is requested, and shall provide evidence, data or other information in support of the request. The Director will review and rule on the request and provide his findings in writing.

(c) City of Grand Junction. A deviation from any requirement of this manual may be granted by the City Manager or the City Manager's designee. A request for deviation shall be submitted in writing as a separate letter attached to the drainage report. The request shall state the provision for which the deviation is requested and shall provide supporting evidence, data, or other appropriate information. The City Manager or the City Manager's designee shall review and rule on the request and provide the findings in writing.

(d) Other Jurisdictions. Contact the City of Fruita, the Town of Palisade, or the Grand Junction Drainage District for information.

(Res. 40-08 (§ 207), 3-19-08)

28.08.080 Acronyms.

The following acronyms are used within the context of this manual:

BMP	Best Management Practice
CAP	Corrugated Aluminum Pipe
CAPA	Corrugated Aluminum Pipe Arch
CMP	Corrugated Metal Pipe
CMPA	Corrugated Metal Pipe Arch
CDOT	Colorado Department of Transportation
CDPHE	Colorado Department of Public Health and Environment
CDPS	Colorado Discharge Permit System
CRS	Colorado Revised Statutes
CSP	Corrugated Steel Pipe
CSPA	Corrugated Steel Pipe Arch
CSWMP	Construction Stormwater Management Plan
CWA	Clean Water Act
CWCB	Colorado Water Conservation Board
EC	Erosion Control
ECP	Erosion Control Plan
EGL	Energy Grade Line
EPA	Environmental Protection Agency
FEMA	Federal Emergency Management Agency
GIS	Geographic Information System
HDS	Hydraulic Design Series
HEC	Hydrologic Engineering Center or Hydraulic Engineering Circular (FHWA)

HERCP	Horizontal Elliptical Reinforced Concrete Pipe
HGL	Hydraulic Grade Line
MS4	Municipal Separate Storm Sewer System
NAVD	North American Vertical Datum
NFIP	National Flood Insurance Program
NOAA	National Oceanic and Atmospheric Administration
NRCS	Natural Resource Conservation Services, formerly the SCS
NPDES	National Pollutant Discharge Elimination System
NWS	National Weather Service
PE	Professional Engineer licensed by the State of Colorado
PMF	Probable Maximum Flood
PVC	Polyvinyl Chloride
RCBC	Reinforced Concrete Box Culvert
RCP	Reinforced Concrete Pipe
ROW	Right-of-Way
SCS	Soil Conservation Service
SPP	Structural Plate Pipe
SSID	Submittal Standards for Improvements and Development (City of Grand Junction)
SWMM	Stormwater Management Manual
SWMP	Stormwater Management Plan (either the construction SWMP or the final drainage report containing post-construction BMPs)
TAC	Technical Advisory Committee
TRC	Technical Review Committee
UDFCD	Urban Drainage and Flood Control District (Denver, Colorado)
USACE	United States Army Corps of Engineers
USBR	United States Bureau of Reclamation
USDCM	Urban Storm Drainage Criteria Manual, prepared by the Urban Drainage and Flood Control District in three volumes
USGS	United States Geological Survey
WQCD	Water Quality Control Division of the Colorado Department of Public Health and Environment
WQCV	Water Quality Capture Volume

(Res. 40-08 (§ 208), 3-19-08)

28.08.090 Definitions.

Applicant means a qualified agent, individual or firm acting on behalf of the owner of property requesting approval of plans for new development and redevelopment.

Authority or *Drainage Authority*. Mesa County, the Cities of Grand Junction and Fruita, the Town of Palisade, and the Grand Junction Drainage District have contracted through intergovernmental agreements (IGA) to form the 5-2-1 Drainage Authority (Authority), under Colorado Revised Statutes, specifically § 29-1-204.2, C.R.S.

Best management practices means schedules of activities, prohibitions of practices, maintenance procedures, and other management practices to prevent or reduce the pollution of State waters. BMPs also

include treatment requirements, operating procedures and practices to control site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage.

CDPS permit means a permit issued by the State of Colorado under Part 5 of the Colorado Water Quality Control Act that authorizes the discharge of pollutants to waters of the State, whether the permit is applicable to a person, group or area.

Channel means a natural or artificial low-lying area with a definite bed and banks, which confines and conveys continuous or periodic flows of water. (Mesa County Land Development Code Section 12.1 and GJMC 21.10.020, Terms defined.)

Clean Water Act means Federal Act of 1977, 33 U.S.C. Section 466 et seq. as amended.

Colorado Water Quality Control Act means Title 25, Article 8, C.R.S.

Commercial means any business, trade, industry or other activity engaged in profit.

Construction activity includes clearing, grubbing, filling, grading, and excavation. Does not include routine maintenance performed by public agencies, private parties, or their agents to maintain original line and grade, hydraulic capacity, or original purpose of the facility. Also see *Land disturbance*. [(Adapted from CDPS General Permit No. COR-030000 @ Part I A(2)(a)]

Construction site means any location where construction or construction related activity occurs.

Construction stormwater management plan means a specific individual construction plan that describes the BMPs to be implemented at a site to prevent or reduce the discharge of pollutants during construction activities.

Director means the Mesa County Planning Director or designee when referring to a Mesa County official, but the City Manager or his designee when referring to a City of Grand Junction official.

Discharge means the addition or release of any pollutant, stormwater, subsurface, groundwater or any substance whatsoever to the storm drainage system.

Downstream refers to locations which are hydraulically lower in elevation than the location at which the comparison is being made. *Downstream* may include locations outside of the stream, channel, pipe, etc., such as sheet flow, which often meanders in several directions.

Drainageway means any natural or artificial (manmade) channel which provides a course for water flowing either continuously or intermittently to downstream areas.

Final stabilization means when all soil disturbing activities at the site have been completed, and uniform vegetative cover has been established with a density of at least 70 percent of pre-disturbance levels, or equivalent permanent, physical erosion reduction methods have been employed. For purposes of the construction SWMP, establishment of a vegetative cover capable of providing erosion control equivalent to pre-existing conditions at the site will be considered final stabilization.

Flood means a temporary rise in a watercourse, flow, or stage, that results in water overtopping its banks and inundating areas adjacent to the channel. (Mesa County Land Development Code Section 12.1; see also GJMC 21.10.020, Terms defined.)

Grand Valley means the portion of Mesa County whose boundary is approximated by the 5,000-foot elevation contour and extends west of the community of Mack, along the north eastern edge of the Colorado National Monument, south of Whitewater, to the east of Palisade, and along the face of the Bookcliffs to the north.

Land disturbance means a manmade change in the existing cover or topography of the land, including grading, excavation, filling, building, paving, and other activities that may result in or contribute to soil erosion or sedimentation in the discharge of pollutants.

Local facility means a detention and/or water quality facility that has been sized based on the area and imperviousness of the watershed that includes all the development that drains to the facility, but is not publicly owned and maintained. Also see *Regional facility* and *On-site facility*.

Local jurisdiction, within the context of the SWMM, means Mesa County, City of Grand Junction or Fruita, Town of Palisade, or the Grand Junction Drainage Authority.

Major drainage system means a stormwater facility, such as a channel, large conduit, detention or retention, which receives storm runoff from a watershed generally 160 acres in size or larger.

Municipal separate storm sewer system (MS4) means a conveyance or the system of conveyances, including roads with drainage systems, municipal streets, curbs, gutters, ditches, drainage inlets, catch basins, pipes, tunnels, culverts, channels, detention basins and ponds owned and operated by a municipality or county and designed or used for collecting or conveying stormwater that is not a combined sewer or used for collecting or conveying sanitary sewage.

New development and redevelopment. For Mesa County definition, refer to the Mesa County Land Development Code. For the City of Grand Junction definition, refer to GJMC Title 21, Zoning and Development. For the City of Fruita, Town of Palisade and the Grand Junction Drainage District definitions, refer to the applicable development codes.

NPDES means the National Pollutant Discharge Elimination System under Section 402 of the Clean Water Act.

On-site facility means a local facility that is contained within and only serves the development in question and not other developments.

Outfall drainage system means the drainage system typically consisting of swales, curb and gutter, storm drains, and sometimes small open channels that discharge to a major drainage system. Also called "local drainage system."

Owner means a person having dominant and/or servient interest in property, having sufficient interest to convey property, and/or having possessory interest in property. The term *owner* also includes the owner's agent.

Part of a larger common plan of development or sale means a contiguous area where multiple separate and distinct construction activities will take place at different times on different schedules under one plan. An example would be a commercial development with multiple separate buildings constructed over the course of multiple construction schedules.

Pollutant means dredged spoil, dirt, slurry, solid waste, incinerator residue, sewage, sewage sludge, garbage, trash, chemical waste, biological nutrient, biological material, radioactive material, heat, wrecked or discarded equipment, rock, sand, or any industrial, municipal, or agricultural waste. [§ 25-8-103(15), C.R.S.]

Pollution means the alteration of the physical, thermal, chemical, or biological quality of, or the contamination of any water that renders the water harmful, detrimental, or injurious to humans, animal life, plant life, property or public health, safety or welfare, or impairs the usefulness or the public enjoyment of the water for any lawful or reasonable purpose.

Post-construction stormwater management plan means the final drainage report, in accordance with GJMC 28.12.060 through 28.12.110, final drainage report, which includes a combination of structural and/or nonstructural BMPs, further described in Chapter 28.64 GJMC, Post-Construction Stormwater Management, that reduce the discharge of pollutants after construction is complete.

Pre-developed or *pre-existing* means conditions that existed as of the adoption date of this manual.

Private drainage system means all privately owned ground, surfaces, structures or systems, excluding the MS4, that contribute to or convey stormwater including but not limited to roofs, gutters, downspouts, lawns, driveways, pavement, roads, streets, curbs, gutters, inlets, drains, catch basins, pipes, tunnels, culverts, channels, detention basins, ponds, draws, swales, streams and any ground surfaces.

Public improvement means any improvement, facility or service together with its associated public site, right-of-way or easement necessary to provide transportation, drainage, public private utilities, parks or recreational, energy or similar essential services. (Mesa County Land Development Code Section 12.1.)

Qualified erosion control specialist means a qualified person, as defined by GJMC 13.28.010, with specialized training, education, or experience in the field of erosion control methods, planning, and inspection.

Recurrence Interval. The recurrence interval corresponds to the statistical return period of an event of the same intensity (e.g., a 100-year recurrence interval flood has a one percent chance to occur each year, which does not mean that it will occur every 100 years).

Regional facility means a detention and/or water quality facility that is publicly owned and maintained and serves all properties within the tributary watershed.

Sediment means soil, mud, dirt, gravel and rocks that have been disturbed, eroded and/or transported naturally by water, wind or gravity and/or mechanically by any person, vehicle or equipment.

Significant materials include but are not limited to: raw materials; fuels; materials such as metallic products; hazardous substances designated under Section 101(14) of CERCLA; any chemical the facility is required to report pursuant to Section 313 of Title III of SARA; fertilizers; pesticides; and waste products such as ashes, slag and sludge that have the potential to be released with stormwater discharge.

Storm drainage system means all surfaces, structures and systems that contribute to or convey stormwater including private drainage systems and the MS4, and any nonmunicipal drain or pipe, channel or other conveyance, including natural and artificial (manmade) washes and ditches for conveying water, groundwater, drainage water or unpolluted water from any source, excluding sewage and industrial wastes, to waters of the State and United States.

Storm water or *stormwater*. Within the context of the Stormwater Management Manual, stormwater, whether one or two words, shall mean surface runoff resulting from precipitation.

Stormwater construction permit means the permit issued by the CDPHE called the general permit for stormwater discharges associated with construction activities. Mesa County or the City of Grand Junction will also issue a stormwater construction permit for land disturbances related to new development.

Stormwater management plan. Within the context of the Stormwater Management Manual, a stormwater management plan (SWMP) means the construction SWMP (CSWMP) and/or the post-construction SWMP.

Stream channel means the area of the floodplain which carries the normal flow of the watercourse. (Mesa County Land Development Code Section 12.1).

Urbanized area means the area identified by the Colorado Department of Public Health and Environment based on the 2000 census and called the urban area of Mesa County. Within the context of the SWMM, urban area also includes the Redlands within the urban growth boundary of the County.

Water quality capture volume means the minimum storage volume, based on the eightieth percentile event, which is retained and released over a specified period of time, depending on the specific structural BMP and is based on the time it takes to fully drain the brim-full volume contained in storage.

Water quality outlet means a structure designed to release the water quality capture volume over the specified period of time for the specific BMP.

Waters of the State means any groundwater, percolating or otherwise, lakes, bays, ponds, impounding reservoirs, springs, rivers, streams, creeks, estuaries, marshes, inlets, canals, wells, watercourses, drainage systems, and irrigation systems; all sources of water such as snow, ice, and glaciers; and all other bodies or accumulations of water, surface and underground, natural or artificial, navigable or nonnavigable, and including beds and banks of all watercourses and bodies of surface water, public or private, located wholly or partly within or bordering upon this State and within the jurisdiction of this State.

Watershed master plan means the Grand Valley Stormwater Management Master Plan or other stormwater master plans approved by the Drainage Authority representing applicable municipalities and Mesa County.

Wetland means any area that is inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, under normal circumstances, a prevalence of vegetation typically adapted to the saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas.

(Res. 40-08 (§ 209), 3-19-08)

Chapter 28.12

DRAINAGE PLANNING SUBMITTAL REQUIREMENTS

Sections:

28.12.010 Review process.
28.12.020 Submittal requirements.
28.12.030 Conceptual/preliminary drainage report.
28.12.040 Conceptual/preliminary report contents.
28.12.050 Conceptual/preliminary report drawing contents.
28.12.060 Final drainage report.
28.12.070 Final report contents.
28.12.080 Final report drawing contents.
28.12.090 Construction plans.
28.12.100 Post-construction BMPs.
28.12.110 Construction SWMP.
28.12.120 Record drawings and acceptances.
28.12.130 Submittal checklist.

28.12.010 Review process.

All development within the jurisdiction of this manual shall submit drainage reports, construction drawings/specifications, and record drawing information for review and approval in accordance with the requirements of this chapter. The City of Fruita, the Town of Palisade, or the Grand Junction Drainage District may alter the requirements of this chapter, in accordance with their guidance documents. **Figure 28.12.010** provides a flow chart of the general review process.

(a) Mesa County. The County will review reports and plans for completeness of the submittal to the Planning Department. The County will provide written or oral review comments of the submittal. The County will make every effort to effect a complete review and comment within a reasonable period; however, the County cannot approve reports or plans by default.

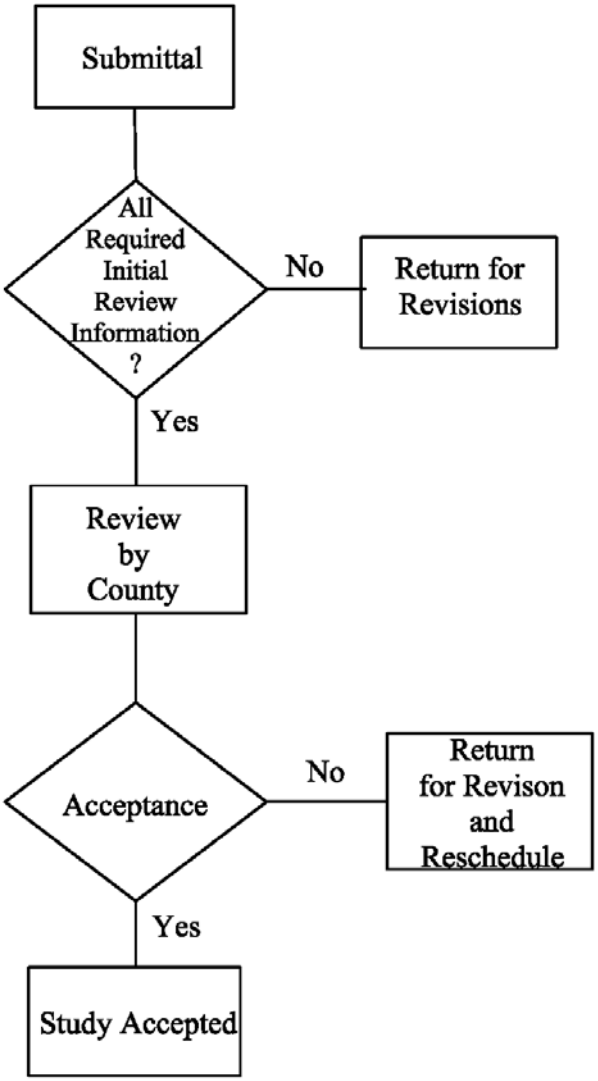
The applicant or his designated representative is required to attend a pre-application conference to review processing steps in accordance with the Mesa County Land Development Code (Code Section 3.1.6). The applicant shall consult with the Director or representative for general information regarding land development regulations, required procedures, possible drainage problems and deviations/variances, and specific submittal requirements. As a minimum, a conceptual and final drainage report will be required, unless modified at the pre-application conference.

(b) City of Grand Junction. The City shall review and approve drainage reports and construction plans in accordance with Submittal Standards for Improvements and Development (SSID), Zoning and Development Code (GJMC Title 21), and the pollution prevention stormwater ordinance.

(c) Other Jurisdictions. Refer to requirements of the City of Fruita, the Town of Palisade or the Grand Junction Drainage District for specific information regarding review and acceptance of drainage reports and plans.

STORMWATER MANAGEMENT MANUAL

SUBMITTAL AND REVIEW FLOW CHART



NOTE: Review time increases if any "NO" is received and the submittal is returned for revisions.

Revision	Date
ORIGINAL ISSUE	3/27/06

WRC ENGINEERING, INC.

REFERENCE:

FIGURE 28.12.010

(Res. 40-08 (§ 300), 3-19-08)

28.12.020 Submittal requirements.

A conceptual/preliminary and final drainage report is required for all new development and redevelopment, except as otherwise determined at the pre-application conference. The number of report copies to be submitted will be determined at the pre-application conference. One copy will be returned to the applicant or his representative with comments.

All submitted reports shall be clearly and cleanly reproduced. Copies of charts, tables, nomographs, calculations, or any other referenced material shall be legible. Washed out, blurred or unreadable portions of the report are unacceptable and may warrant resubmittal of the report. The submittal shall include a declaration of the type of report submitted (i.e., conceptual/preliminary or final).

Table 28.12.020 shall be used to determine the adequacy of the submittal, in addition to those requirements identified at the pre-application meeting, which may alter the checklist. Incomplete or absent information may result in the report being rejected for review. Revision dates must be included on all resubmittals.

All development and redevelopment must provide construction site best management practices (see Chapter 28.60 GJMC), on-site detention (see Chapter 28.56 GJMC), and post-construction BMPs (see Chapter 28.64 GJMC), unless otherwise modified at the pre-application conference.

Table 28.12.020: Stormwater Management Manual Drainage Report Checklist

Instructions:
1. Applicant to identify with a check-mark if information is provided with report. If applicant believes information is not required, indicate with "n/a" and attach separate sheet with explanation.
2. The reviewer will determine if information labeled "n/a" is required and whether information must be submitted.
3. Those items noted with an asterisk are not typically required for conceptual/preliminary report. Applicant shall confirm this with local jurisdiction.
4. Submit three copies of report and include copy of check list bound with report.

TITLE PAGE

A. Type of report (conceptual/preliminary or final drainage report).
B. Project name.
C. Preparer name, firm, address, number, and date.
D. Professional Engineer's seal of preparer.
E. Certifications (see GJMC 28.12.070).

I. INTRODUCTION

A. Background

_____ 1. Identify report preparer and purpose.
_____ 2. Identify date of letter with previous County comments.

B. Project Location

_____ 1. Identify Township, Range, and Section.
_____ 2. Identify adjacent street and subdivision names.
_____ 3. Reference to General Location Map.

C. Property Description

_____ 1. Identify area in acres of entire contiguous ownership.
_____ 2. Describe existing ground cover, vegetation, soils, topography and slopes.

Table 28.12.020: Stormwater Management Manual Drainage Report Checklist (Continued)

3. Describe existing drainage facilities, such as channels, detention areas, or structures. _____
4. Describe existing irrigation facilities, such as ditches, headgates, or diversions. _____
5. Identify proposed types of land use and encumbrances. _____

D. Previous Investigations

1. Identify drainage master plans that include the project area, including floodplain studies. _____
2. Identify drainage reports for adjacent development. _____

II. DRAINAGE SYSTEM DESCRIPTION

A. Existing Drainage Conditions

1. Describe existing topography and provide map with contours extending a minimum of 100 feet beyond property limits. _____
2. Identify major drainageway or outfall drainageway and describe map showing location of proposed development within the drainageways. _____
3. Identify pre-developed drainage patterns and describe map showing predeveloped sub-basins and concentrated discharge locations. Provide calculations of pre-developed peak flows entering and leaving the site. _____

B. Master Drainage Plan

1. Describe location of the project relative to a previously prepared master drainage plan, including drainage plans prepared for adjacent development. _____

C. Off-Site Tributary Area

1. Identify all off-site drainage basins that are tributary to the project. _____
2. Identify assumptions regarding existing and future land use and effects of off-site detention on peak flows. _____

D. Proposed Drainage System Description

1. Identify how off-site stormwater is collected and conveyed through the site and ultimately to the receiving water(s). _____
2. Identify sub-basins and describe, in general terms, how on-site stormwater is collected and conveyed through the site for each location where stormwater is discharged from the site. _____
3. Describe detention volumes, release rates and pool elevations. _____*
4. Identify the difference in elevation between pond invert and the groundwater table. _____*
5. Describe how stormwater is discharged from the site, including both concentrated and dispersed discharges and rates. _____
6. Describe stormwater quality facilities. _____
7. Describe maintenance access aspects of design. _____*
8. Describe easements and tracts for drainage purposes, including limitation on use. _____*

E. Drainage Facility Maintenance

1. Identify responsible parties for maintenance of each drainage and water quality facility. _____*
2. Identify general maintenance activities and schedules. _____*

Table 28.12.020: Stormwater Management Manual Drainage Report Checklist (Continued)

III. DRAINAGE ANALYSIS AND DESIGN CRITERIA

A. Regulations

_____ 1. Identify that analysis and design was prepared in accordance with the provisions of this manual.

_____ 2. Identify other regulations or criteria which have been used to prepare analysis and design.

B. Development Criteria

_____ 1. Identify drainage constraints placed on the project, such as by a major drainage study, floodplain study or other drainage reports relevant to the project.

_____ 2. Identify drainage constraints placed on the project, such as from major street alignments, utilities, existing structures, and other developments.

C. Hydrologic Criteria

(If manual was followed without deviation, then a statement to that effect is all that is required. Otherwise provide the following information where the criteria used deviates from this manual.)

_____ 1. Identify developed storm runoff peak flows and volumes and how they were determined, including rainfall intensity or design storm.

_____ 2. Identify which storm events were used for minor and major flood analysis and design.

_____ 3. Identify how and why any other deviations from this manual occurred.

D. Hydraulic Criteria

(If manual was followed without deviation, then a statement to that effect is all that is required. Otherwise provide the following information where the criteria used deviates from this manual.)

_____* 1. Identify type(s) of streets within and adjacent to development and source for allowable street capacity.

_____* 2. Identify which type(s) of storm inlets were analyzed or designed and source for allowable capacity.

_____* 3. Identify which type of storm sewers which were analyzed or designed and Manning's n-values used.

_____* 4. Identify which method was used to determine detention volume requirements and how allowable release rates were determined.

_____* 5. Identify how the capacity of open channels and culverts were determined.

_____* 6. Identify any special analysis or design requirements not contained with this manual.

_____ 7. Identify how and why any other deviations from this manual occurred.

E. Variance from Criteria

_____ 1. Identify any provisions of this manual for which a variance is requested.

_____ 2. Identify pre-existing conditions which cause the variance request.

Table 28.12.020: Stormwater Management Manual Drainage Report Checklist (Continued)

***IV. POST-CONSTRUCTION STORMWATER MANAGEMENT. See Chapter 28.64 GJMC for requirements.**

Note: This section of the final drainage report identifies additional information required by Mesa County's, City of Grand Junction's, and Town of Palisade's, permit for stormwater discharges associated with municipal separate storm sewer systems (MS4s), Permit No. COR-090000. The final drainage plan and the construction SWMP (see Chapter 28.60 GJMC) meets the requirements of the MS4s permit. In general, this section identifies permanent BMP practices to control the discharge of pollutants after construction is complete.

*A. Stormwater Quality Control Measures

_____* 1. Describe the post-construction BMPs to control discharge of pollutants from the project site.

_____* 2. If compensating detention is provided, discuss practices to address water quality from area not tributary to detention area.

_____* 3. If underground detention is proposed, discuss how water quality facilities will be provided on the surface.

_____ 4. If proprietary BMPs are proposed, provide the justification and sizing requirements (see GJMC 28.64.040).

*B. Calculations

_____ 1. Provide methods and calculations for WQCV, sediment storage, and water quality outlet structure.

V. CONCLUSIONS

A. Compliance with Manual

_____ Compliance with manual and other approved documents, such as drainage plans and floodplain studies.

B. Design Effectiveness

_____ Effectiveness of drainage design to control impacts of storm runoff.

C. Areas in Flood Hazard Zone

_____ Meet requirements of Floodplain Regulations: Mesa County Land Development Code, Section 7.13; GJMC 21.07.010.

D. Variances from Manual

_____ Applicant shall identify any requested variances and provide basis for approving variance. If no variances are requested, applicant shall state that none are requested.

VI. REFERENCES

_____ Provide a reference list of all criteria, master plans, drainage reports, and technical information used.

TABLES

_____ Include copy of all tables prepared for report.

FIGURES

_____ A. General Location Map (See GJMC 28.12.080(a))

_____ B. Floodplain Information

_____ C. Drainage Plan (See GJMC 28.12.080(b))

_____ D. Other pertinent figures.

Table 28.12.020: Stormwater Management Manual Drainage Report Checklist (Continued)

APPENDICES

A. DESIGN CHARTS

1. Provide copy of all design charts (i.e., tables, figures, charts from other criteria) used for the report. _____

B. HYDROLOGIC CALCULATIONS (see Chapters 28.24 and 28.28 GJMC)

_____ 1. Land use assumptions for off-site runoff calculations.

2. Time of concentration and runoff coefficients for pre-existing and post development conditions. _____

_____ 3. Pre-developed hydrologic computations.

_____ 4. Developed conditions hydrologic computations.

C. HYDRAULIC CALCULATIONS

1. Capacity of existing channels, streets, storm sewers, inlets, culverts and other facilities. _____

_____ 2. Calculations for existing storm sewer and open channel.

_____ 3. Irrigation ditch flows and ditch system capacity.

_____* 4. Detention pond design (see Chapter 28.56 GJMC for requirements).

a. Storage volume, release rates, and pool elevations for 10-year and 100-year storm. _____*

b. Outlet structure dimensions, orifice diameter, weir lengths, pipe headwater and other data. _____*

_____* c. Outlet velocity and energy dissipation requirements.

_____* d. Routing of outlet flows and emergency spillway flows.

5. Street capacity calculations, if data in manual not used (see Chapter 28.44 GJMC). _____*

6. Storm inlet capacity calculations, if data in manual not used (see Chapter 28.44 GJMC). _____*

7. Storm sewer capacity calculations, if data in manual not used (see Chapter 28.44 GJMC). _____*

8. Channel capacity calculations, if data in manual not used (see Chapter 28.32 GJMC). _____*

_____* 9. Culvert capacity calculations (see Chapter 28.48 GJMC).

_____* 10. Other hydraulic structure calculations (see Chapter 28.36 GJMC).

D. STORMWATER QUALITY CALCULATIONS

_____ 1. Water quality capture volume (WQCV).

_____* 2. Storage volume for sediment volume and pool elevations for WQCV.

3. Outlet calculations for required area per row, diameter of individual holes, number of holes per row, and number of holes per column. _____*

_____ **CERTIFICATION – PROFESSIONAL ENGINEER'S SEAL AND SIGNATURE**

ACKNOWLEDGEMENTS

Drainage Report checklist was prepared by: _____

(Res. 40-08 (§ 301), 3-19-08)

28.12.030 Conceptual/preliminary drainage report.

The purpose of the conceptual/preliminary drainage report is to:

(a) Identify drainage conditions prior to proposed development, including designated floodplain boundaries (see **Table 28.12.020**).

(b) Identify existing and potential drainage problems, which may occur on site or off site because of the development.

(c) Identify proposed solutions to drainage problems, including location of detention storage and water quality requirements, in sufficient detail to verify technical feasibility.

Text shall be typed on eight-and-one-half-inch by 11-inch paper. All pages, including appendices, shall be numbered in a fashion that identifies the report (e.g., PDR-#). Text, tables, figures, charts, calculations, and appendices shall be bound to form a formal report. Drawings shall be included in a pocket attached with the report, but shall not be smaller than 11 inches by 17 inches or larger than 24 inches by 36 inches in size. The report shall include a cover letter presenting the conceptual/preliminary design for review and shall be stamped and signed by an engineer licensed in Colorado.

(Res. 40-08 (§ 302), 3-19-08)

28.12.040 Conceptual/preliminary report contents.

The conceptual/preliminary drainage report shall contain general information regarding the proposed drainage facilities for the development. For instance, only identify that a channel or storm drain is proposed for conveyance, and not the size, slope, velocity or other more detailed information. Also, it is only required to identify the location and type of detention (i.e., drainage and water quality), and not the volumes or release rates; however, post-development flow rates shall be calculated and submitted with the preliminary report.

The report shall be prepared in accordance with the outline provided as part of the checklist in **Table 28.12.020** (see also GJMC 28.12.130). Grading and erosion control information are not required. The checklist must be completed by the applicant and included with the drainage report. The checklist will be used to determine the completeness of the report. If information provided is lacking or incomplete, the information may be required prior to further review. It is understood that information in the conceptual/preliminary drainage report is subject to change. More detail can be required if necessary due to the complexity of a development.

(Res. 40-08 (§ 302.1), 3-19-08)

28.12.050 Conceptual/preliminary report drawing contents.

(a) General Location Map. A map (eight and one-half inches by 11 inches) shall be provided in sufficient detail at a scale not larger than one inch equals 1,000 feet and included with the report. The map shall identify:

  (1) Drainage flows entering and leaving the development and general drainage patterns within the development.

  (2) Path of all drainage from the upper end of any off-site basins to the defined major drainageways (see Chapter 28.16 GJMC, Drainage Policy).

  (3) Major construction (i.e., development, irrigation ditches, existing detention facilities, culverts, and storm drains) along the entire path of drainage.

  (4) All major basins. Topographic contours are optional.

(b) Conceptual/Preliminary Drainage Plan. Map(s) of the proposed development at a scale of one inch equals 20 feet to one inch equals 200 feet on a 24-inch by 36-inch drawing shall be included. The plan shall show the following:

(1) Existing and (if available) proposed contours at five-foot maximum intervals. The contours shall extend beyond the property boundaries the distance necessary to show how the development interacts hydraulically with the surrounding area, but no less than 50 feet. Mesa County contours are acceptable provided they are representative of actual field conditions.

(2) All existing drainage facilities. If existing (pre-development) conditions cannot be adequately addressed on the proposed drainage plan, then a separate existing conditions drainage plan shall be prepared and included with the submittal document.

(3) Approximate flooding limits based on available information.

(4) Conceptual major drainage facilities including detention basins, storm drains, swales, riprap, and outlet structures in the detail consistent with the proposed development plan.

(5) Major drainage boundaries and sub-boundaries.

(6) Any off-site feature influencing development, including both upstream and downstream structures.

(7) Proposed flow directions entering, within, and exiting the development and, if available, proposed contours. Identify the drainage path from the development to the nearest MS4 facility or major drainageway.

(8) Existing and proposed irrigation facilities.

(9) Legend to define map symbols.

(10) Title block in lower right corner.

(11) All elevations shall be NAVD 1988.

(Res. 40-08 (§ 302.2), 3-19-08)

28.12.060 Final drainage report.

The purpose of the final drainage report is to:

(a) Identify drainage conditions prior to proposed development, including floodplain boundaries.

(b) Identify existing and potential drainage problems, which may occur on site or off site because of the development.

(c) Investigate or refine conceptual solutions to drainage problems, including detention storage and water quality requirements, in sufficient detail to verify their technical feasibility.

(d) Present final design and details for drainage facilities discussed in the conceptual/preliminary drainage report.

(e) Identify post-construction BMPs to control the discharge of pollutants in stormwater to the maximum extent practicable.

Text shall be typed on eight-and-one-half-inch by 11-inch paper. All pages, including appendices, shall be numbered in a fashion that identifies the report (e.g., FDR-#). Text, tables, figures, charts, calculations, and appendices shall be bound to form a formal report. Drawings shall be 24 inches by 36 inches and included in a pocket attached with the report. The report shall include a cover letter presenting final design for review and shall be stamped and signed by an engineer licensed in Colorado.

(Res. 40-08 (§ 303), 3-19-08)

28.12.070 Final report contents.

The final drainage report shall provide final details of proposed drainage facilities, including grading, erosion control, and water quality enhancement, and is to be submitted along with construction documents (see GJMC 28.12.130).

The final drainage report shall be prepared by an engineer registered in Colorado in accordance with the outline provided as part of the checklist in **Table 28.12.020** (see also GJMC 28.12.130). The checklist must be completed by the applicant and included with the drainage report. The checklist will be used to determine the completeness of the report. If information provided is lacking or incomplete, the information may be required prior to further review.

The report shall contain the following certifications:

> I hereby certify that this *Final Drainage Report* (plan) for the design of (Name of Development) was prepared by me (or under my direct supervision) in accordance with the provisions of the *Stormwater Management Manual* for the owners thereof. I understand that the (local jurisdiction) does not and will not assume liability for drainage facilities designed by others.
>
> _____
> Registered Professional Engineer
> State of Colorado No._____
> (Affix Seal)
>
> I, (Name of Developer) hereby certify that the drainage facilities for (Name of Development) shall be constructed according to the design presented in this report. I understand that the (local jurisdiction) does not and will not assume liability for the drainage facilities designed and/or certified by my engineer. I understand that the (local jurisdiction) reviews drainage plans but cannot, on behalf of (Name of Development), guarantee that final drainage design review will absolve (Name of Developer) and/or their successors and/or assigns of future liability for improper design. I further understand that approval of the Final Plat and/or Final Development Plan does not imply approval of my engineer's drainage design.
>
> _____
> Name of Developer
>
> _____ _____
> Authorized Signature Date

(Res. 40-08 (§ 303.1), 3-19-08)

28.12.080 Final report drawing contents.

(a) General Location Map. An eight-and-one-half-inch by 11-inch map shall be provided in sufficient detail at a scale not larger than one inch equals 1,000 feet and included with the report. The map shall identify:

(1) Drainage flows entering and leaving the development and general drainage patterns.

(2) Path of all drainage from the upper end of any off-site basins to the defined major drainageways (see Chapter 28.16 GJMC, Drainage Policy).

(3) Major construction (i.e., development, irrigation ditches, existing detention facilities, culverts, and storm drains) along the entire path of drainage.

(4) All major basins. Topographic contours are optional.

(b) Final Drainage Plan. Map(s) of the proposed development at a scale of one inch equals 20 feet to one inch equals 200 feet on a 24-inch by 36-inch drawing shall be included. The plan shall show the following:

(1) Existing and proposed contours at two-foot maximum intervals. The contours shall be based on a USGS datum and extend a minimum of 50 feet beyond property lines, or further if required to show how the development interacts with the surrounding area.

(2) Location of benchmarks, which must be one of the following:

(i) Mesa County monumentation, including GIS reference points;

(ii) USGS NAVD 1988;

(iii) City of Grand Junction; or

(iv) Colorado Department of Transportation.

(3) Property lines and easements with purposes noted.

(4) Existing street names and proposed streets, indicating names, right-of-way width, flowline width, curb type, sidewalk, and approximate slopes.

(5) All existing drainage boundaries and peak flows entering and within the exiting development. Existing facilities such as irrigation and roadside ditches, drainageways, culverts, and detention sites. Include pertinent characteristics, such as location, size, shape, slope, and material. A separate existing conditions drainage plan shall be prepared and included with the submittal document that details the pre-development conditions listed in this line item.

(6) Any off-site feature influencing development, including both upstream and downstream structures.

(7) Proposed drainage boundaries and sub-boundaries.

(8) Proposed type of street flow (i.e., vertical or combination curb and gutter), roadside ditches, gutter slope, and flow directions, and cross-pans.

(9) Proposed storm drains and open drainageways, including inlets, manholes, culverts, and other appurtenances, including erosion/riprap protection.

(10) Proposed outfall point for runoff from the developed area and facilities to convey flows to the final outfall point without damage to downstream properties.

(11) Routing and accumulation and flows at various critical points for the initial storm runoff listed on the drawing.

(12) Volumes and release rates for detention storage facilities and information on outlet works.

(13) Location and elevations of all existing floodplains affecting the property.

(14) Location and elevations of all existing and proposed utilities affected by or affecting the drainage design.

(15) Routing of off-site drainage flow through the development.

(16) Definition of flow path leaving the development through the downstream properties ending at a major drainageway.

(17) Legend to define map symbols (see **Table 28.12.080** for symbol criteria).

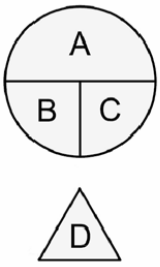
(18) Title block in lower right hand corner.

(19) Identify each post-construction BMP including the WQCV provided or other bases for sizing BMPs.

(20) All elevations shall be NAVD 1988.

STORMWATER MANAGEMENT MANUAL

DRAWING SYMBOL AND HYDROLOGY SUMMARY TABLE



A = BASIN DESIGNATION

B = AREAS IN ACRES

C = COMPOSITE RUNOFF COEFFICIENTS

D = DESIGN POINT DESIGNATION

SUMMARY RUNOFF TABLE
(to be placed on drainage plan)

DESIGN POINT	CONTRIBUTING AREA (ACRES)	RUNOFF PEAK Minor Storm * (CFS)	RUNOFF PEAK Major Storm (CFS)
XX	XX .XX	XX.X	XX.X

*2-year storm for storm drain design, street capacity
10-year storm for culvert and detention design

Revision	Date
ORIGINAL ISSUE	3/27/06
MINOR STORM CHANGES	12/19/07

WRC ENGINEERING, INC.

REFERENCE:

TABLE 28.12.080

(Res. 40-08 (§ 303.2), 3-19-08)

28.12.090 Construction plans.

(a) Mesa County. The final construction plans and final drainage report must be submitted for acceptance to the Director at least 20 working days prior to the consideration of the plat before the County Commissioners. Before final subdivision plats and site plans can be submitted to County Commissioners for approval, the following conditions must be met:

(1) Drainage reports and/or construction plans must be accepted by the Director without conditions;

(2) All required easements and licenses with the County must be approved by the Director and the County Attorney, and the appropriate title insurance provided; and

(3) Easements and other agency approvals must be fully executed and copies provided to the County.

Acceptance of the final construction plans and final drainage report are required prior to issuance of a permit.

Construction plans shall be prepared in accordance with sound engineering principles, this manual and the Mesa County Land Development Code for subdivision designs. Construction documents shall include geometric, dimensional, structural, foundation, bedding, hydraulic, landscaping, and other details as needed to construct the storm drainage facility. The approved final drainage plan shall be included as part of the construction document for all facilities affected by the drainage plan. Construction plans shall be signed by a registered professional engineer as being in accordance with the County approved drainage report, drawings, and this manual. Requirements for construction plans are outlined in the checklist in **Table 28.12.090**.

(b) City of Grand Junction. Refer to the Submittal Standards for Improvements and Development for specific requirements for construction plans.

(c) Other Jurisdictions. Refer to requirements of the City of Fruita, Town of Palisade or the Grand Junction Drainage District for construction plans.

Table 28.12.090: Stormwater Management Manual Drainage Plan Checklist

Instructions: 1. Applicant to identify with a check-mark if information is provided. If applicant believes information is not required, indicate with "n/a."

2. County will determine if information labeled "n/a" is required and whether information must be submitted.

I. EXISTING FACILITIES

_____ A. Contours at two-foot intervals, based on USGS datum. Contours to extend at least 50 feet past property line.

_____ B. Location and elevation of USGS benchmarks or benchmarks referenced to USGS.

_____ C. Property lines.

_____ D. Drainage easements.

_____ E. Street names.

_____ F. Major and minor channels and floodplains.

_____ G. A historic drainage plan including historic basin boundaries and flow paths.

Table 28.12.090: Stormwater Management Manual Drainage Plan Checklist (Continued)

II. PROPOSED FACILITIES

_____ A. Contours at two-foot intervals, based on USGS datum.

_____ B. Property lines.

_____ C. Drainage easements.

_____ D. Street names and grades.

_____ E. Right-of-way and easement.

_____ F. Finished floor elevations for protection from major storm runoff.

_____ G. Detention pond information:

_____ 1. Location of each detention pond with site at 1" = 50' scale or larger with two-foot contour intervals.

_____ 2. Inlet and outlet structure, and trickle channel design details.

_____ 3. Details of emergency spillway and channel.

_____ 4. Landscape information, including side slopes, vegetation and planting requirements.

_____ 5. Details of water quality outlet structure.

H. Channel information:

_____ 1. Profiles with existing and proposed grades.

_____ 2. Cross-sections on 100-foot stations showing existing and proposed topography and required rights-of-way.

_____ 3. Locations and size of all existing and proposed structures.

_____ 4. Locations and profiles of adjacent utilities.

_____ 5. Typical channel section and lining details.

I. Storm sewer information:

_____ 1. Alignment and location of manholes, inlets, and outlet structures.

_____ 2. Profile of invert and pipe crown.

_____ 3. Invert elevations at manholes and inlets.

_____ 4. Lengths and grades between manholes and inlets.

_____ 5. Locations and elevations of utilities adjacent to and crossing storm sewer.

_____ 6. Easement and other O&M access geometry.

_____ 7. Outlet details, such as end sections, headwall and wingwalls, erosion control, and vegetation.

_____ J. Street cross-sections with design 100-year flood depth.

_____ K. Other drainage related structures and facilities, including underdrains and sump pump discharge lines.

_____ L. Other permanent BMP measures to control pollutant discharges to the County’s MS4 system.

Table 28.12.090: Stormwater Management Manual Drainage Plan Checklist (Continued)

III. HYDRAULIC AND HYDROLOGIC INFORMATION

A. Routing and accumulative runoff peaks at upstream and downstream ends of the site and at various critical points on-site for initial and major storms. Inflow and outflow from each sub-basin shall be shown for both initial and major storms. _____

B. Street cross-sections showing 100-year flood levels. _____

C. Major and minor channels and floodplains. _____

D. Detention pond data: _____

1. Release rates for 10- and 100-year storm events. _____
2. Required and provided volumes for 10- and 100-year storm events. _____
3. Design depths for 10- and 100-year storm events. _____
4. Water quality capture volume and pool elevation. _____

E. Channel data:

1. Water surface profiles. _____
2. Representative 100-year flow velocity and Froude number. _____

F. Storm sewer data:

1. Profile of water surface for design flow rate. _____
2. Peak flows for design flow, two-year and 100-year storm events. _____

IV. STANDARD NOTES

A. No building, structure, or fill will be placed in the detention areas and no changes or alterations affecting the hydraulic characteristics of the detention areas will be made without the approval of the County. _____

B. Maintenance and operation of the detention and water quality areas is the responsibility of property owner. If owner fails in this responsibility, the County has the right to enter the property, maintain the detention areas, and be reimbursed for costs incurred. _____

C. Detention pond volumes, all drainage appurtenances, and basin boundaries shall be verified. As-built drawings shall be prepared by a registered professional engineer prior to issuance of certificate of occupancy for any structure within the development. _____

D. Permission to reproduce these plans is hereby given to Mesa County for County purposes associated with plan review, approval, permitting, inspection and construction of work.

V. PROFESSIONAL ENGINEER'S SEAL AND SIGNATURE _____

VI. OTHER

A. Horizontal and vertical control information and ties to existing and proposed features. _____

ACKNOWLEDGEMENTS

Drainage Plan checklist was prepared by: _____

(Res. 40-08 (§ 303.3), 3-19-08)

28.12.100 Post-construction BMPs.

Mesa County, the City of Grand Junction, the Grand Junction Drainage District, and the Town of Palisade, who are members of the Drainage Authority, have obtained permits to discharge stormwater under the Colorado Discharge Permit System (permit numbers COR-090031, COR-090077, COR-090006, and COR-090005, respectively). The terms and conditions of the permits set forth minimum requirements for stormwater management programs including construction site stormwater runoff control and post-construction stormwater management for new development and redevelopment to reduce pollutants in all stormwater runoff to the MS4.

These permit conditions are the basis for requirements identified in Chapter 28.64 GJMC. The final drainage report shall identify and include design bases, calculations, and construction details for post-construction BMPs, in accordance with requirements of Chapter 28.64 GJMC.

(Res. 40-08 (§ 303.4), 3-19-08)

28.12.110 Construction SWMP.

The permit conditions described in GJMC 28.12.100 are the basis for requirements identified in Chapter 28.60 GJMC. The construction SWMP requirements, which are described in Chapter 28.60 GJMC, meet the conditions of the permit. The construction SWMP is a separate document from the final drainage report, must be prepared and certified by a qualified erosion control specialist, and is generally submitted for approval after the final drainage report. Contact local jurisdiction for exact timing of submittal.

(Res. 40-08 (§ 303.5), 3-19-08)

28.12.120 Record drawings and acceptances.

(a) Mesa County.

(1) Record Drawings.

(i) Record drawings for all improvements are to be submitted to the County. Drawings shall be submitted in electronic format, along with mylar (minimum three mil.) reproducible copy and paper prints. Drawings shall include appropriate seals and signatures in accordance with current State law, with the request for probationary acceptance of public improvements or prior to requesting a certificate of occupancy for commercial, industrial or multifamily residential building sites. Certification of the record drawings is required as follows:

(A) Registered Professional Engineer (PE). A registered PE in the State of Colorado shall certify, based on survey from a registered land surveyor, the as-built detention pond volumes and surface areas at the design depths, outlet structure sizes and elevations, storm drain sizes and invert elevations at inlets, manholes, and discharge location, and representative open channel cross-sections, and dimensions of all the drainage structures.

(B) Registered Professional Engineer. The responsible design engineer shall state that "to the best of my knowledge, belief, and opinion, the drainage facilities were constructed in accordance with the design intent of the approved drainage report and construction drawings."

(ii) The Director will compare the certified record drawing information with the construction drawings to ensure that:

(A) The record drawing information demonstrates that the construction is in compliance with the design intent.

(B) The record drawings are certified by a professional engineer licensed in Colorado.

(2) Probationary Acceptance. All public storm drainage facilities shall be guaranteed by the developer to the County for a minimum 18-month warranty period (with the exception of drains over 20 feet deep, which shall require a two-year warranty period or other special cases).

The developer is responsible for routine maintenance, any workmanship defects, and for removal and cleanup of construction debris, dirt and mud in the system during the warranty period.

(3) Acceptances.

(i) For newly constructed public drainage improvements, the County may consent to a reduction of the improvements guarantee provided by the developer when the drainage improvements are granted probationary acceptance.

(ii) For new commercial, industrial and residential building sites, the drainage portion of the certificate of occupancy shall be accepted when the record drawings are determined by the County to comply with the above criteria.

(b) City of Grand Junction. Refer to the Submittal Standards for Improvements and Development (SSID) for specific requirements regarding record drawings and acceptance.

(c) Other Jurisdictions. Refer to requirements of the City of Fruita, Town of Palisade or the Grand Junction Drainage District regarding record drawings and acceptance.

(Res. 40-08 (§ 304), 3-19-08)

28.12.130 Submittal checklist.

(a) Mesa County. To aid the designer and reviewer, a summary of the required certifications and approvals is presented below.

ITEM	CERTIFICATION REQUIRED	COUNTY ACCEPTANCE REQUIRED
Conceptual Drainage Report	Engineer	No
Final Drainage Report	Engineer and Developer	Yes
Construction Drawings	Engineer	Yes
Construction SWMP (see Chapter 28.60 GJMC)	Qualified EC Specialist	Yes
Record Drawings	Engineer	Yes

Checklists for conceptual/preliminary and final drainage reports, and for construction plans, are provided in **Table 28.12.020** and **Table 28.12.090**. These checklists contain recommended report outline and contents for all drainage reports. A copy of the completed checklist shall be bound with the conceptual/preliminary and final drainage report.

The applicant is to identify with a "▤" if information is provided with the appropriate submittal. If applicant believes information is not required, indicate with "n/a." The County will review the submittal to determine if information is required and whether information must be submitted. Due to the nature of a conceptual/preliminary report, not all information listed in the outline/checklist may be required for a conceptual/preliminary drainage report, such as those items listed with an asterisk (*). If the applicant is uncertain if information is required, the applicant is encouraged to contact the County.

(b) City of Grand Junction. The submittal checklist for the City of Grand Junction follows the same steps and procedures set forth for Mesa County presented in subsection (a) of this section. In addi-

tion the designer and reviewer are to refer to the Submittal Standards for Improvements and Development (SSID) for specific requirements regarding checklist requirements.

(c) Other Jurisdictions. Refer to requirements of the City of Fruita, Town of Palisade or the Grand Junction Drainage District regarding checklist requirements.

(Res. 40-08 (§ 305), 3-19-08)

Chapter 28.16

DRAINAGE POLICY

Sections:

28.16.010 Introduction.
28.16.020 Basic principles.
28.16.030 Regional and local planning.
28.16.040 Regional master planning.
28.16.050 Drainage improvements.
28.16.060 Drainage fee calculation.
28.16.070 Proposed drainage improvements.
28.16.080 Floodplain management.
28.16.090 Storm runoff detention.
28.16.100 Storm runoff retention.
28.16.110 Stormwater quality.
28.16.120 Drainage facilities maintenance.
28.16.130 Watershed transfer of storm runoff.
28.16.140 Technical criteria – Stormwater management technology.
28.16.150 Technical criteria – Design storm events.
28.16.160 Technical criteria – Storm runoff determination.
28.16.170 Technical criteria – Streets.
28.16.180 Technical criteria – Flood proofing.
28.16.190 Technical criteria – Alluvial fans.
28.16.200 Irrigation facilities.
28.16.210 Irrigation facilities – Watershed analysis.
28.16.220 Irrigation facilities – Discharge to irrigation conveyance facility.
28.16.230 Irrigation facilities – Irrigation reservoirs.
28.16.240 Preservation of natural drainageways.

28.16.010 Introduction.

Presented in this chapter of the manual are policies that govern development of specific standards and criteria for the design, evaluation, and construction of drainage facilities. These policies are based on industry standards for stormwater management that have evolved through experience gained. Policy statements are indicated by ***bold italic*** text to distinguish them from background information, which is presented to assist with decisions regarding special circumstances that may arise during development.

(Res. 40-08 (§ 401), 3-19-08)

28.16.020 Basic principles.

(a) Jurisdictional Cooperation. Mesa County, the Cities of Grand Junction and Fruita, the Town of Palisade, and the Grand Junction Drainage District have contracted through intergovernmental agreements (IGA) to form the 5-2-1 Drainage Authority (Authority), under Colorado Revised Statutes, specifically § 29-1-204.2, C.R.S. The stated purpose of the Authority is to pursue unified stormwater management planning that meets the requirements of the Colorado Water Quality Control Act (§ 25-8-101, C.R.S. et seq.) and the Federal Water Pollution Control Act, as amended (33 U.S.C. 1251 et seq.) for the discharge of stormwater associated with municipal separate storm sewer systems.

The Drainage Authority was created to pursue a jurisdictionally unified effort to promote integrated, comprehensive, regional stormwater management planning, while recognizing local requirements may have minor differences in policies, standards and criteria presented in this manual.

(b) Drainage Planning and Required Space. ***All new development and redevelopment shall provide storm drainage planning that includes allocation of space for drainage facilities, construction and maintenance, and dedication of rights-of-way and/or easements.***

(c) Multi-Purpose Resource. Stormwater runoff is an integral part of Mesa County's and the City of Grand Junction's water resources and may have potential for beneficial uses, such as groundwater recharge, recreation, and wildlife habitat. These uses, however, must be compatible with adjacent land uses and applicable State water laws.

Stormwater runoff shall be considered an integral part of Mesa County's water resources.

(d) Water Rights. A drainage design must be planned and constructed with recognition given to adjudicated water rights and applicable water laws.

The existence of adjudicated water rights and all applicable State laws related thereto shall be recognized in stormwater management plans.

(e) Drainage Analysis Tributary Area. Stormwater runoff will follow pathways established by physical boundaries and not political or property boundaries. Therefore:

Any drainage analysis must consider all tributary area and the potential for future land use changes within the tributary area.

(Res. 40-08 (§ 402), 3-19-08)

28.16.030 Regional and local planning.

(a) Reasonable Use Rule. The *reasonable use rule* is defined for drainage planning purposes as permitting the use of an economic and hydraulically efficient drainage system which is demonstrated not to adversely impact downstream properties within reason. This reasonable use of drainage therefore allows development to occur while preserving the rights of adjacent property owners.

Stormwater discharges from new development and redevelopment shall be:

(1) Discharged to downstream properties within the pre-developed drainage path and in a manner and quantity and quality that approximates pre-developed conditions. If developed stormwater discharges occur in a more concentrated manner, then additional measures are required to protect downstream properties.

(2) Limited to pre-developed rates, unless downstream drainage facilities can accommodate increased flow rates from development and permission/easements are granted.

(Res. 40-08 (§ 403.1), 3-19-08)

28.16.040 Regional master planning.

It is the intent of Mesa County and the other cooperating governmental entities to develop, adopt, and use Watershed Master Plans to identify stormwater requirements. Once adopted, these plans will be reviewed and updated regularly. When Watershed Master Plans are not available, then requirements in the Stormwater Management Manual will govern.

(Res. 40-08 (§ 403.2), 3-19-08)

28.16.050 Drainage improvements.

Drainage facilities are categorized as part of either the major drainage system or the outfall system. Recommended public improvements to major drainage and outfall drainage systems are defined in Watershed Master Plans, if they exist. If a Master Plan does not exist, other information will be used to determine the scope of public improvements.

All new development and redevelopment shall participate in drainage improvements as set forth below:

(a) Outfall Drainage System.

(1) Design and construct that portion of the outfall drainage system, as defined by the approved final drainage report (Chapter 28.12 GJMC).

(2) If the outfall system is defined in a Watershed Master Plan, and traverses the development, the developer shall design and construct that portion of the outfall system within the development, in accordance with this manual.

(3) If the outfall system defined in a Watershed Master Plan does not traverse the development, but is required to convey stormwater from the development to the major drainageway, the developer shall design and construct that portion of the outfall system within the development, in accordance with this manual. The local jurisdiction may participate in the connection of the outfall to the major drainageway at their sole discretion.

(b) Major Drainage System.

(1) If new development (i.e., the placement of fill or structures) encroaches into a 100-year floodplain (whether mapped or not), the developer will be required to construct improvements as described in the Watershed Master Plan. If a Watershed Master Plan is not available, the developer shall have prepared a channel stabilization analysis, under the guidance of the local jurisdiction, to identify required improvements and shall implement the mitigation plan.

(2) Additional improvements to protect health, safety, and welfare may be required by the local jurisdiction if new development is within the vicinity of a 100-year floodplain, whether mapped or not. The developer may be required to participate in a channel stabilization analysis, under the guidance of the local jurisdiction, and may be required to participate in the implementation of the mitigation plan. For the purpose of this policy, "vicinity" shall mean any portion of the property that lies within a setback area defined by a slope of 10 feet horizontal to one foot vertical (10:1) from the channel invert to the point where the slope daylights.

(Res. 40-08 (§ 403.3), 3-19-08)

28.16.060 Drainage fee calculation.

Fees may be collected by the local jurisdiction and used by the local jurisdiction solely for the planning, design and construction of drainage improvements to the outfall drainage system and major drainage systems.

When drainage fees are assessed for new development and redevelopment, the drainage fee will be determined based on the following equation:

$$\text{Drainage Fee} = B(C_D - C_H)A^{0.7} \qquad (28.16\text{-}1)$$

where:

	B	=	Fee constant (U.S. dollars, see local jurisdiction for value)
	C_D	=	100-year runoff coefficient (expressed as a decimal) based on developed land use conditions
	C_H	=	100-year runoff coefficient (expressed as a decimal) based on pre-developed land use conditions
	A	=	Area of development (acres)

(Res. 40-08 (§ 403.4), 3-19-08)

28.16.070 Proposed drainage improvements.

All investigations, reports, and construction plans prepared for drainage improvements shall be submitted for review and acceptance before construction of said improvements, and shall be consistent with this Stormwater Management Manual and Watershed Master Plans.

(Res. 40-08 (§ 403.5), 3-19-08)

28.16.080 Floodplain management.

Floodplains within Mesa County, Grand Junction, Fruita and Palisade shall be regulated in accordance with the provisions of the applicable land development/use code.

(Res. 40-08 (§ 403.6), 3-19-08)

28.16.090 Storm runoff detention.

Since urban development can increase the rate, volume, duration, and frequency of stormwater runoff, measures must be implemented to avoid harm to downstream properties. Detention is considered a viable method to reduce development impacts and drainage costs. Temporarily detaining storm runoff can significantly reduce downstream flood hazards as well as reduce pipe and channel sizes in developed areas. Temporary storage also provides for sediment and debris collection which helps to maintain water quality in downstream channels and streams. However, detention may not be necessary where downstream drainage facilities have adequate capacity to convey runoff from fully developed upstream areas without negatively impacting downstream properties.

(a) Detention Requirements.

(1) On-site detention storage is required for all new development or redevelopment to limit 10-year peak stormwater discharges to the 10-year storm runoff based on pre-developed conditions. In addition to the 10-year detention, detention of the 100-year storm event and release at pre-developed rates will be required, if the capacity of the downstream drainage system will be exceeded. With local jurisdiction approval, detention may be considered for off-site flows draining to a site. See Chapter 28.56 GJMC for details.

(2) A fee in lieu of detention may be required in lieu of on-site detention that is not required (see GJMC 28.56.050 through 28.56.070). Granting fee in lieu of detention does not exempt the development from providing post-construction BMPs.

(b) Detention Exemption. ***At the sole discretion of the local jurisdiction, exemptions to on-site detention may be granted for the following conditions. Note that in all cases, post-construction BMPs are required:***

(1) A development which discharges to a regional drainage facility is exempt provided the regional facility is completed in accordance with a Watershed Master Plan, the regional facility was designed to include runoff from the proposed development, and there is adequate conveyance capacity for the drainage system from the development to the regional facility.

(2) A development lying within the limits of a Watershed Master Plan which explicitly exempts on-site detention for development.

(3) A development which discharges to a local detention facility is exempt provided the local detention is completed in accordance with the final drainage plan for the development and was designed to include runoff from the proposed development.

(4) A development which discharges to an outfall drainage system that has adequate conveyance capacity for the 100-year flood from a fully developed watershed.

(5) When it can be demonstrated that the peak flows from the development will not increase the peak flows from the watershed for storm events up to the 100-year flood. The burden of proof is on the developer to demonstrate this condition.

A fee in lieu of detention may be required in lieu of on-site detention that is not required.

(Res. 40-08 (§ 403.7), 3-19-08)

28.16.100 Storm runoff retention.

Storm runoff retention or over-detention may be used when downstream drainage facilities lack adequate conveyance capacity or are essentially nonexistent and construction of an outfall drainage system is impractical.

Retention or over-detention may be used in those instances where there are severe limitations on the downstream conveyance capacity or where there is essentially no outfall or drainage system to convey storm runoff from the development. The acceptability of retention will be determined on a case-by-case basis.

(Res. 40-08 (§ 403.8), 3-19-08)

28.16.110 Stormwater quality.

Studies by the Environmental Protection Agency (EPA) and others have shown that land disturbances due to construction activities and the resulting development decrease the quality of storm runoff. The CDPS stormwater discharge permit requires that construction activities and new development be controlled to minimize the discharge of pollutants to the maximum extent practicable. As such, it is recognized that construction sediment and erosion control, stream stabilization, and permanent best management practices (BMPs) are necessary to protect the quality of the waters of the State.

All significant development and redevelopment disturbing more than one acre within the urban areas of Mesa County shown on Figure 28.16.110 shall implement:

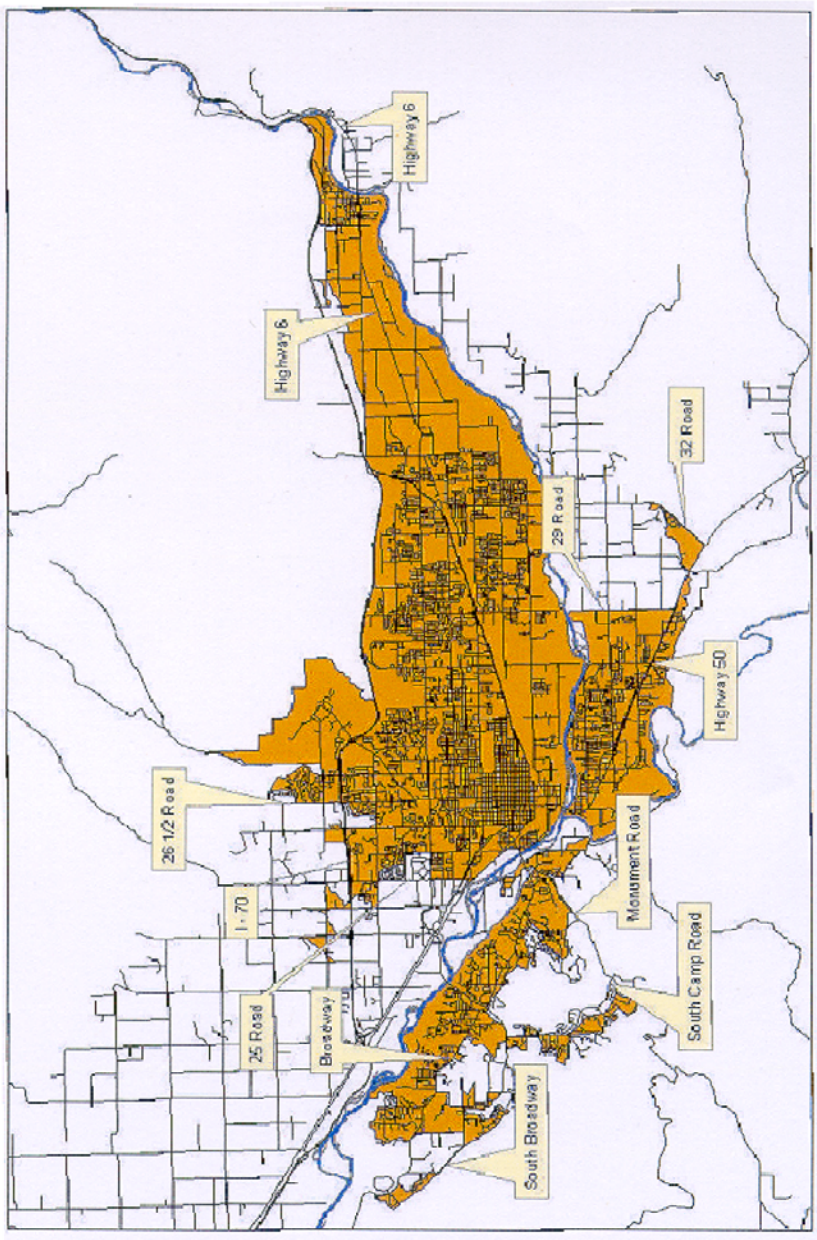
(a) Sediment and erosion control measures during construction activities;

(b) Stream stabilization measures for the major drainageways;

(c) Post-construction best management practices to control the discharge of pollutants to the municipal separate stormwater system (MS4).

STORMWATER MANAGEMENT MANUAL

MESA COUNTY URBANIZED AREA



NOTES:

1. PHASE II STORMWATER REGULATIONS WILL BE IMPLEMENTED WITHIN THE URBANIZED AREA.
2. URBANIZED BOUNDARY INCLUDES ALL OF THE CITY OF GRAND JUNCTION.

Revision	Date
ORIGINAL ISSUE	3/27/06

WRC ENGINEERING, INC.

REFERENCE:

FIGURE 28.16.110

(Res. 40-08 (§ 403.9), 3-19-08)

28.16.120 Drainage facilities maintenance.

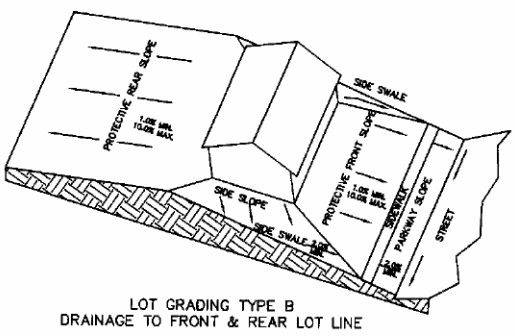
An important part of all storm drainage facilities is continued maintenance of the facilities to ensure they will function as designed. Maintenance of drainage facilities includes a number of routine tasks, such as removal of debris and sediment, and nonroutine tasks, such as restoring damaged structures.

All drainage facilities will be maintained to preserve their function, and shall:

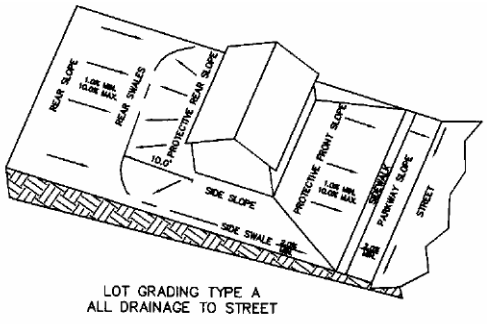
(a) Be designed to minimize and facilitate maintenance.

(b) Include access to the entire drainage facility by dedication of rights-of-way, easements and tracts of land specifically for drainage purposes. Tracts or easement dedications shall prohibit uses and the construction of permanent improvements that restrict or block access. Specifically, detention and retention basins in subdivisions shall be located in tracts owned by the property owners' association with an easement granted to the local jurisdiction. Basins for individual sites require neither a tract nor an easement but do require a maintenance agreement.

(c) Be incorporated in the lot grading for residential development in conformance with FHA lot grading Type A (all drainage to street) or Type B (drainage to front and rear lot line). Typical FHA three dimension Type A and Type B grading plans are shown below:



LOT GRADING TYPE B
DRAINAGE TO FRONT & REAR LOT LINE



LOT GRADING TYPE A
ALL DRAINAGE TO STREET

(d) Be maintained by the property owner, the developer and/or a homeowners' association. Should the property owner fail to adequately maintain drainage facilities, the right is reserved to enter the property, upon proper notice, for the purpose of performing drainage maintenance. All maintenance costs shall be assessed against the owner(s) of the property.

(e) Include v-pans (two-foot minimum width) or storm sewer systems with an inlet in each yard when the grading plan creates backyard swales (regardless of swale slope). These must be installed prior to curb and gutter installation. Check with local municipality to confirm this requirement.

(Res. 40-08 (§ 403.10), 3-19-08)

28.16.130 Watershed transfer of storm runoff.

Drainage law recognizes the inequity of transferring the burden of managing storm drainage from one location or property to another. Liability questions also arise when the historic drainage continuum is altered. The diversion of storm runoff from one basin to another shall be avoided unless specific and prudent reasons justify and dictate such a transfer.

Stormwater diversion may be investigated during development of Watershed Master Plans and may be shown, in some instances, to be a viable option to address drainage and flooding problems. Tests for reasonableness of the potential transfer include:

(a) Determine where the runoff would go if the diversion system were to fail. If the flow stays in the historic basin, then the diversion may be reasonable.

(b) Determine if the downstream channel to which the drainage flows are being transferred is adequate to handle increased flows. If the channel has capacity, the diversion may be reasonable.

(c) Check condition where diversion fails during the major flood. If the downstream natural channel would have adequate capacity without adverse effects, the diversion may be reasonable.

(d) Determine if there would be any adverse water quality impact in either drainageway. If there is little or no impact, the diversion may be reasonable.

The development process can and will significantly alter the historic or natural drainage paths. When these alterations result in development outfall system that discharges back into the natural drainageway at or near the historic location, then the alterations (i.e., intra-basin transfer) are generally acceptable. However, when the subdivision outfall system does not return to the historic drainageway, an inter-basin transfer may result.

Inter-basin transfer as a drainage solution for new development is prohibited, unless allowed as a deviation/variance to this manual (see Chapter 28.08 GJMC) or as part of the Watershed Master Plan. During development of Watershed Master Plans where retrofit facilities are evaluated, inter-basin transfer may be a viable alternative in certain instances and will be reviewed on a case-by-case basis.

(Res. 40-08 (§ 403.11), 3-19-08)

28.16.140 Technical criteria – Stormwater management technology.

All storm drainage facilities shall be planned and designed in accordance with this manual. Criteria in this manual may be revised or amended as new technology is developed and/or experience gained in the use of these criteria. Exemptions to criteria and standards may be approved on a case-by-case basis.

Construction of any drainage facility not initiated within a two-year period from the time of construction plan approval must be reevaluated for approval and must receive re-approval.

(Res. 40-08 (§ 404.1), 3-19-08)

28.16.150 Technical criteria – Design storm events.

All new development and redevelopment shall plan for, design and construct drainage facilities to convey storm runoff from the minor storm and major storm events. Emergency overflow paths for drainage may be required for storms greater than the 100-year flood event as evaluated on a case-by-case basis.

Analysis and design of all drainage improvements for new development and significant redevelopment shall be based on projected future land use conditions, in accordance with local jurisdictional requirements and plans, except as may be modified by adopted Watershed Master Plans.

Culverts for local categorized streets may be designed for a flood more frequent than the 100-year, subject to the following conditions:

(a) The overtopping of the roadway during the 100-year event is limited to depths no greater than one foot and the downstream embankment is protected from erosion during overtopping.

(b) The culvert must pass the 10-year flood with a minimum of one foot of freeboard from the water surface to the lowest point in the roadway.

(c) The water surface elevation during the 100-year flood shall not cause additional flooding of adjacent properties and shall be compliant with local floodplain regulations.

All drainage systems shall be sized without accounting for peak flow reductions from on-site or local detention unless noted otherwise in the tables below. When required to size best management practices, the mean annual storm event shall be used.

A summary of requirements and design storms for the different types of stormwater facilities is presented in the following table.

STREETS

Minor Storm	***Design Requirements***
2-year	***Flow depth ≤0.5 feet at gutter flow line***
	Flow depth ≤top of curb
	Flow velocity ≤8.0 feet per second
Major Storm	***Design Requirements***
100-year	***Flow depth ≤1.0 foot at gutter flow line***
	Flow velocity ≤8.0 feet per second
	Freeboard ≥1.0 foot at all finished floor elevations

STORM DRAIN SYSTEMS

Minor Storm	***Design Requirements***
2-year*	***Flow velocity between 2.5 and 15 feet per second***
	EGL must remain below manhole rims and inlet throats
Major Storm	***Design Requirements***
100-year*	***Flow velocity between 2.5 and 15 feet per second***
	EGL must remain below manhole rims and inlet throats

****These flow rates will be whatever the street inlets cumulatively accept during the two-year and 100-year storm events.***

CULVERTS

Minor Storm	***Design Requirements for Roadways with right-of-way ≤80 feet***
10-year †	***Freeboard ≥1.0 foot at lowest point of drive lane(s)***
	Approval of local jurisdiction to use minor storm design
Major Storm	***Design Requirements for Roadways with right-of-way ≤80 feet***
100-year †	***Overtopping ≤1.0 foot at crown of roadway***
	No additional flooding of adjacent properties
	Comply with all floodplain regulations
	Freeboard ≥1.0 foot at all finished floor elevations
	Design Requirements for Roadways with right-of-way ≥80 feet
	Flow depth ≤0.0 feet at crown of roadway
	Freeboard ≥1.0 foot at all finished floor elevations

†Design of culverts may consider the effects of detention.

DETENTION/WATER QUALITY

Water Quality	***Design Requirements***
WQCV	***Design is per Volume 3 of the USDCM (see Chapter 28.80 GJMC)***
Detention	
Minor Storm	***Design Requirements***
10-year	***Design volume is the detention volume plus the WQCV***
	Allowable release rates apply
Major Storm	***Design Requirements***
100-year	***Design volume is the detention volume (do not add WQCV)***
	Allowable release rates apply

(Res. 40-08 (§ 404.2), 3-19-08)

28.16.160 Technical criteria – Storm runoff determination.

Storm runoff peaks and volumes for the design and evaluation of storm drainage facilities shall be determined using statistical analysis of recorded stream gage data, the rational method, or synthetic rainfall runoff models.

(Res. 40-08 (§ 404.3), 3-19-08)

28.16.170 Technical criteria – Streets.

Streets and street rights-of-way may be used to convey storm runoff from the minor and major events, subject to limitations set forth in this manual.

Storm runoff is permitted to cross street crowns at intersections, subject to limitations set forth in this manual.

Storm runoff is permitted to cross street crowns at culverts and bridges, subject to limitations set forth in this manual.

(Res. 40-08 (§ 404.4), 3-19-08)

28.16.180 Technical criteria – Flood proofing.

Flood proofing can be defined as those measures which reduce the potential for flood damages to properties within a floodplain. Measures can range from elevating structures to intentional flooding of non-critical building spaces (i.e., basement) to minimize structural damages.

Flood proofing is permitted in accordance with the provisions of the Mesa County Land Development Code. For other jurisdictions, contact the specific jurisdiction for specific guidance.

(Res. 40-08 (§ 404.5), 3-19-08)

28.16.190 Technical criteria – Alluvial fans.

Alluvial fans, consisting of sand and fine sediment, are subject to radical changes in shape, direction, depth, and flow carrying capacity during storm events. These changes increase the potential flood hazards of developing on alluvial fan areas.

Additional analysis and specialized design is required for any development located within an active alluvial fan. Requirements for analysis and design will be determined on a case-by-case basis.

(Res. 40-08 (§ 404.6), 3-19-08)

28.16.200 Irrigation facilities.

Irrigation conveyance facilities and reservoirs in the Mesa County area have historically intercepted the storm runoff from the rural and agricultural watersheds, generally without major problems. With urbanization of the watersheds, however, the storm runoff has increased in rate, quantity and frequency, as well as changing water quality. In developed areas, the irrigation facilities can no longer be utilized indiscriminately to convey storm runoff. New developments and redevelopment are prohibited from using irrigation facilities to convey storm runoff, except as described below.

(Res. 40-08 (§ 405), 3-19-08)

28.16.210 Irrigation facilities – Watershed analysis.

Drainage analysis and design shall be based on the assumption that an irrigation conveyance facility does not intercept storm runoff from the upper watershed and that the upper watershed is tributary to the watershed downstream of the irrigation conveyance facility, unless such irrigation conveyance facility has been designed to accommodate storm runoff and is part of an adopted Watershed Master Plan.

(Res. 40-08 (§ 405.1), 3-19-08)

28.16.220 Irrigation facilities – Discharge to irrigation conveyance facility.

Storm runoff shall be directed into pre-developed drainageways downstream of the irrigation conveyance facility. Storm runoff shall not be discharged into an irrigation conveyance facility, except as required by water rights law or the discharge is part of an adopted Watershed Master Plan or negotiated with an irrigation company.

Where irrigation ditches will serve as the outfall for a detention facility, the ditch water surface elevation shall be determined for the maximum irrigation flow of the ditch, and the stormwater surface elevation shall be determined for the combination of the maximum irrigation flow and the 100-year stormwater discharge of the detention facility.

(Res. 40-08 (§ 405.2), 3-19-08)

28.16.230 Irrigation facilities – Irrigation reservoirs.

New development is restricted to areas outside of:

(a) The reservoir's high water line created by the design flood for the emergency spillway.

(b) The high water line created by the breach of a dam (except high hazard classified dams which have passed inspection by the State Engineer's Office in accordance with § 37-87-105, C.R.S. et seq.). For dams without the breach high waterline identified, the developer shall analyze and define the high waterline resulting from such a breach.

(c) Existing or potential future emergency spillway paths, beginning at the dam and proceeding to the point where the flood water returns to the natural drainage course.

(Res. 40-08 (§ 405.3), 3-19-08)

28.16.240 Preservation of natural drainageways.

Natural drainageways are considered an important environmental feature that contributes to the image and livability of a community. Their value includes the ability to convey floodwater, to provide opportunities for trails and open space corridors, and to maintain natural vegetation and wildlife habitat to the greatest degree possible.

Preservation of natural drainageways, based on developed land use hydrology, is encouraged. Development of property shall not adversely affect any natural drainage facility or natural watercourse, and shall be subject to the following provisions:

(a) Drainageways shall remain in as near a natural state as is practicable. All proposed modification to the natural drainageway shall be subject to approval.

(b) When the flow rates, velocities, side slopes or other characteristics indicate a potential negative impact to the natural drainageway, the impact shall be mitigated in accordance with criteria set forth in this manual.

(Res. 40-08 (§ 406), 3-19-08)

Chapter 28.20

(Reserved)

Chapter 28.24

RAINFALL

Sections:

28.24.010 Introduction.
28.24.020 Data sources.
28.24.030 Comparison to NOAA Atlas 14.
28.24.040 Rainfall analysis – Rainfall depth – Duration – Frequency.
28.24.050 Rainfall analysis – Rainfall depths for durations from one to six hours and less than one hour.
28.24.060 Rainfall analysis – Mean annual precipitation and storm events.
28.24.070 Depth-area reduction factors.
28.24.080 Intensity-duration-frequency curves for rational method.
28.24.090 Design storms.

28.24.010 Introduction.

Presented in this chapter are design rainfall data for the mean annual, minor, and major storm events. These data are used to determine storm runoff peak flows and volumes in conjunction with the runoff models described in Chapter 28.28 GJMC. All hydrologic analyses within the jurisdiction of this manual shall utilize the rainfall data presented herein for calculating storm runoff.

(Res. 40-08 (§ 601), 3-19-08)

28.24.020 Data sources.

Rainfall data is presented for three areas within Mesa County, the Grand Valley, as approximately defined by the area below 5,000 feet in elevation, area outside the Grand Valley, and the Leach Creek/Horizon Drive watersheds.

(a) Rainfall Data – Grand Valley Area. The rainfall data for the Grand Valley was obtained from the Henz Meteorological Services report prepared for Mesa County (Henz, 1992), which included a detailed analysis of the gage at Walker Field. Tables, figures, and equations are provided for point rainfall, intensity, and storm distributions for various storm recurrence intervals.

(b) Rainfall Data – Outside Grand Valley. For the area outside of the Grand Valley, rainfall data published by the National Oceanic and Atmospheric Administration (NOAA) in the NOAA Atlas 2, "Precipitation – Frequency Atlas of the Western United States, Volume III – Colorado" (NOAA, 1973) is recommended to develop point rainfall values, storm intensities, and distributions for the remainder of Mesa County. Procedures to obtain and interpret the data are provided herein.

(c) Rainfall Data – Both Areas. In the case where a watershed includes both areas (or areas outside of Mesa County), it is recommended that both sets of rainfall data be used to generate peak runoff rates and volumes, depending on which area the sub-watershed lies within. In addition, if point rainfall values from NOAA Atlas 2 vary throughout the watershed by more than 10 percent, the rainfall values used for analysis should also vary depending on where the sub-watershed lies.

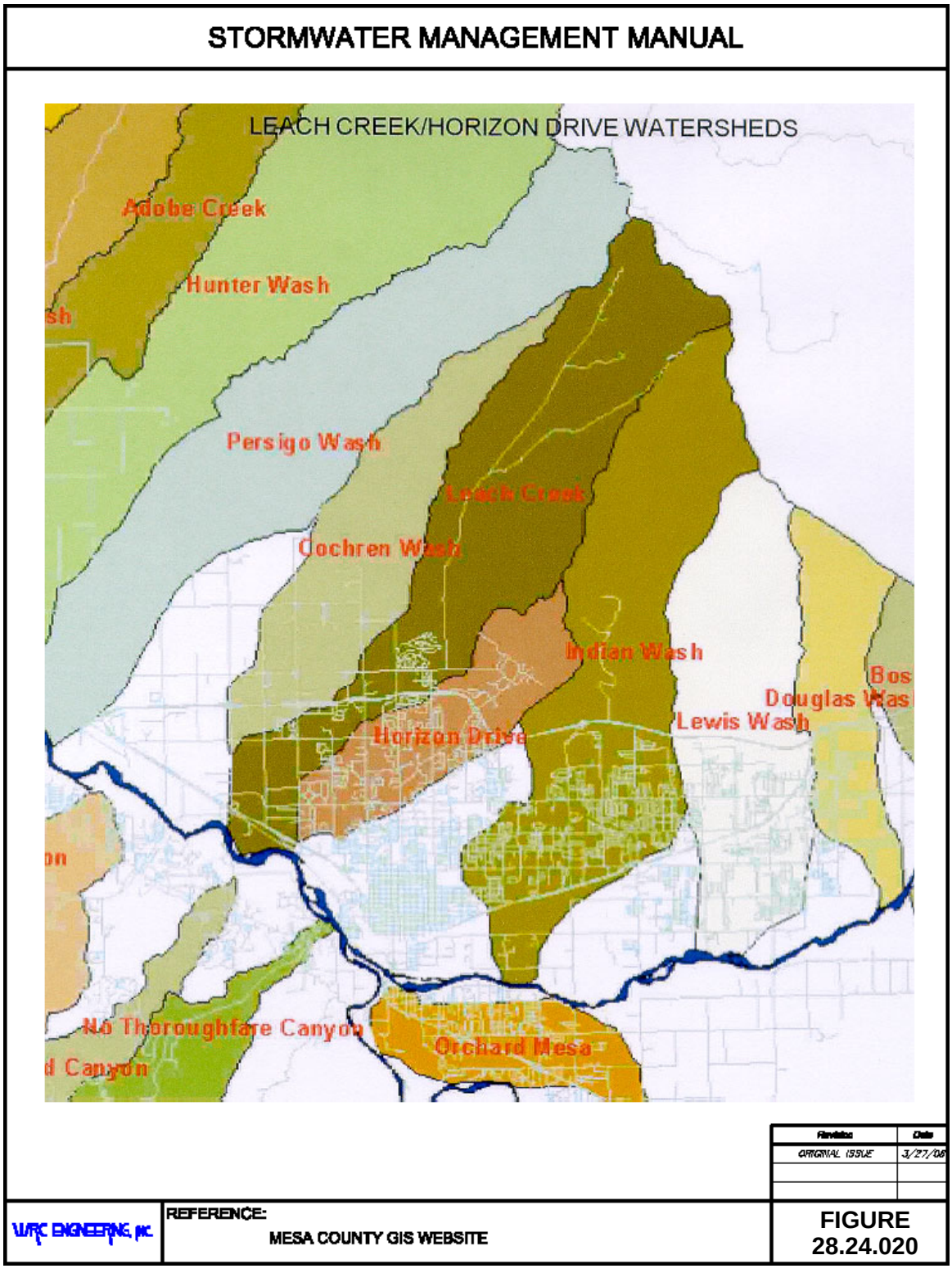
(d) Rainfall Data – Leach Creek/Horizon Drive Watershed. For projects within the Leach Creek/Horizon Drive watershed (see **Figure 28.24.020**), the depth-duration-frequency data approved by FEMA (FEMA October 1, 2002) are recommended because these data were used for floodplain analysis and for design purposes. However, since the FEMA-approved data did not include all durations and frequencies, and since the Henz data are similar, the Henz data was used to supplement the FEMA data.

(e) Mean Annual Precipitation. Mean annual precipitation and mean annual storm events for design of water quality BMPs were obtained from Driscoll (Driscoll et al., November 1989). *Analysis of Storm Event Characteristics for Selected Rainfall Gages Throughout the United States,* EPA

8919148B 1100). These values are based on recording gage number 3488 and can be used throughout Mesa County.

(f) Probable Maximum Precipitation. In cases where probable maximum precipitation analyses are required, methodology outlined in a publication by NOAA and the USACE entitled "Hydrometeorological Report No. 49, Probable Maximum Precipitation Estimates, Colorado River and Great Basin Drainages" (NOAA and USACE, 1977) is recommended.

Figure 28.24.020: Leach Creek/Horizon Drive Watersheds



(Res. 40-08 (§ 601.1), 3-19-08)

28.24.030 Comparison to NOAA Atlas 14.

The National Weather Service (NWS) has updated the precipitation-frequency atlas for the semiarid, southwestern region of the United States (including the Mesa County area) from NOAA Atlas 2 to NOAA Atlas 14. A comparison was made for the 100- and two-year storms for durations of six- and 24-hour between NOAA Atlas 2 and NOAA Atlas 14.

The comparison shows that NOAA Atlas 14 is generally lower than NOAA Atlas 2 (i.e., from four to 16 percent in the Grand Valley and from zero to 46 percent in the mountains). NOAA Atlas 14 does appear to be more consistent with the data developed by Henz for the Grand Valley area. However, since NOAA Atlas 14 has not been accepted by the Colorado Water Conservation Board, precipitation values for areas outside of the Grand Valley were not obtained from NOAA Atlas 14, but were obtained from NOAA Atlas 2. When preparing Watershed Master Plans, the County will evaluate whether NOAA Atlas 14 values are more appropriate and may decide to use NOAA Atlas 14. For new developments and redevelopment, rainfall/runoff relationships shall be in accordance with GJMC 28.24.020.

(Res. 40-08 (§ 601.2), 3-19-08)

28.24.040 Rainfall analysis – Rainfall depth – Duration – Frequency.

For areas within the Grand Valley, point precipitation values are provided in **Table 28.24.040(a)** for various recurrence interval storms. These data were used to develop intensity-duration-frequency values and are used in developing storm distributions.

Table 28.24.040(a): Point Rainfall Values for the Grand Valley Area

Storm Duration	Precipitation Depth (inches)					
	2-year Recurrence	5-year Recurrence	10-year Recurrence	25-year Recurrence	50-year Recurrence	100-year Recurrence
5-min	0.10	0.14	0.18	0.25	0.31	0.39
10-min	0.15	0.22	0.28	0.38	0.48	0.60
15-min	0.19	0.28	0.36	0.48	0.61	0.76
30-min	0.27	0.39	0.50	0.67	0.85	1.06
1-hr	0.34	0.49	0.63	0.85	1.07	1.34
2-hr	0.42	0.58	0.72	0.94	1.15	1.40
3-hr	0.47	0.63	0.77	0.99	1.19	1.44
6-hr	0.55	0.73	0.87	1.10	1.31	1.56
12-hr	0.55	0.83	0.98	1.22	1.44	1.69
24-hr	0.70	0.93	1.12	1.42	1.69	2.01

For the area outside of the Grand Valley, the NOAA Atlas 2 Rainfall Depth-Duration-Frequency Maps are reproduced for the Mesa County area in **Figures 28.24.040(a)** through **(l)**. Maps are presented for the six- and 24-hour durations for the two-, five-, 10-, 25-, 50-, and 100-year recurrence intervals. Depending on the location of the project, point rainfall values are read from these figures, converted to other storm durations, and used to generate intensity-duration-frequency curves and design storms, following procedures described below.

For the areas within the Leach Creek/Horizon Drive watershed, point precipitation values are provided in **Table 28.24.040(b)** for various frequencies and durations.

Table 28.24.040(b): Point Rainfall Values for the Leach Creek/Horizon Drive Watershed

Storm Duration	Precipitation Depth (inches)					
	2-year Recurrence	**5-year Recurrence**	**10-year Recurrence**	**25-year Recurrence**	**50-year Recurrence**	**100-year Recurrence**
5-min	0.10	0.14	0.18	0.25	0.31	0.39
10-min	0.15	0.22	0.28	0.38	0.48	0.60
15-min	0.19	0.28	0.36	0.48	0.61	0.76
30-min	0.27	0.39	0.50	0.67	0.85	1.06
1-hr	*0.29*	*0.41*	*0.52*	0.85	*0.86*	*1.07*
2-hr	0.42	0.58	0.72	0.94	1.15	1.40
3-hr	*0.46*	*0.63*	*0.78*	0.99	*1.24*	*1.52*
6-hr	*0.55*	*0.72*	*0.86*	1.10	*1.28*	*1.52*
12-hr	*0.67*	*0.85*	*0.99*	1.22	*1.39*	*1.61*
24-hr	*0.79*	*1.01*	*1.19*	1.42	*1.71*	*1.99*

NOTE: The *italicized* values are the actual FEMA-approved data. The remaining data was obtained from **Table 28.24.040(a)**.

Figure 28.24.040(a): Rainfall Depth-Duration-Frequency: 2-Year, 6-Hour

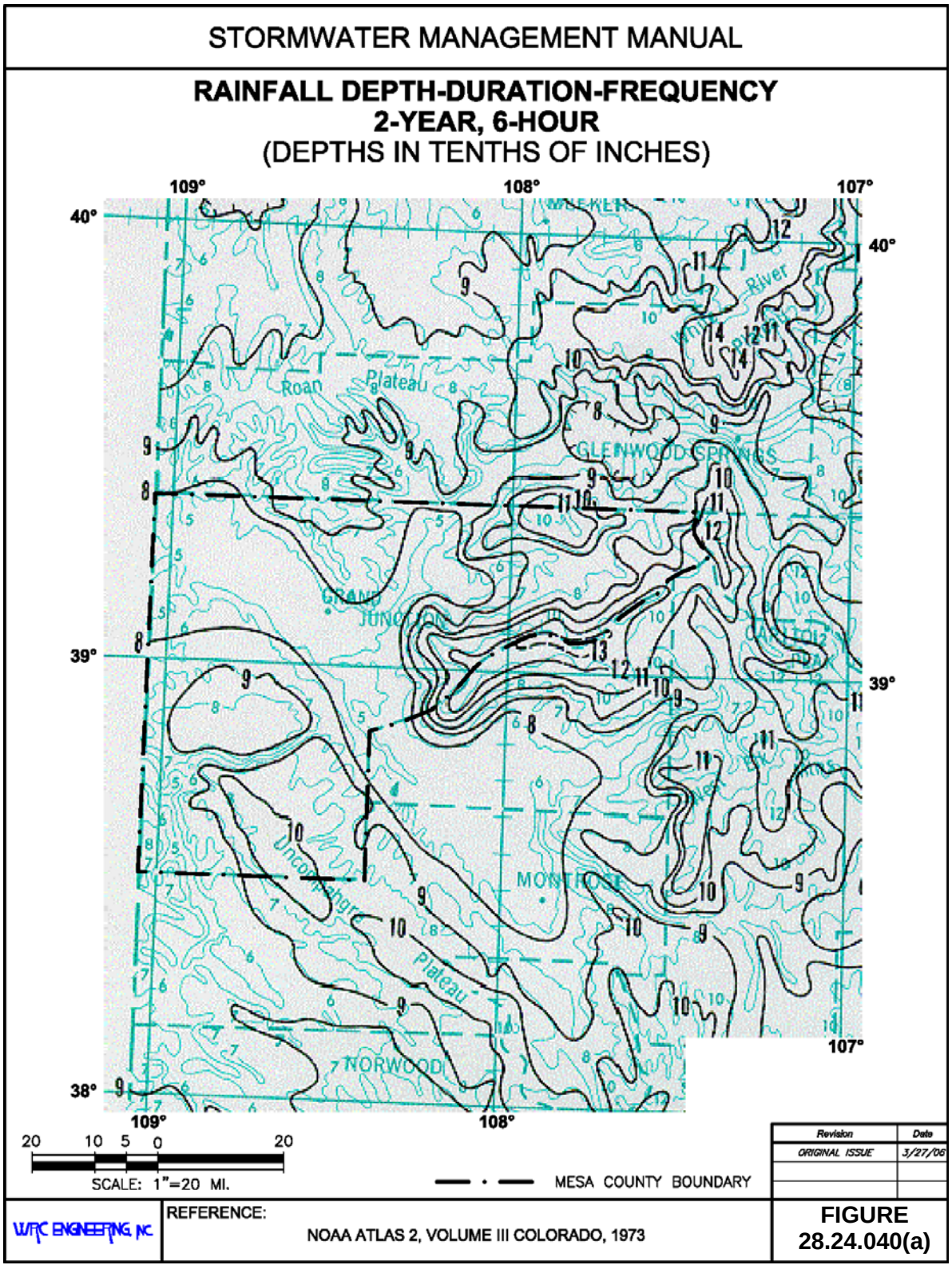


Figure 28.24.040(b): Rainfall Depth-Duration-Frequency: 5-Year, 6-Hour

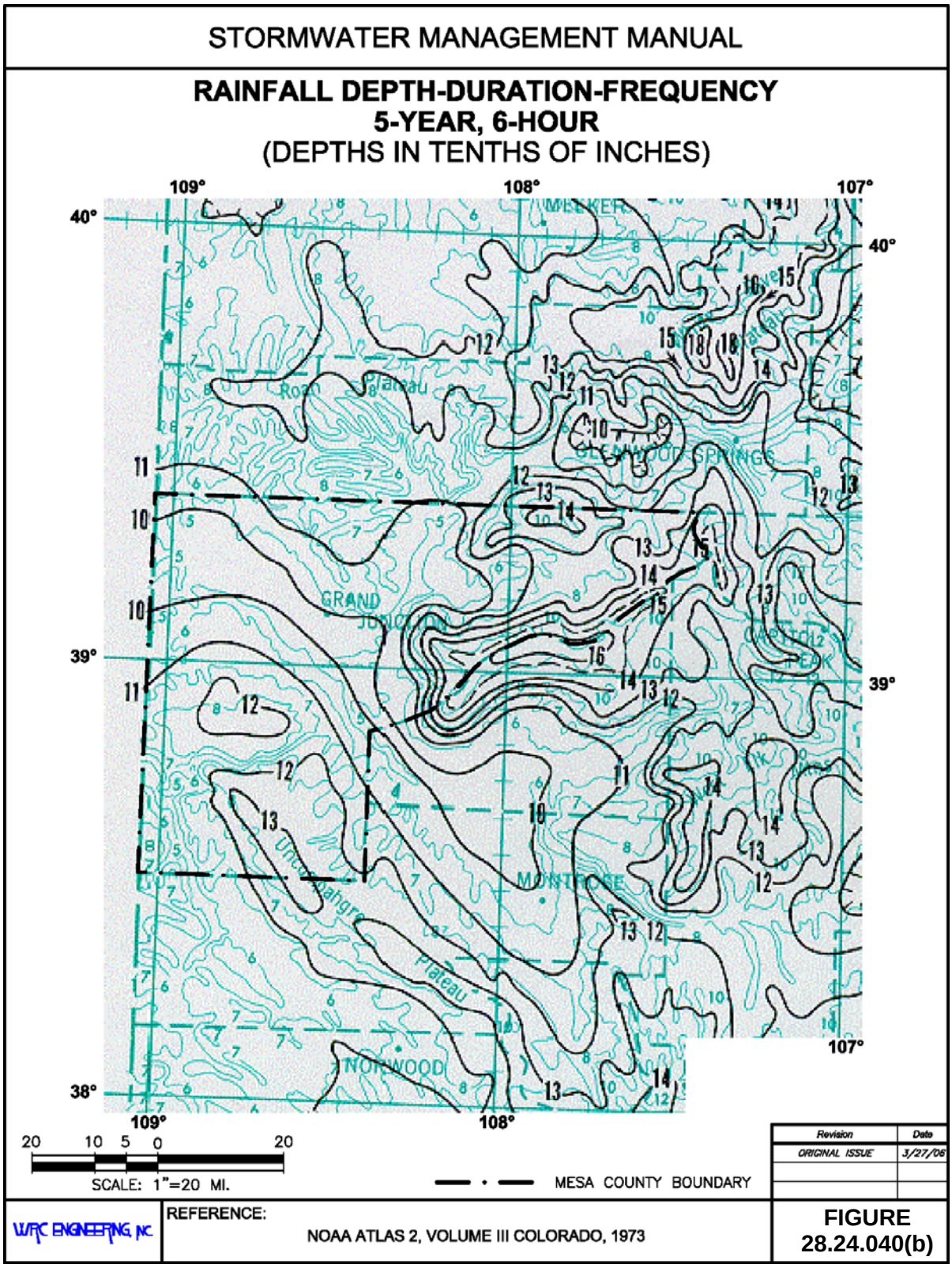


Figure 28.24.040(c): Rainfall Depth-Duration-Frequency: 10-Year, 6-Hour

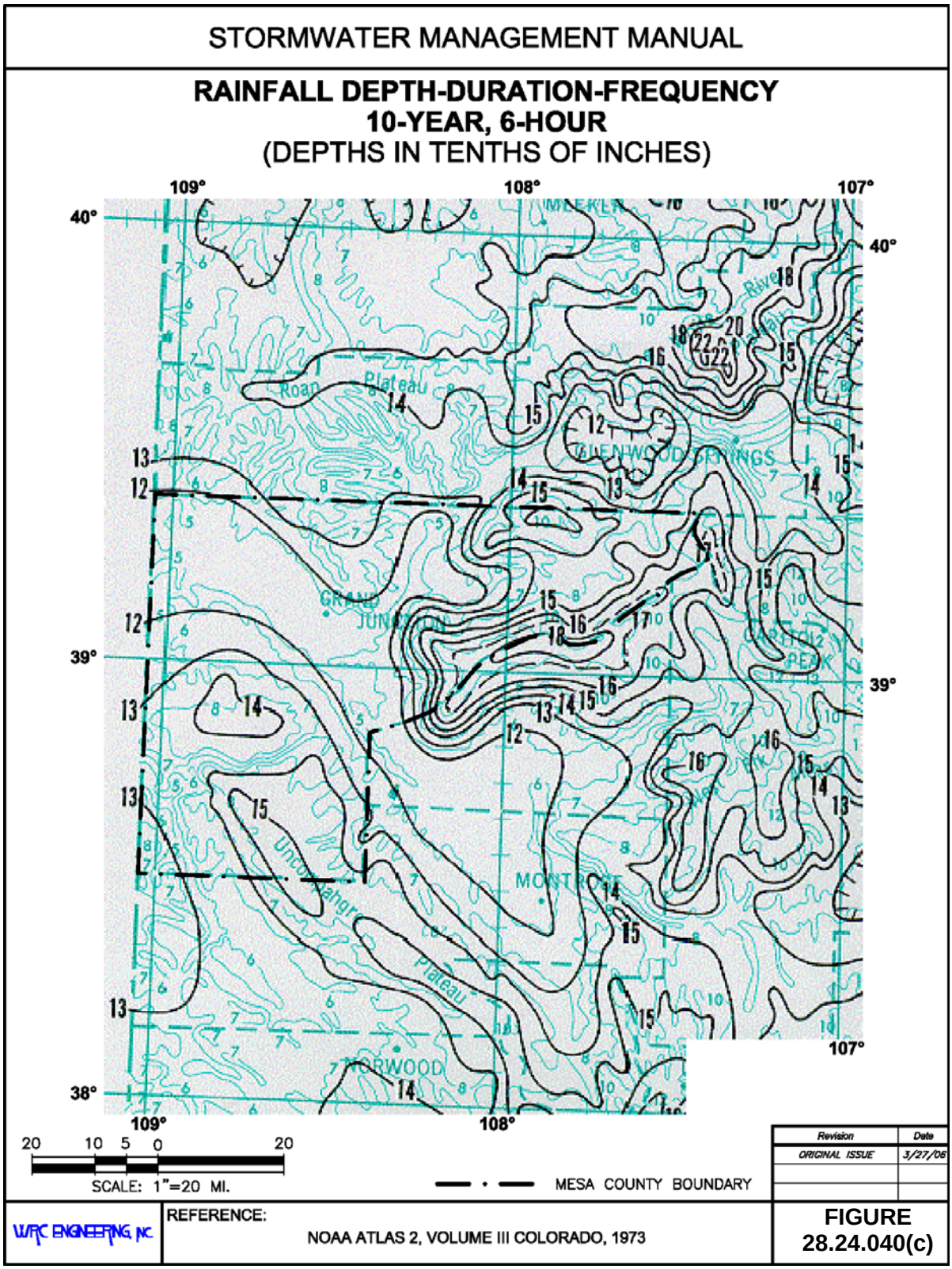


Figure 28.24.040(d): Rainfall Depth-Duration-Frequency: 25-Year, 6-Hour

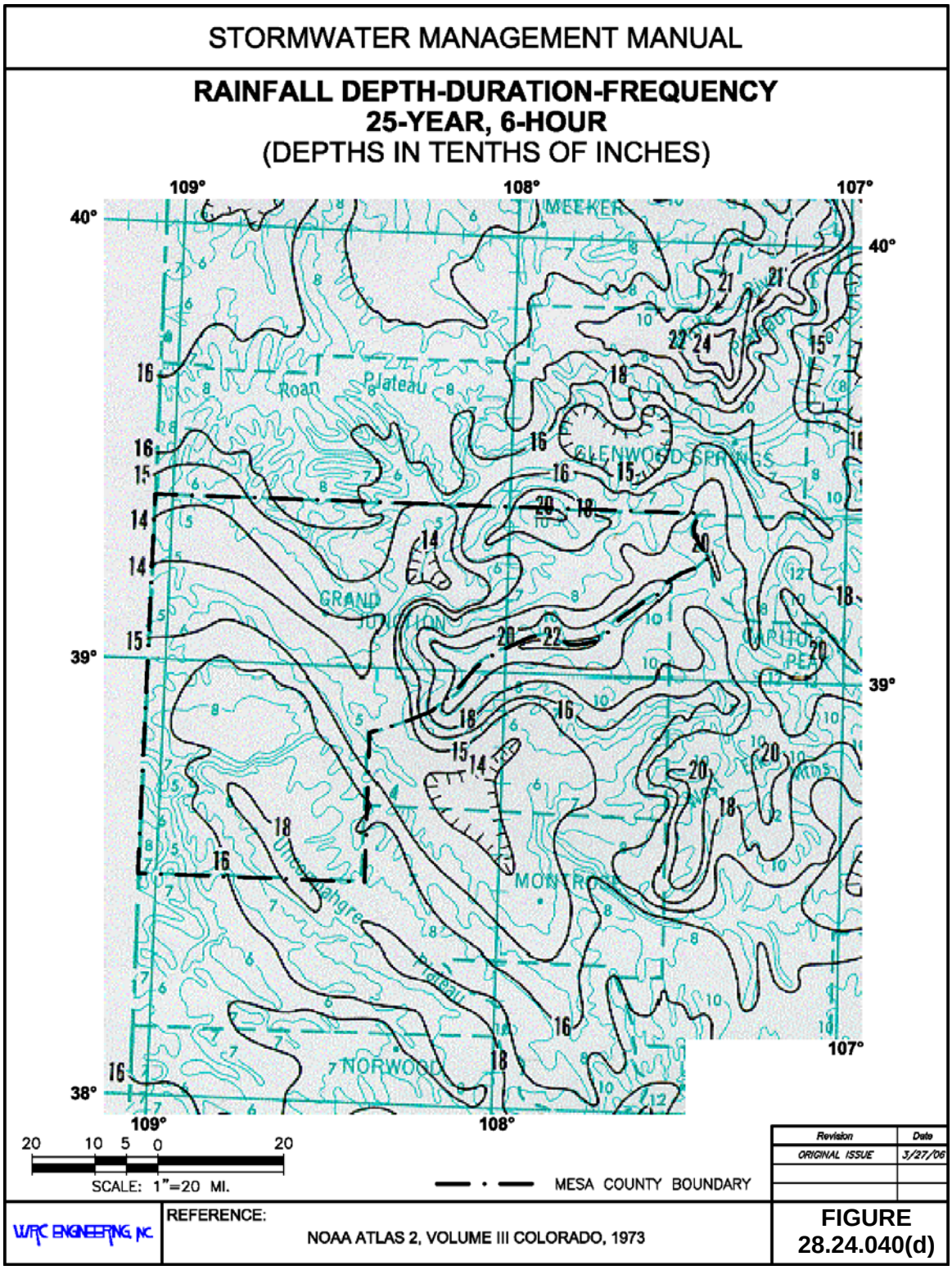


Figure 28.24.040(e): Rainfall Depth-Duration-Frequency: 50-Year, 6-Hour

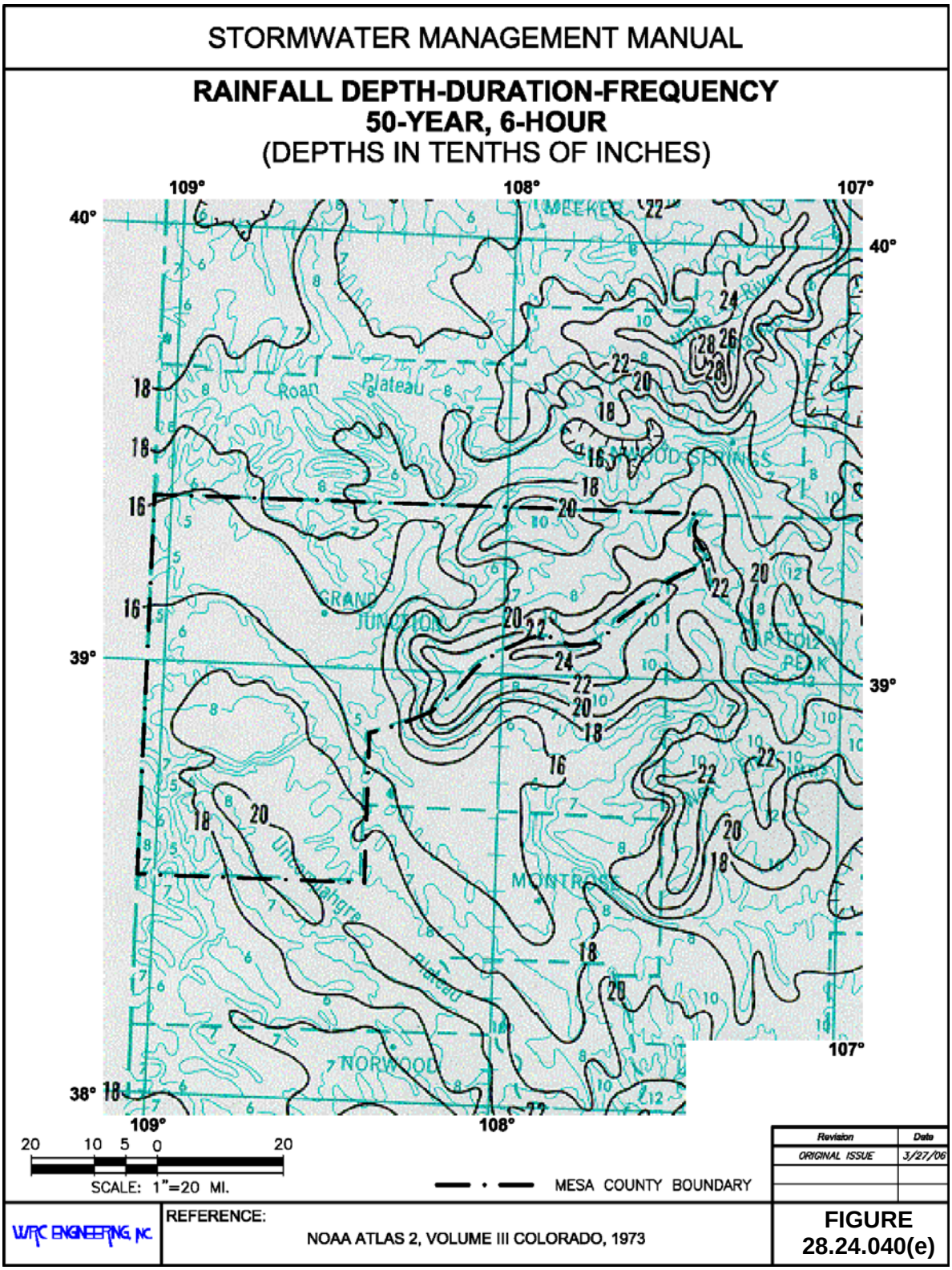


Figure 28.24.040(f): Rainfall Depth-Duration-Frequency: 100-Year, 6-Hour

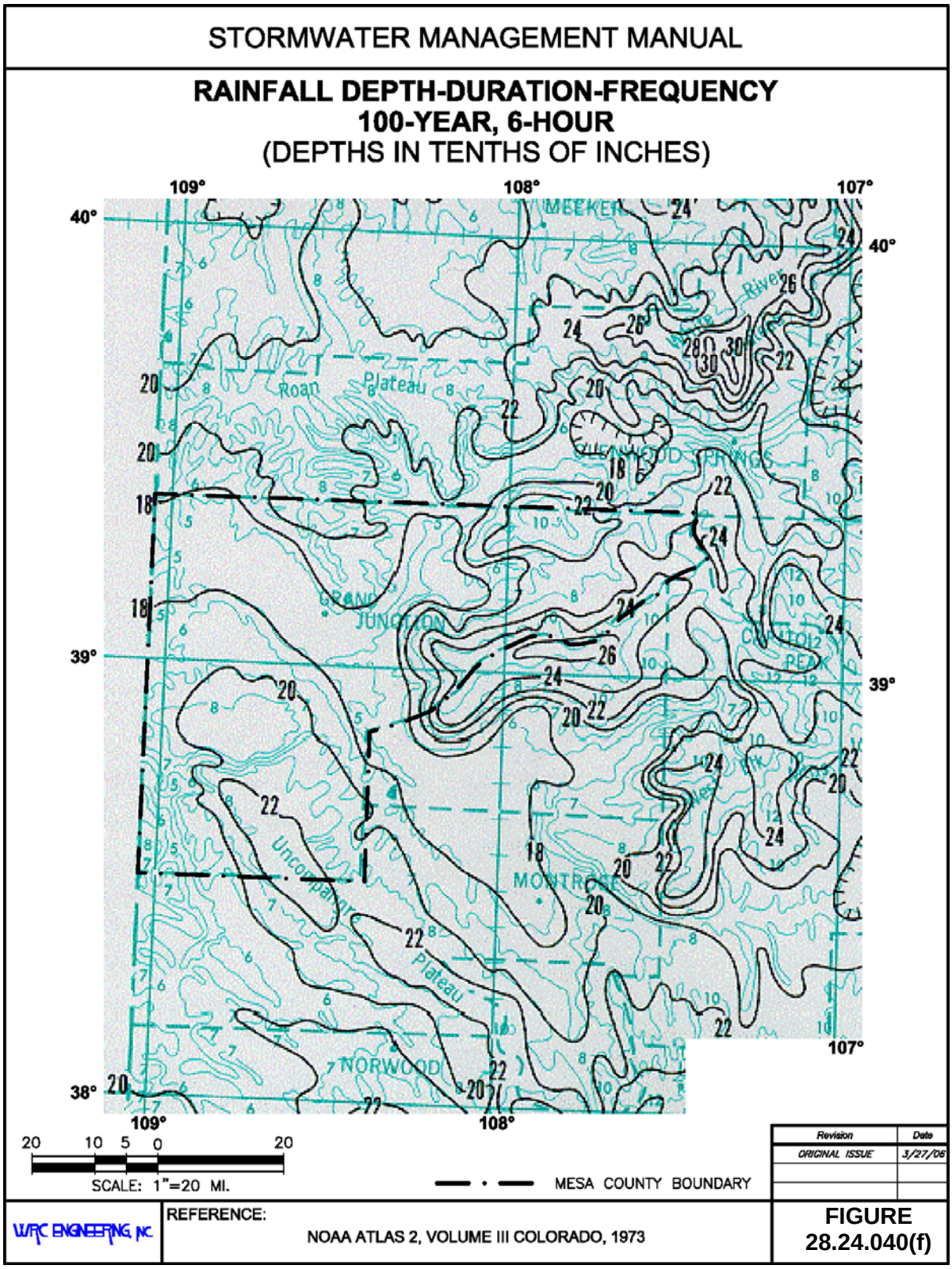


Figure 28.24.040(g): Rainfall Depth-Duration-Frequency: 2-Year, 24-Hour

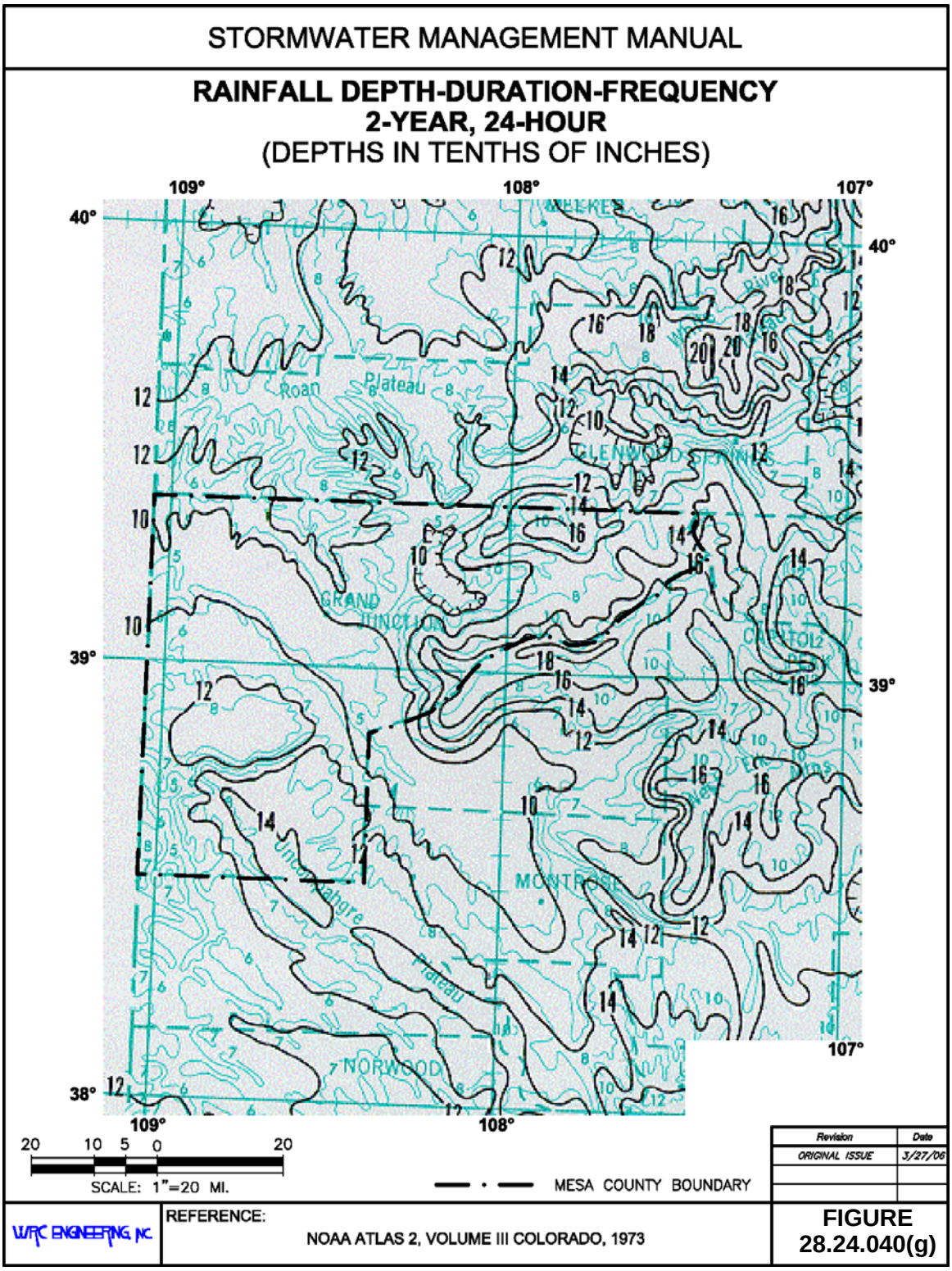


Figure 28.24.040(h): Rainfall Depth-Duration-Frequency: 5-Year, 24-Hour

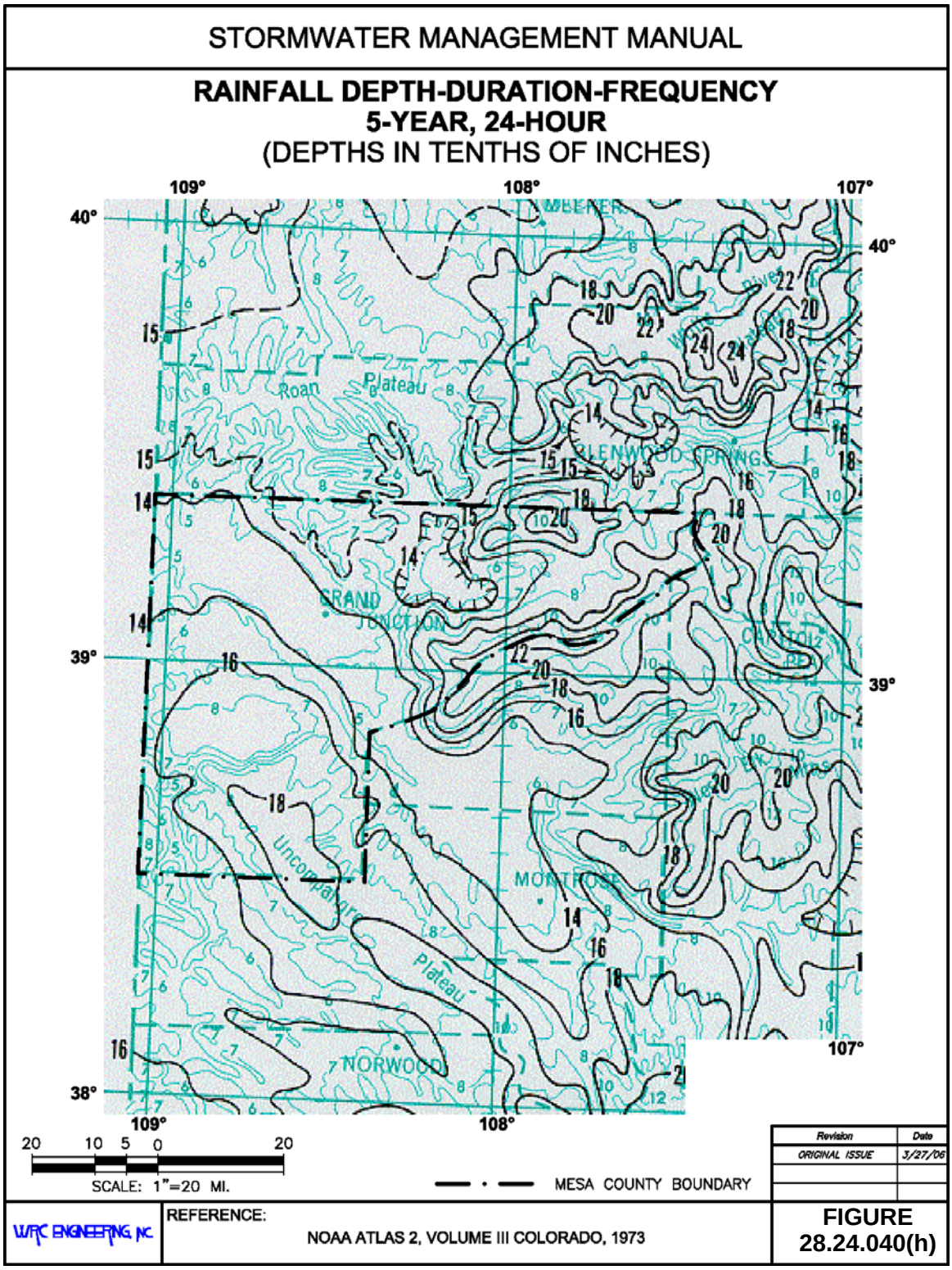


Figure 28.24.040(i): Rainfall Depth-Duration-Frequency: 10-Year, 24-Hour

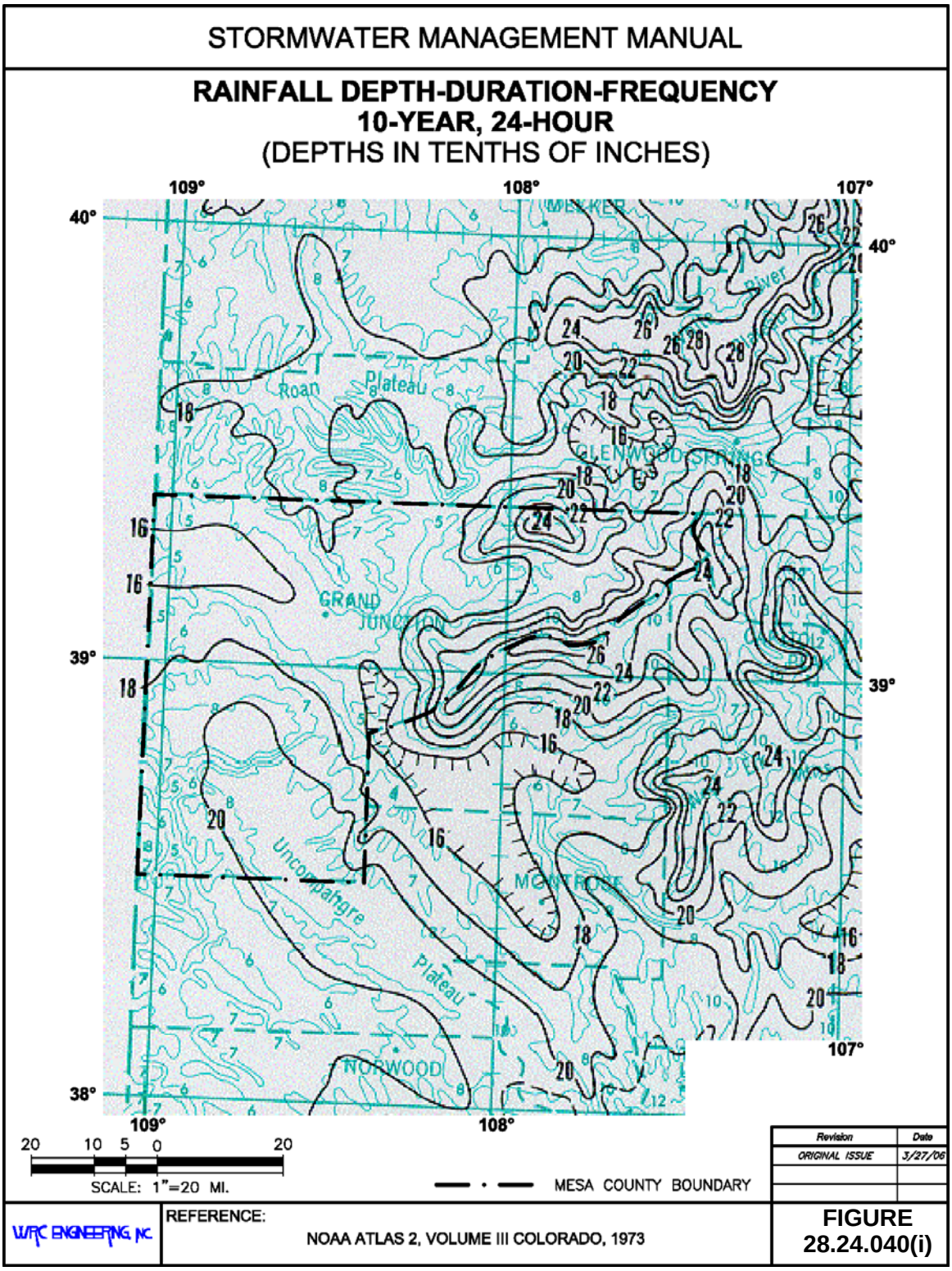


Figure 28.24.040(j): Rainfall Depth-Duration-Frequency: 25-Year, 24-Hour

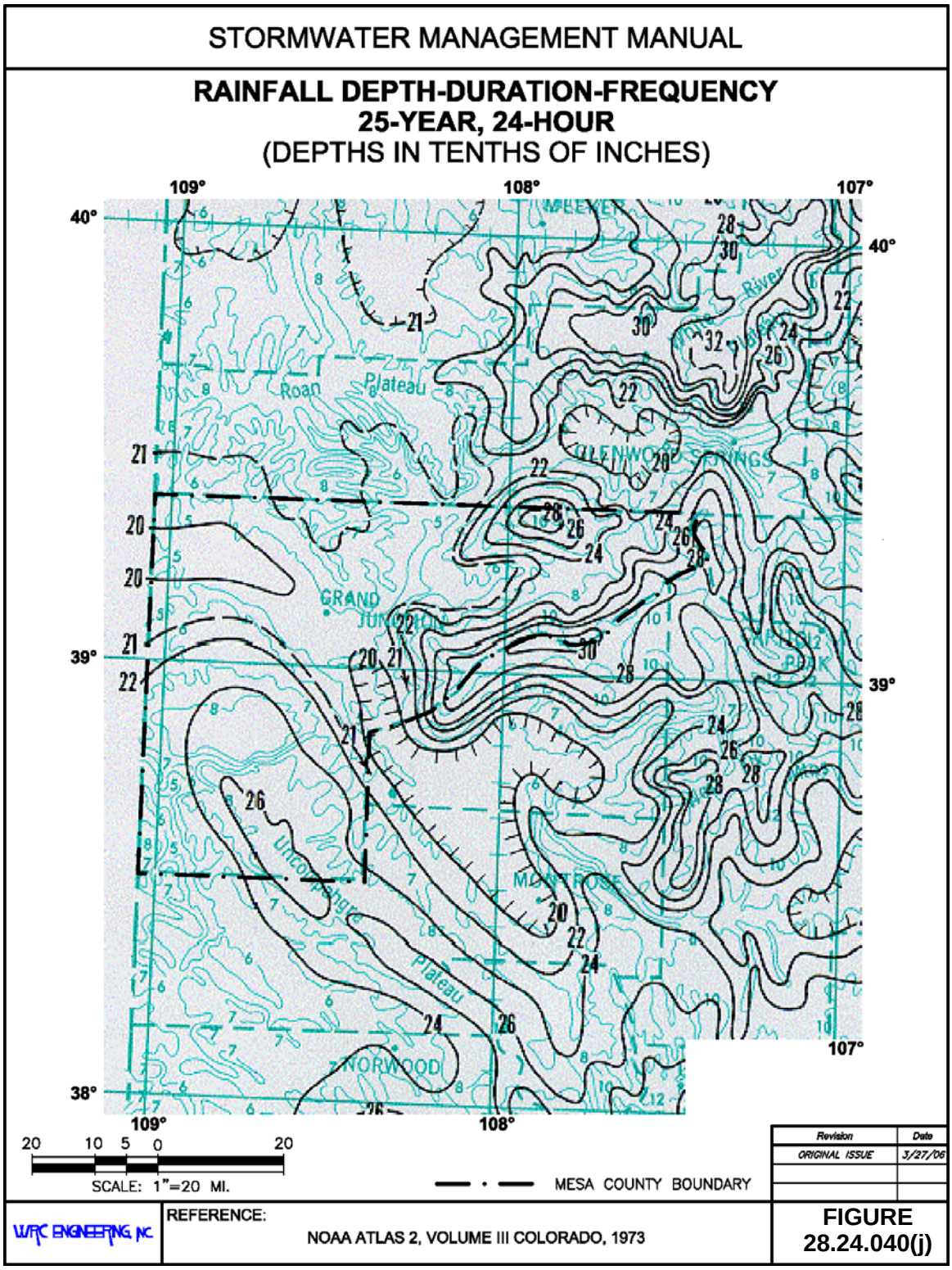


Figure 28.24.040(k): Rainfall Depth-Duration-Frequency: 50-Year, 24-Hour

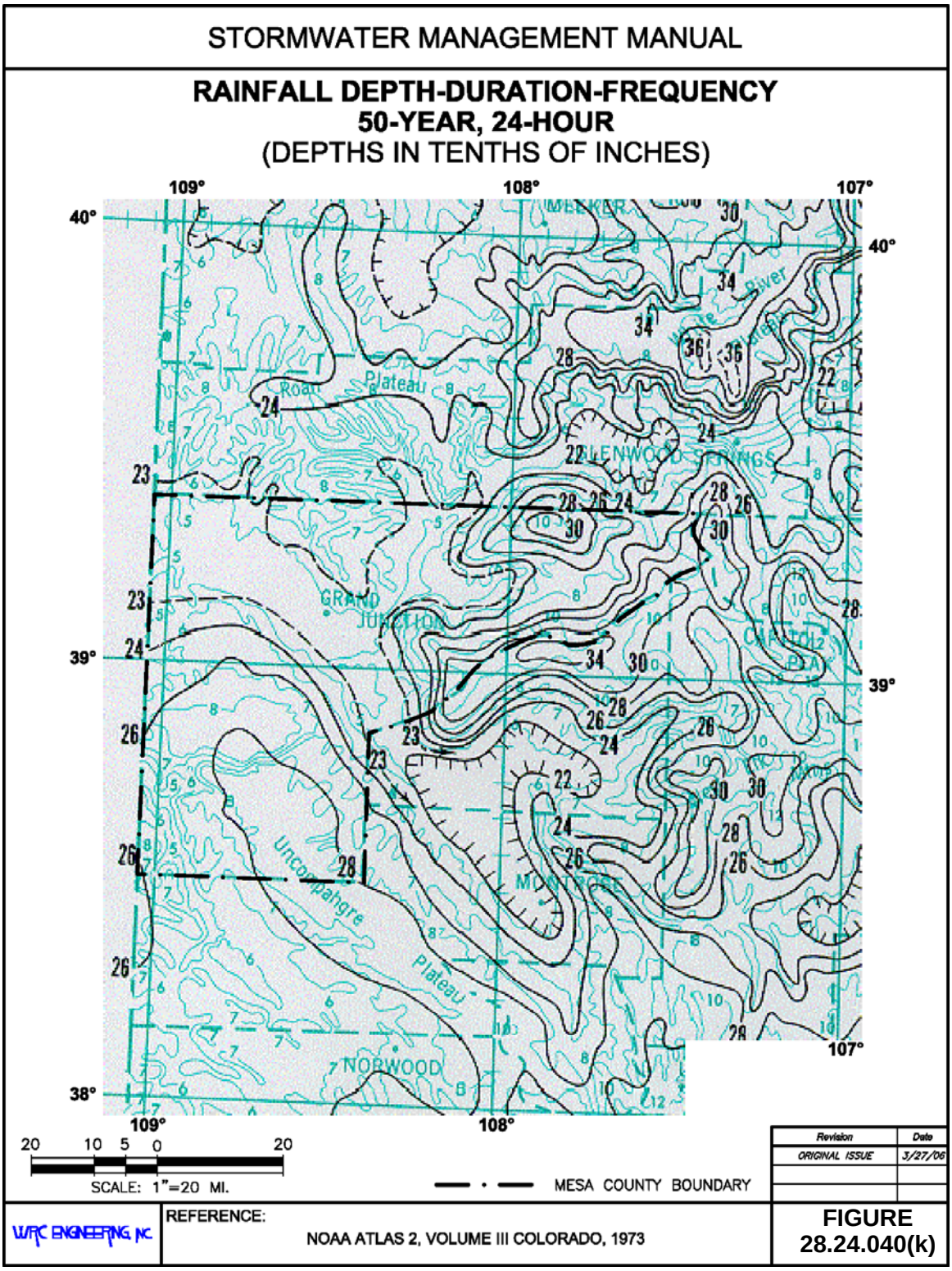
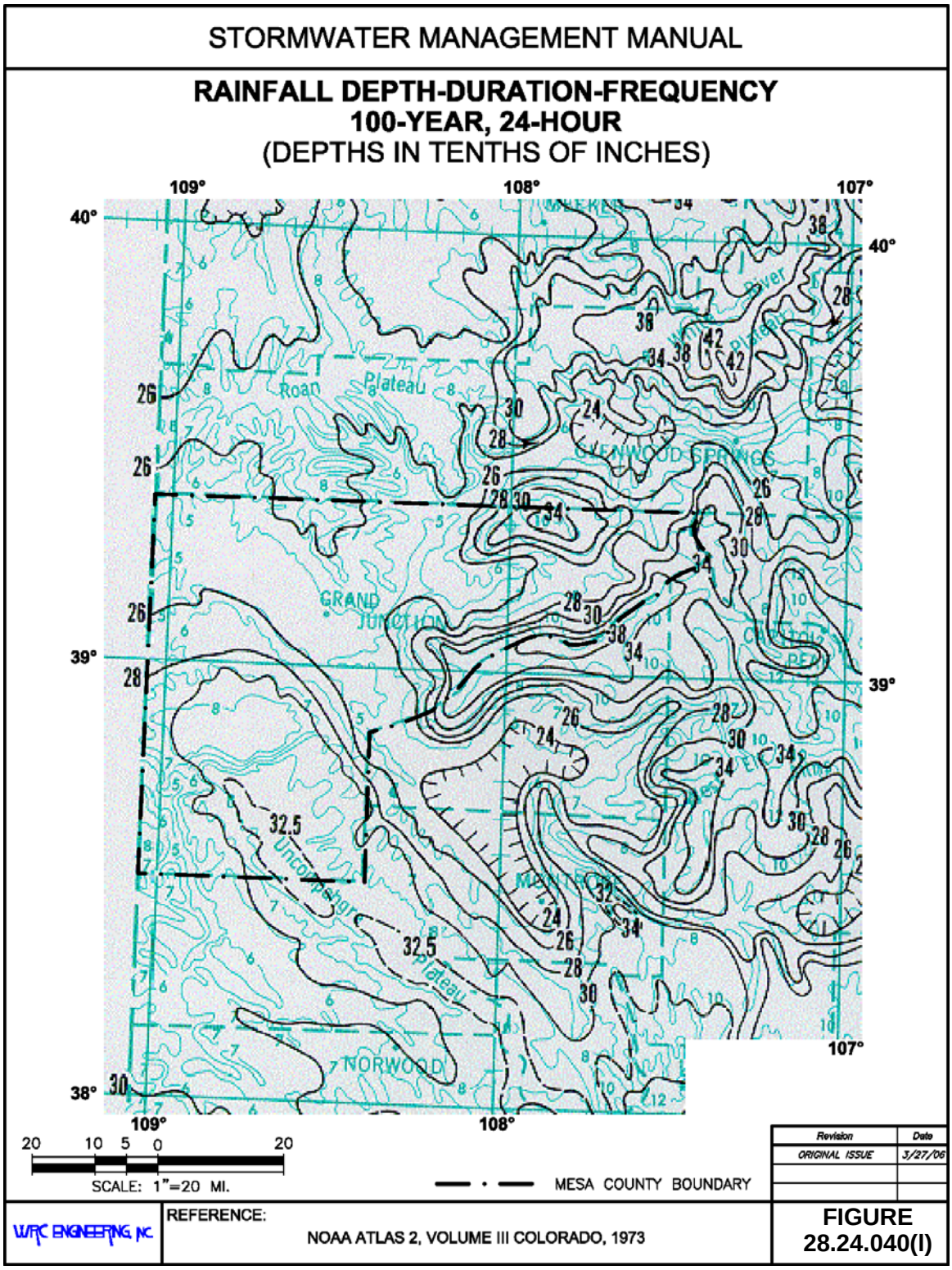


Figure 28.24.040(l): Rainfall Depth-Duration-Frequency: 100-Year, 24-Hour



(Res. 40-08 (§ 602.1), 3-19-08)

28.24.050 Rainfall analysis – Rainfall depths for durations from one to six hours and less than one hour.

For areas within Grand Valley, point rainfall values for different storm durations are obtained from **Table 28.24.040(a)**.

For areas outside the Grand Valley, the rainfall values are determined using procedures recommended in NOAA Atlas 2 and summarized below:

(a) Step 1. Read and record the point rainfall values for the six- and the 24-hour durations obtained from **Figures 28.24.040(a)** through **(l)** for the two- and 100-year recurrence intervals at the desired location(s) within Mesa County.

(b) Step 2. Calculate the two-year, one-hour and 100-year, one-hour rainfall amounts using the following equations:

$$Y2 = 0.011 + 0.942 [(x1) (x1 / x2)] \quad (28.24\text{-}1)$$

$$Y100 = 0.494 + 0.755 [(x3) (x3 / x4)] \quad (28.24\text{-}2)$$

Where:

Y2 = 2-yr, 1-hr estimated value (in)

Y100 = 100-yr, 1-hr estimated value (in)

x1 = 2-yr, 6-hr value (in)

x2 = 2-yr, 24-hr value (in)

x3 = 100-yr, 6-hr value from (in)

x4 = 100-yr, 24-hr value from (in)

(c) Step 3. Plot the two- and 100-year, one-hour rainfall (Y2 and Y100) values on **Figure 28.24.050** and draw a straight line connecting these points. The one-hour point rainfall values for the five-, 10-, 25-, and 50-year storm events are then read from the graph.

(d) Step 4. Calculate the two- and three-hour duration rainfall for the various recurrence intervals using the following equations:

$$P2\text{-}hr = 0.341\ P6\text{-}hr + 0.659\ P1\text{-}hr \quad (28.24\text{-}3)$$

$$P3\text{-}hr = 0.569\ P6\text{-}hr + 0.431\ P1\text{-}hr \quad (28.24\text{-}4)$$

Where:

P 2-hr = 2-hr ‘x’-yr estimated value (in)

P 3-hr = 3-hr ‘x’-yr estimated value (in)

P 1-hr = 1-hr ‘x’-yr previously determined (in)

P 6-hr = 6-hr ‘x’-yr previously determined (in)

(e) Step 5. Calculate the point rainfall values for durations less than one hour by multiplying the one-hour precipitation depths by the factors listed in **Table 28.24.050**:

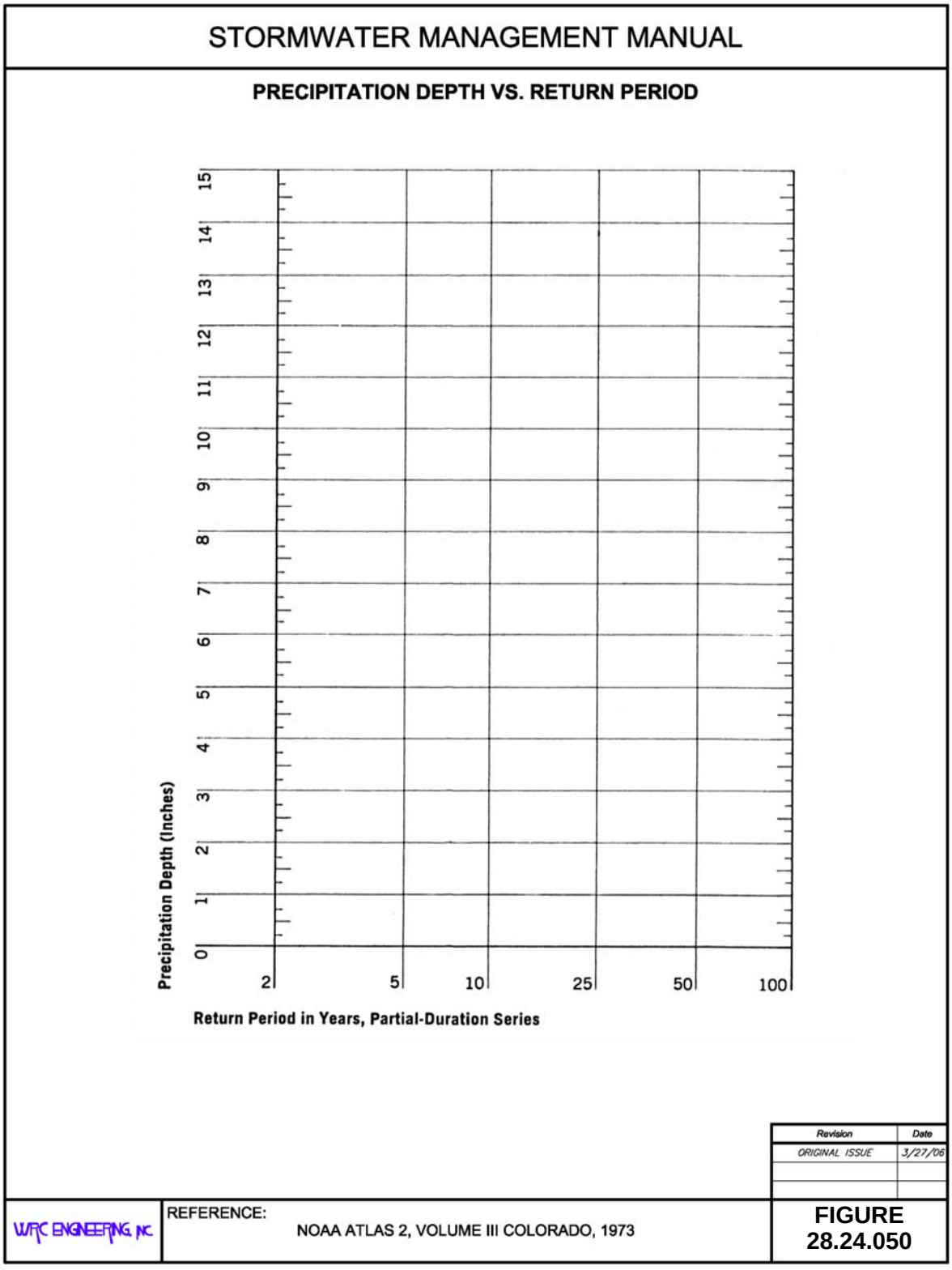
Table 28.24.050: Factors for Durations of Less Than One Hour

Duration (min)	5	10	15	30	60
Ratio to 1 hour	0.29	0.45	0.57	0.79	1.00

The results from the steps above will result in a table of point rainfall values for the project area, similar to **Table 28.24.040(a)**. These data can then be adjusted for the size of the watershed if needed (see GJMC 28.24.070) and used to develop intensity-duration-frequency curves (see GJMC 28.24.080) design storm (see GJMC 28.24.090).

For areas within the Leach Creek/Horizon Drive watershed, point rainfall values for different storm durations are obtained from **Table 28.24.040(b)**.

Figure 28.24.050: Precipitation Depth Versus Return Period



(Res. 40-08 (§ 602.2), 3-19-08)

28.24.060 Rainfall analysis – Mean annual precipitation and storm events.

For analysis and design of water quality BMPs, the mean annual precipitation and storm events are used, which are summarized below:

Table 28.24.060: Mean Storm Statistics

	Average	Coefficient of Variation
Annual Statistics		
No. of Storms	25	0.27
Precipitation (in/year)	6.76	0.35
Independent Storm Events		
Duration (hr)	9.4	0.73
Intensity (in/hr)	0.044	1.15
Volume (in)	0.28	0.70
Interval (hr)	370	1.21

Note that the coefficient of variation is defined as the ratio of the standard deviation to the mean.

(Res. 40-08 (§ 602.3), 3-19-08)

28.24.070 Depth-area reduction factors.

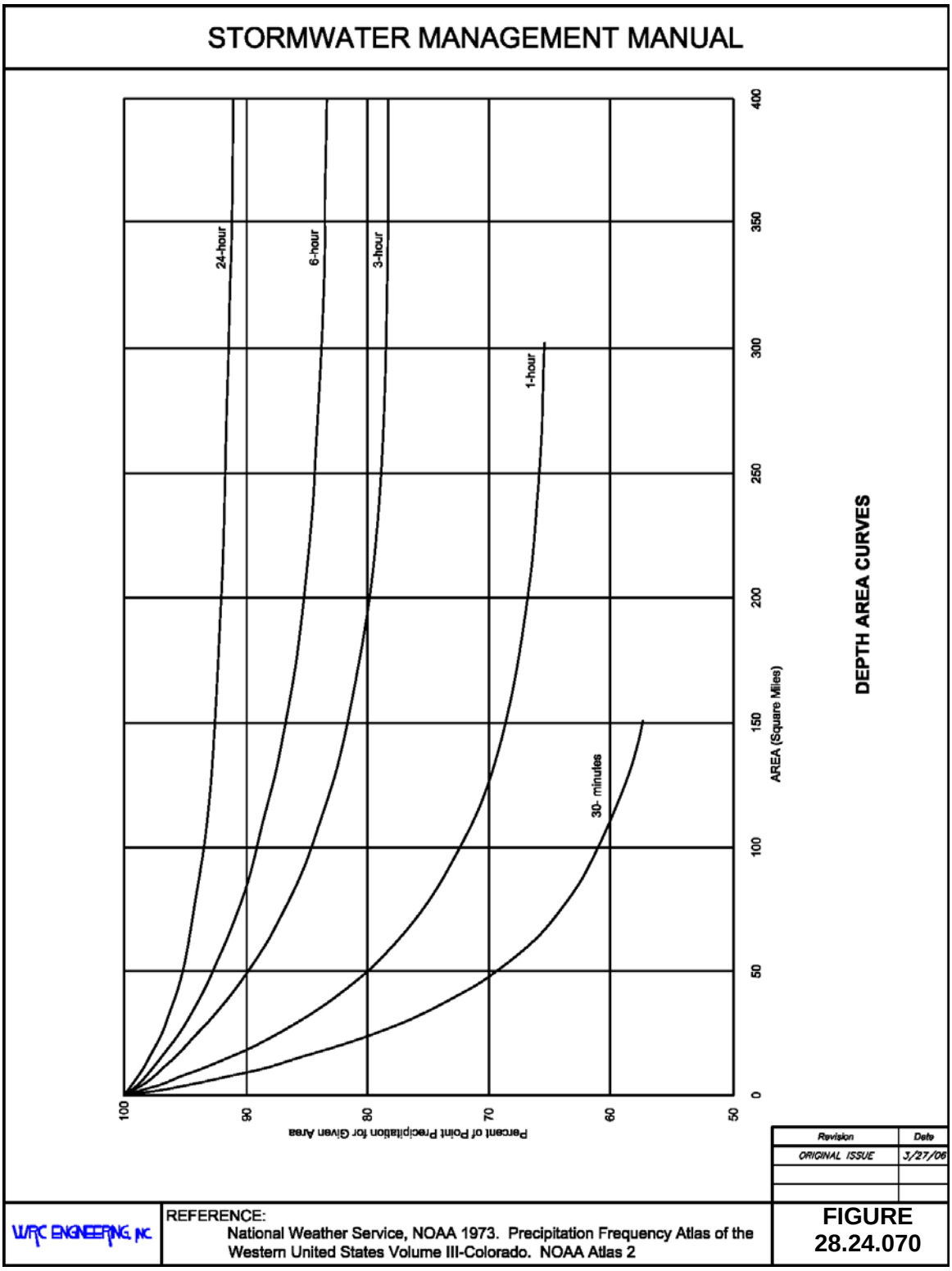
The area adjustment to the point rainfall values described below applies to both the Grand Valley area and areas outside of the Grand Valley. In general, watersheds of less than 10 square miles do not require adjustment.

The NOAA Atlas 2 precipitation depths are related to rainfall frequency at an isolated point. Storms, however, cause rainfall to occur over extensive areas simultaneously, with more intense rainfall typically occurring near the center of the storm. Standard precipitation analysis methods require adjusting point precipitation depths downward to estimate the average depth of rainfall over the entire storm area. This is normally performed using depth-area reduction curves relating to a point precipitation reduction factor to storm area and duration.

The depth-area reduction factors used for rainfall analysis in the Mesa County area are provided in **Figure 28.24.070**.

For areas greater than 200 square miles, the ability of the thunderstorm generating mechanisms (i.e., available moisture, strong convective currents, etc.) to sustain a thunderstorm much greater than 200 square miles in diameter is greatly reduced. Therefore, only a portion of an entire drainage basin could be subject to precipitation from the thunderstorm event. Analysis of this effect on runoff peaks and volumes is complicated by the necessity to determine the “storm centering” which produces the greatest peak flow and/or volume at the selected design point. In order to obtain a consistent method of analysis for these areas, the designer shall consult with the director to determine the appropriate method of analysis and design rainfall area reduction factors for the specific location and basin under study.

Figure 28.24.070: Depth-Area Curves



(Res. 40-08 (§ 603), 3-19-08)

28.24.080 Intensity-duration-frequency curves for rational method.

For areas within the Grand Valley Area, rainfall intensities as a function of storm duration and recurrence interval are provided in **Table 28.24.080** and **Figure 28.24.080**. These data were derived from the investigation by Henz Meteorological Services (Henz 1992).

Table 28.24.080: Intensity-Duration-Frequency Data for Grand Valley

Storm Duration	Precipitation Intensity – Grand Valley Area (inches/hour)					
	2-Year Recurrence	5-Year Recurrence	10-Year Recurrence	25-Year Recurrence	50-Year Recurrence	100-Year Recurrence
5	1.20	1.68	2.16	3.00	3.72	4.68
10	0.90	1.32	1.68	2.28	2.88	3.60
15	0.76	1.12	1.44	1.92	2.44	3.04
30	0.54	0.78	1.00	1.34	1.70	2.12
60	0.34	0.49	0.63	0.85	1.07	1.34

Intensity values for any time of concentration up to 60 minutes can also be determined from the following equation (Froehlich 1995):

$$I_x = a*P_1/(10+Tc)^b$$

Where:

I_x = Intensity for recurrence interval "x," in/hour

P_1 = Point rainfall value for one-hour duration (see **Table 28.24.040(a)**) (inches)

Tc = Time of concentration, minutes

a, b = coefficients, a = 28.9, b = 0.786 for all of Mesa County

Using the coefficients above, this equation will generally match the values in **Table 28.24.040(a)** to within two percent. Whereas the coefficients have not been verified for areas outside the Grand Valley, since the equation is based on the same ratios provided in **Table 28.24.040(b)**, the results will be comparable.

For areas outside of the Grand Valley, first determine the two- and 24-hour point rainfall values for the desired storm recurrence intervals, then determine the one-hour point rainfall value, as described in GJMC 28.24.050. Finally, use the above equation to compute the intensity at any time of concentration and for all storm recurrence intervals.

For areas within the Leach Creek/Horizon Drive watershed, determine the two- and 24-hour point rainfall from **Table 28.24.040(b)**, and then follow the procedures described above.

Figure 28.24.080: Intensity-Duration-Frequency Curves – Grand Valley Area

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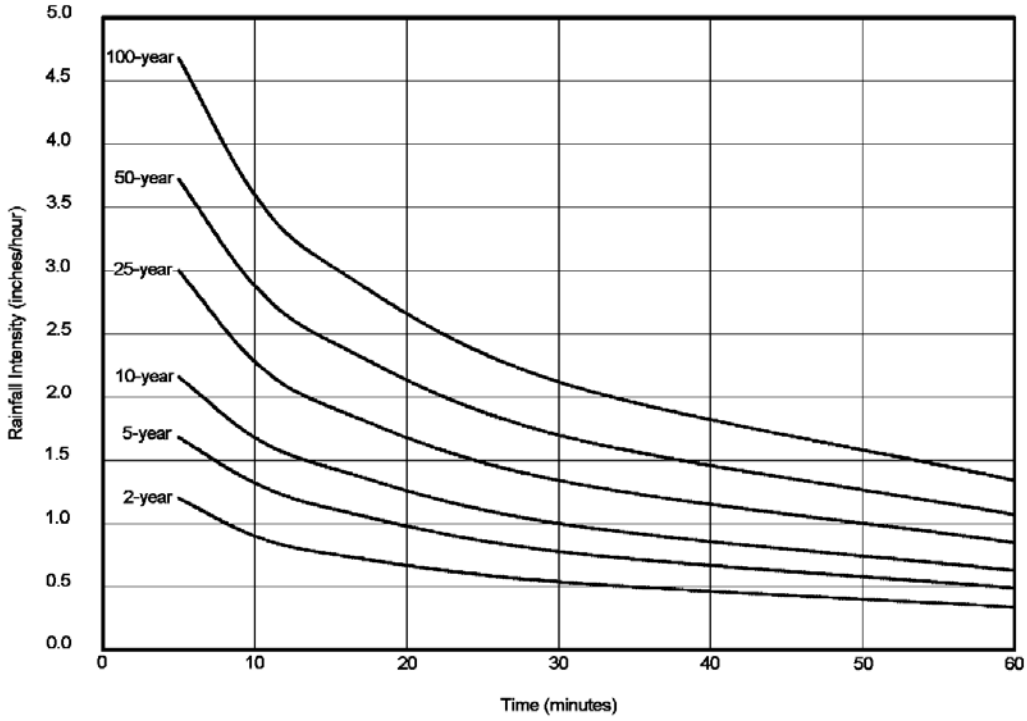
INTENSITY-DURATION-FREQUENCY CURVES
GRAND VALLEY AREA



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WRC ENGINEERING, INC.	REFERENCE: Henz Meteorological Services 1992. Mesa County Storm Drainage Criteria Manual Technical Memorandum 1 and 2	FIGURE 28.24.080

(Res. 40-08 (§ 604), 3-19-08)

28.24.090 Design storms.

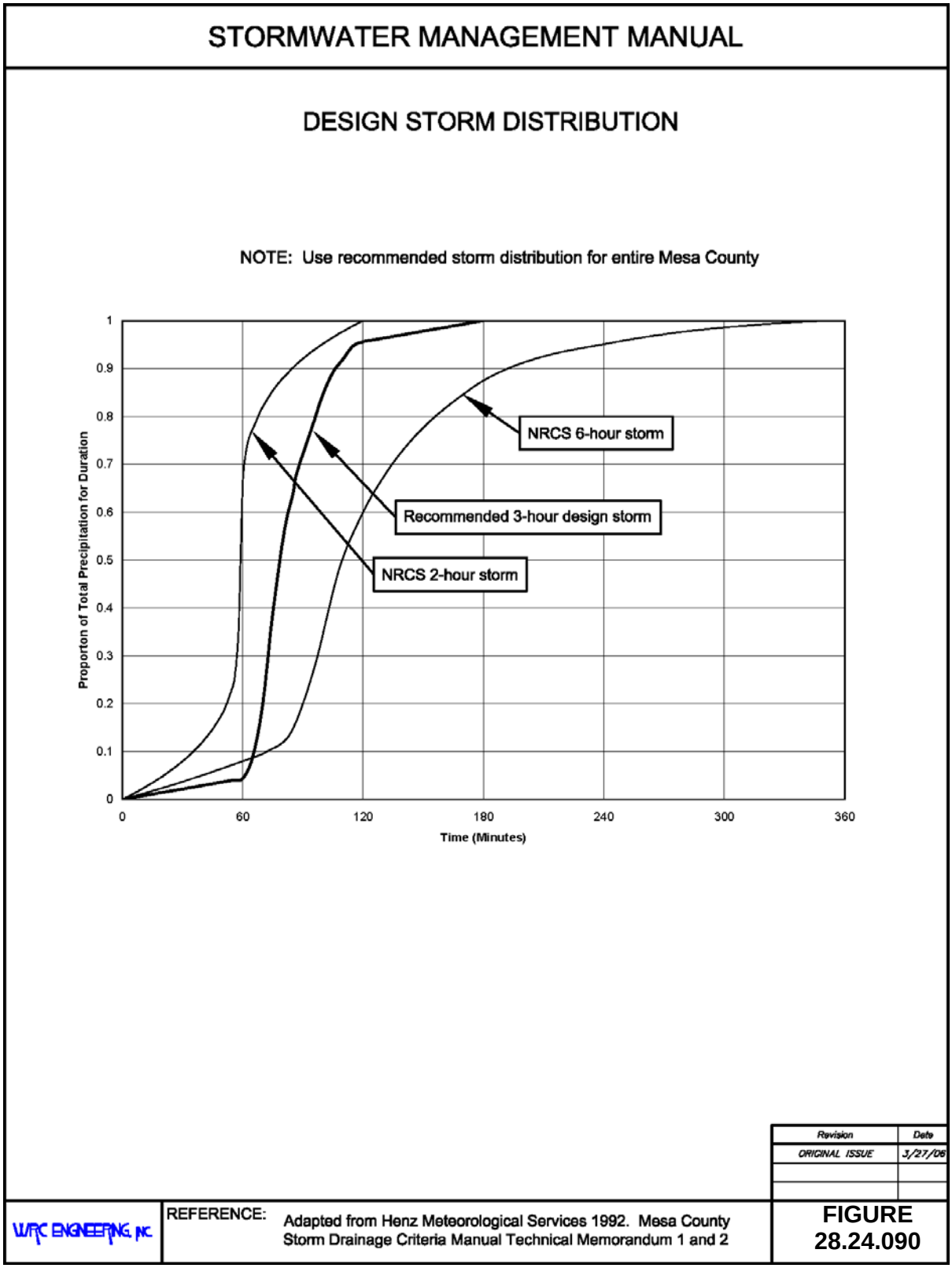
For hydrograph analysis, the recommended minimum design storm duration is three-hour (Henz 1992). Approximately 90 percent of the three-hour total rainfall is distributed within the second hour of the storm, in accordance with recommendations of Henz (Henz 1992). The remaining 10 percent of the storm total is divided equally between the first and third hour.

An example of this distribution is provided in **Table 28.24.090** and on **Figure 28.24.090**, which also compares the recommended design storm to the NRCS two- and six-hour distributions. As can be seen from the figure, the recommended storm is more severe in that 90 percent of the total precipitation occurs in a one-hour period compared to 80 percent for the NRCS two-hour and a little more than 50 percent for the NRCS six-hour event.

Table 28.24.090: Design Rainfall Distribution

Duration (minutes)	Cumulative Proportion of 3-Hour Precipitation	Duration (minutes)	Cumulative Proportion of 3-Hour Precipitation	Duration (minutes)	Cumulative Proportion of 3-Hour Precipitation
5	0.004	65	0.089	125	0.960
10	0.007	70	0.199	130	0.964
15	0.011	75	0.391	135	0.967
20	0.015	80	0.546	140	0.971
25	0.018	85	0.642	145	0.974
30	0.022	90	0.728	150	0.978
35	0.026	95	0.792	155	0.982
40	0.029	100	0.847	160	0.985
45	0.033	105	0.892	165	0.989
50	0.036	110	0.929	170	0.993
55	0.040	115	0.947	175	0.996
60	0.044	120	0.956	180	1.000

Figure 28.24.090: Design Storm Distribution



(Res. 40-08 (§ 605), 3-19-08)

Chapter 28.28

STORM RUNOFF

Sections:

28.28.010 Introduction.
28.28.020 Watershed characteristics.
28.28.030 Time of concentration.
28.28.040 Nonurbanized watersheds.
28.28.050 Urbanized watersheds.
28.28.060 Precipitation losses.
28.28.070 SCS curve number method.
28.28.080 CN determination.
28.28.090 Green and Ampt method.
28.28.100 Rational formula method.
28.28.110 SCS unit hydrograph method.
28.28.120 Channel routing of hydrographs.
28.28.130 Reservoir routing of hydrographs.

28.28.010 Introduction.

For the area within the jurisdiction of this manual, two deterministic hydrological models can be used to estimate storm runoff, rational formula and the SCS unit hydrograph method. The techniques for these methods are presented in this chapter.

The rational and SCS unit hydrograph methods require the user to determine watershed characteristics (i.e., area, length, slope, imperviousness, etc.) and the characteristic response time for the watershed (time of concentration). The SCS unit hydrograph method also requires calculation of the precipitation losses. Procedures for these parameters are presented first, followed by specific requirements for each method.

For certain circumstances, where adequate recorded stream flow data are available and the watershed area is large (greater than 10 square miles), a statistical analysis may be required to predict the storm runoff peaks or for calibration of deterministic models.

(Res. 40-08 (§ 701), 3-19-08)

28.28.020 Watershed characteristics.

The watershed characteristics needed for the runoff computation methods include the watershed area, the various flow path lengths, slopes, and surface conditions (i.e., overland, grassed channel, gutter), soil infiltration rates, and land use or imperviousness.

(a) Physical Features. Watershed boundaries and areas can be determined from topographic maps, but a field investigation is recommended to verify boundaries. Land use and flow path characteristics can be obtained from zoning maps, aerial photographs, field investigations, or detailed topographic maps. Soil characteristics can be determined from NRCS (formerly SCS) soil reports for Mesa County.

(b) Watershed Imperviousness. Imperviousness, I_{mp}, is a basic characteristic that is a direct measure of the watershed's potential to produce storm runoff in terms of peak rates and total runoff volume. It is also a predictive indicator of watershed response to urbanization and the subsequent impact on stream stabilization and water quality.

Imperviousness is used in the rational method to derive the runoff coefficient and can be used in the SCS unit hydrograph method to derive runoff curve number. Imperviousness is typically determined in one of two ways, either by identification of watershed surface conditions (i.e., natural

ground versus hard surfaces) and direct computation or by characterization of the land uses (i.e., undeveloped, residential, commercial, industrial) which have typical values of imperviousness.

Recommended impervious values for surface conditions and for typical land use types are provided in **Table 28.28.020**. The more precise approach is to divide the watershed into pervious and impervious surfaces and then compute the overall imperviousness directly, which is the required method for determining imperviousness for new development. This approach can be used when aerial photographs or detailed development plans (i.e., for planned unit developments) are available, or field investigations of existing conditions are performed.

When this information is not available or for projecting watershed imperviousness for future land uses, then typical imperviousness values from **Table 28.28.020** are used. For single-family residential development when the housing density (i.e., units per acre) and the size and type of housing (i.e., ranch, split level, and two-story) can be determined, then the use of **Figures 28.28.020(a)**, **28.28.020(b)** and **28.28.020(c)** is recommended. These figures are indicative of the existing development trend to place larger houses, including driveways, walks, patios, and outbuildings, on smaller lots. However, imperviousness values have also been found to be representative of older developments with small lots where additional impervious surfaces were added over time.

Note that in undeveloped areas that are to remain undeveloped, two percent imperviousness may be used for all areas that have soil and vegetative cover. However, these undeveloped areas often have significant geological features such as rock outcroppings that must be accounted for by calculating a composite imperviousness for these basins. Rock outcroppings are typically assigned an imperviousness of 100 percent for these calculations.

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RECOMMENDED IMPERVIOUSNESS VALUES

Land Use or Surface Characteristic	Percentage Imperviousness
Business	
Commercial Areas	85
Neighborhood Areas	70
Residential	
Single Family	(see figures)
Multi-unit (detached)	60
Multi-unit (attached)	75
Half-acre lot or larger	(see figures)
Apartments	80
Industrial	
Light industrial	80
Heavy industrial	90
Parks, cemeteries	5
Playgrounds	10
Schools	50
Railroad yards	15
Undeveloped Areas	
Historic flow analysis	2
Greenbelts, agriculture	2
Off-site flow analysis (when land use not defined)	45
Streets	
Paved (concrete/asphalt)	100
Gravel	40
Drives and walks	90
Roofs	90
Lawns (all soils)	0

NOTES:

1. The imperviousness values are representative of land uses shown and are for future development projections only. Impervious values for existing land uses may vary.
2. For areas that will not be developed, 2% imperviousness is an appropriate assumption where soil and vegetative cover are present. Areas with geological features, including significant rock outcroppings, need to be accounted for. See GJMC 26.28.020(b).

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ADDED NOTE 2	1/25/08

WRC ENGINEERING, INC.

REFERENCE:
UDFCD 2001. Urban Storm Drainage Criteria Manual, Volume 1 (revised)

TABLE 28.28.020

Figure 28.28.020(a): Watershed Imperviousness, Single-Family Residential Ranch Style House

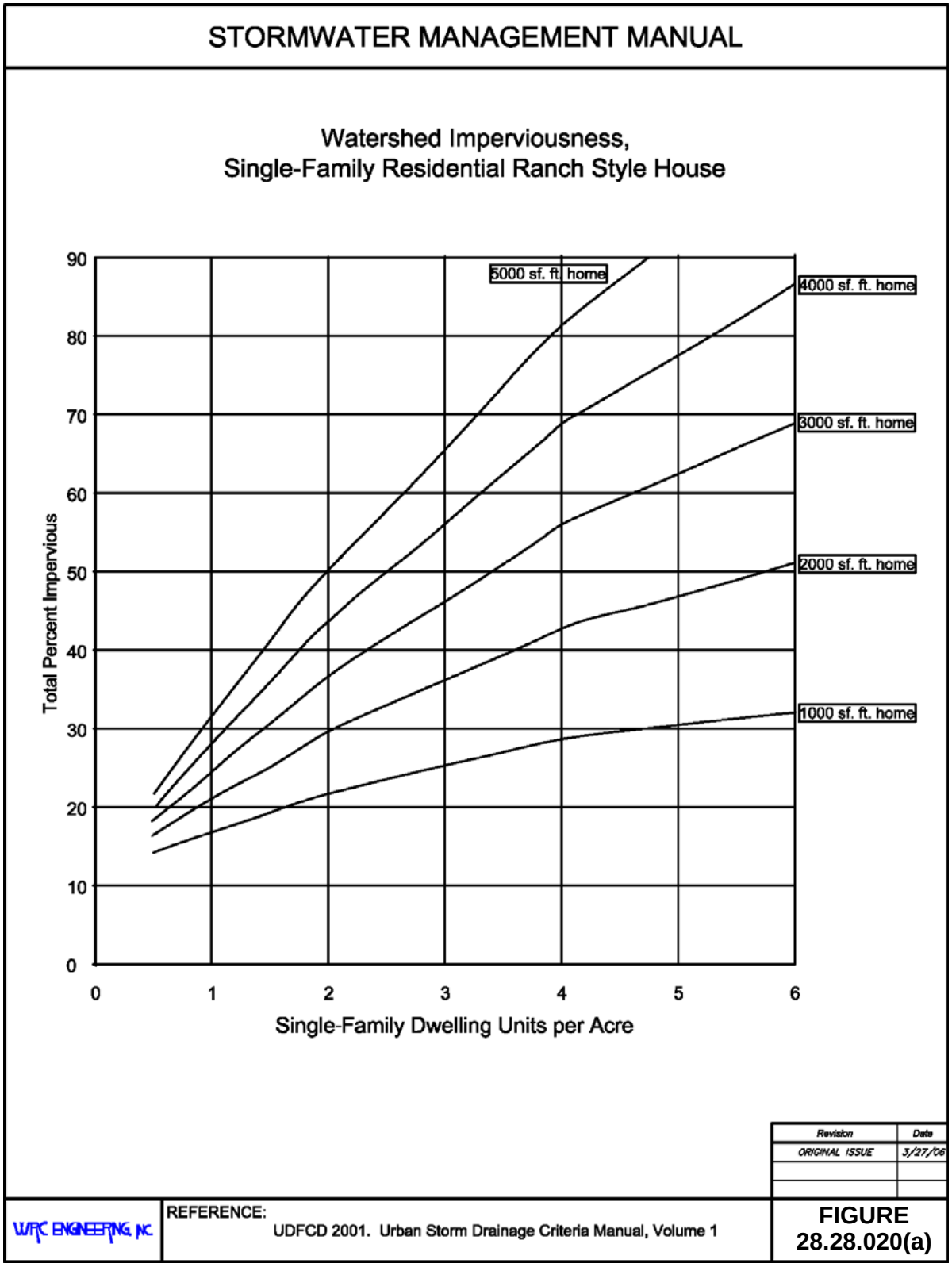
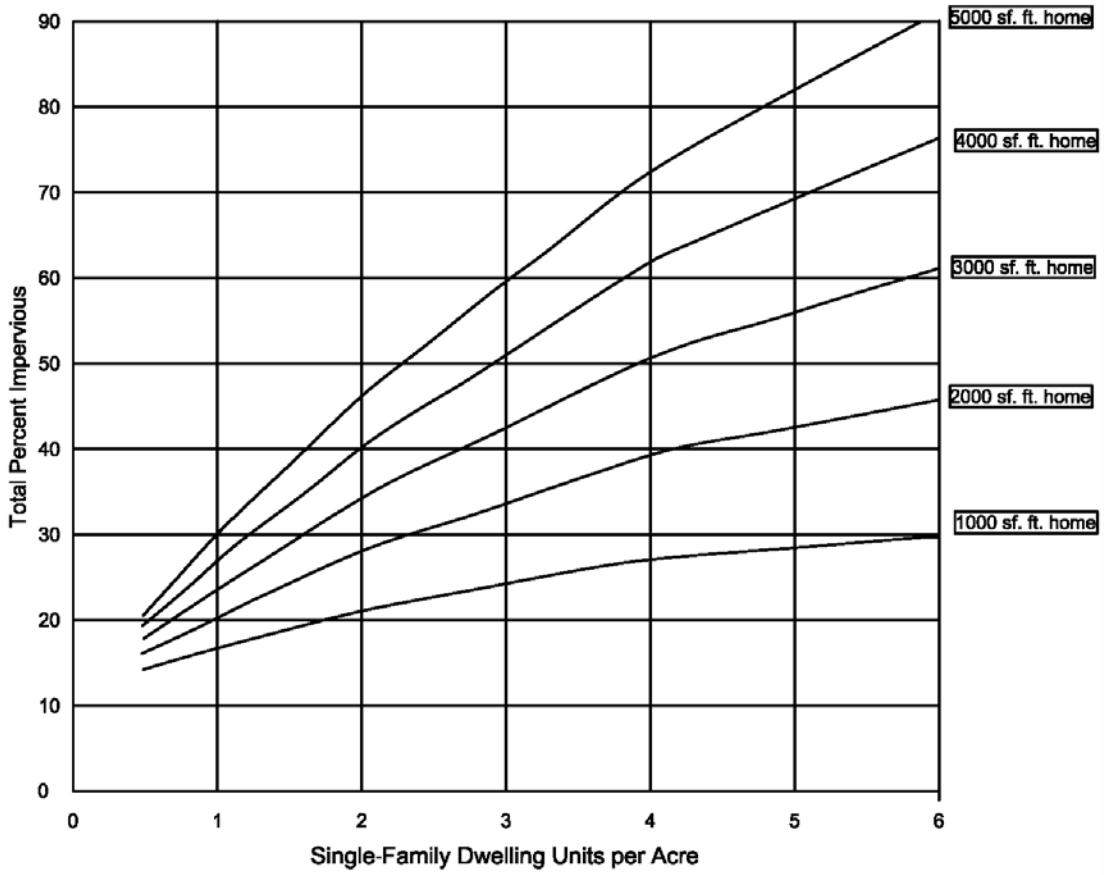


Figure 28.28.020(b): Watershed Imperviousness, Single-Family Residential Split Level House

STORMWATER MANAGEMENT MANUAL

Watershed Imperviousness,
Single-Family Residential Split-Level House



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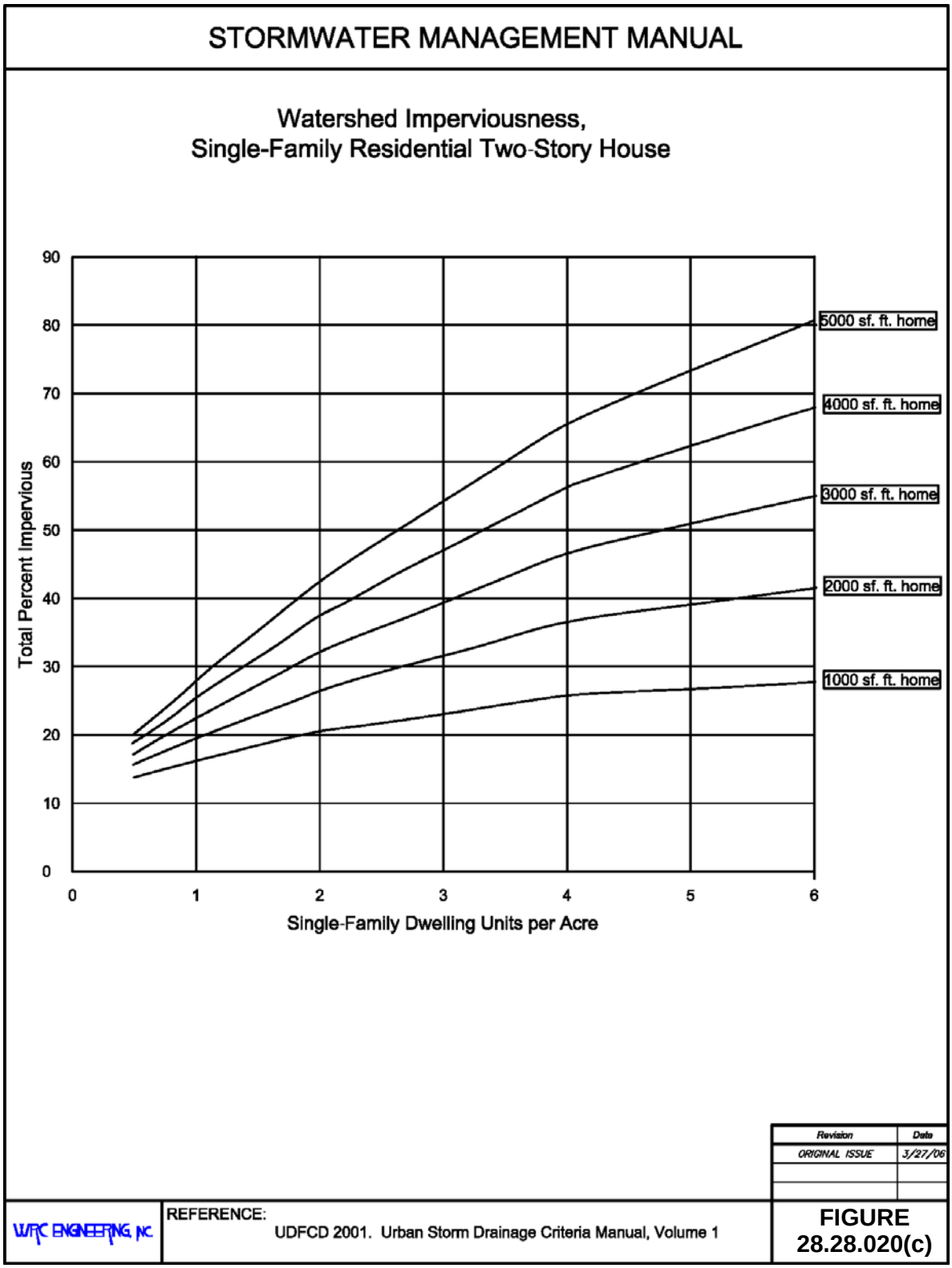
REFERENCE:
UDFCD 2001. Urban Storm Drainage Criteria Manual, Volume 1

FIGURE 28.28.020(b)

Figure 28.28.020(c): Watershed Imperviousness, Single-Family Residential Two-Story House



(Res. 40-08 (§ 702), 3-19-08)

28.28.030 Time of concentration.

The time of concentration, t_c, is the time required for runoff to flow from the most remote part of the watershed area to the point of interest. For the rational formula, the time of concentration is calculated so that the average rainfall rate for a corresponding duration can be determined from the rainfall intensity-duration-frequency curves. For the SCS unit hydrograph methods, the time of concentration is used to determine the time-to-peak, t_p, of the unit hydrograph and subsequently, the peak runoff.

For consistency between runoff analyses, the time of concentration equations presented in this chapter shall be used for all small watershed (less than 1.0 square miles) runoff calculations. For large watershed calculations, the watershed lag equation for the SCS unit hydrograph method is recommended (see GJMC 28.28.110(c)).

Time of concentration consists of an initial time or overland flow time, t_i, plus travel time, t_t, which is in a combined form. In both urban and nonurban environments, the initial or overland flow is assumed to occur as sheet flow and as a function of surface type and slope, with an upper limit on the distance which this type of flow can occur.

(Res. 40-08 (§ 703), 3-19-08)

28.28.040 Nonurbanized watersheds.

For nonurban areas, the travel time occurs in a combined form, such as a small swale, channel, or wash. In urban areas, the travel time occurs in a combined form, such as in the storm drain, paved gutter, road-side drainage ditch, or drainage channel. Travel time can be estimated from the hydraulic properties of the storm drain, gutter, swale, ditch, or wash. Initial time, on the other hand, will vary with surface slope, depression storage, surface cover, antecedent rainfall, and infiltration capacity of the soil, as well as distance of surface flow.

The time of concentration for both urban and nonurban areas is calculated as follows:

$$t_c = t_i + t_t \qquad (28.28\text{-}1)$$

Where:

t_c = Time of concentration (min)

t_i = Initial, inlet, or overland flow time (min)

t_t = Travel time in the ditch, channel, gutter, storm drain, etc. (min)

Standard Form No. 2 has been developed to organize the calculation of t_c.

The initial or overland flow time, t_i, may be calculated using the following equation:

$$t_i = 1.8\,(1.1 - K)\,L_o^{1/2} / S^{1/3} \qquad (28.28\text{-}2)$$

Where:

t_i = Initial or overland flow time (min)

K = Flow resistance coefficient

L_o = Length of overland flow (feet, 300-foot maximum)

S = Average watershed slope (percent)

Equation 28.28-2 was originally developed by the Federal Aviation Administration (FAA, 1970) for use with the rational formula method. However, the equation is also valid for computation of the initial or overland flow time for the SCS unit hydrograph method. The five-year runoff coefficient, C_5, presented in **Table 28.28.040(a)** is recommended for the flow resistance coefficient, K.

STORMWATER MANAGEMENT MANUAL

RATIONAL FORMULA RUNOFF COEFFICIENTS

Equation:

$$C_{CD} = K_{CD} + (0.858i^3 - 0.786i^2 + 0.774i + 0.04$$
$$C_A = K_A + (1.31i^3 - 1.44i^2 + 1.135i - 0.12)$$
$$C_B = (C_A + C_{CD})/2$$

KCD VALUES						
NRCS Soil	**2-year**	**5-year**	**10-year**	**25-year**	**50-year**	**100-year**
C and D	0	-0.10i+0.11	-0.18i+0.21	-0.28i+0.33	-0.33i+0.40	-0.39i+0.46
A	0	-0.08i+0.09	-0.14i+0.17	-0.19i+0.24	-0.22i+0.28	-0.25i+0.32

Impervious Decimal	Type A					
	2-year	**5-year**	**10-year**	**25-year**	**50-year**	**100-year**
0.0	0.00	0.00	0.08	0.14	0.18	0.23
0.1	0.00	0.06	0.14	0.20	0.24	0.28
0.2	0.06	0.13	0.20	0.26	0.30	0.33
0.3	0.13	0.19	0.25	0.31	0.34	0.37
0.4	0.19	0.25	0.30	0.35	0.38	0.41
0.5	0.25	0.30	0.35	0.40	0.42	0.45
0.6	0.33	0.37	0.41	0.45	0.47	0.50
0.7	0.42	0.45	0.49	0.53	0.54	0.56
0.8	0.54	0.56	0.60	0.63	0.64	0.66
0.9	0.69	0.71	0.73	0.76	0.77	0.79
1.0	0.89	0.90	0.92	0.94	0.95	0.96

Impervious Decimal	Type B					
	2-year	**5-year**	**10-year**	**25-year**	**50-year**	**100-year**
0.0	0.00	0.08	0.17	0.27	0.32	0.36
0.1	0.06	0.14	0.22	0.31	0.36	0.40
0.2	0.12	0.20	0.27	0.35	0.40	0.44
0.3	0.18	0.25	0.32	0.39	0.43	0.47
0.4	0.23	0.30	0.36	0.42	0.46	0.50
0.5	0.29	0.35	0.40	0.46	0.50	0.52
0.6	0.37	0.41	0.46	0.51	0.54	0.56
0.7	0.45	0.49	0.53	0.58	0.60	0.63
0.8	0.57	0.59	0.63	0.66	0.69	0.70
0.9	0.71	0.73	0.75	0.78	0.80	0.81
1.0	0.89	0.90	0.92	0.94	0.95	0.96

Impervious Decimal	Type C and D Soil					
	2-year	5-year	10-year	25-year	50-year	100-year
0.0	0.05	0.16	0.26	0.38	0.46	0.51
0.1	0.11	0.21	0.30	0.41	0.48	0.53
0.2	0.17	0.26	0.34	0.44	0.50	0.55
0.3	0.22	0.30	0.38	0.47	0.53	0.57
0.4	0.28	0.35	0.42	0.50	0.55	0.58
0.5	0.34	0.40	0.46	0.53	0.57	0.60
0.6	0.41	0.46	0.51	0.57	0.61	0.63
0.7	0.49	0.53	0.57	0.62	0.66	0.68
0.8	0.60	0.63	0.66	0.70	0.73	0.74
0.9	0.73	0.75	0.77	0.80	0.83	0.83
1.0	0.89	0.90	0.92	0.94	0.96	0.96

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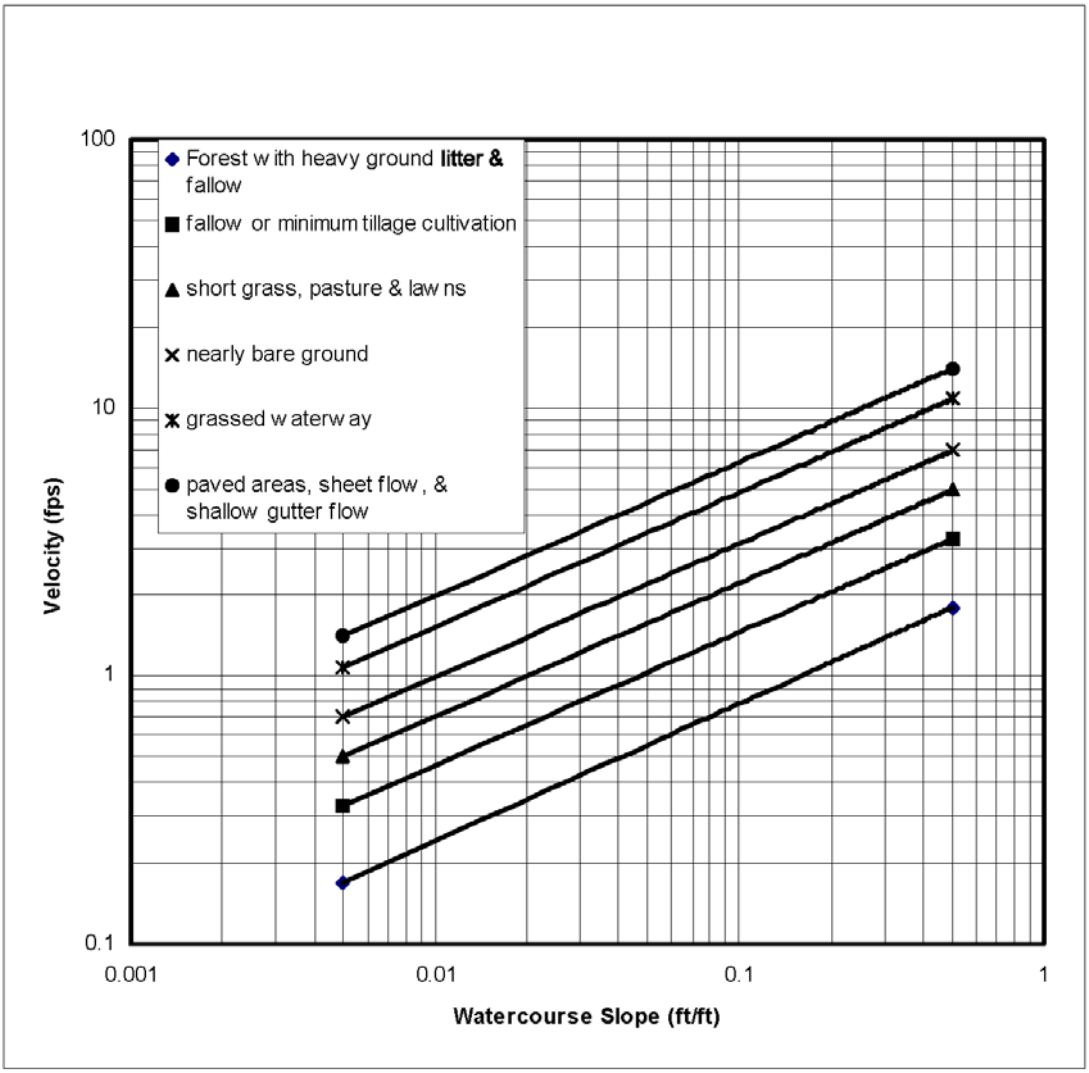
TABLE 28.28.040(a)

Figure 28.28.040: Travel Velocity for Rational Method

STORMWATER MANAGEMENT MANUAL

TRAVEL VELOCITY FOR RATIONAL METHOD



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REFERENCE: Adapted from USDA, SCS 1975. Urban Hydrology for Small Watersheds, TR 55

FIGURE 28.28.040

The overland flow length, L_o, is generally defined as the length over which the flow characteristics appear as sheet flow or very shallow flow in broad, grassed swales. Changes in land slope, surface characteristics, and small drainage ditches or gullies will tend to force the overland flow into a combined flow condition, which results in higher flow velocities and shorter travel times. Therefore, the initial flow time is limited to the time to travel a distance of 300 feet.

For watersheds longer than 300 feet, the travel time, t_t, must be added to the overland flow time. Travel time can be calculated using Manning's equation and the hydraulic properties of the storm drain, gutter, swale, ditch, or channel or can be approximated from Equation 28.28-3 and **Figure 28.28.040**:

$$V = C_v S_w^{0.5} \quad (28.28\text{-}3)$$

Where:

V = Velocity, fps

S_w = Watercourse slope, ft./ft.

C_v = Conveyance coefficient

Table 28.28.040(b): Travel Time Conveyance Coefficients

Land Surface	Conveyance Coefficient C_v
Heavy meadow	2.5
Tillage/field	5.0
Short pasture and lawns	7.0
Nearly bare ground	10
Grassed waterways	15
Paved areas and shallow swales	20

The time of concentration is then the sum of the initial flow time t_i and the travel time t_t. The minimum recommended t_c for nonurban watersheds is 10 minutes.

(Res. 40-08 (§ 703.1), 3-19-08)

28.28.050 Urbanized watersheds.

Overland flow in urbanized watersheds can occur from the back of the lot to the street, in parking lots, in greenbelt areas, or within park areas and can be calculated using the procedure described in GJMC 28.28.030. Travel time, t_t, to the first design point or inlet is often determined based on the conveyance coefficient for paved areas and shallow swales, but can be estimated using Manning's equation.

The time of concentration for the first design point in an urbanized watershed using this procedure should not exceed the time of concentration calculated using Equation 28.28-4, which was developed using rainfall/runoff data collected in urbanized regions (USDCM, 1969).

$$t_c = L / 180 + 10 \quad (28.28\text{-}4)$$

Where:

t_c = Time of concentration at the first design point (min.)

L = Watershed length (ft.)

Equation 28.28-4 may result in a lesser time of concentration at the first design point and thus would govern in an urbanized watershed. The recommended minimum t_c to the first urban design point is five minutes. For subsequent design points, the time of concentration is calculated by accumulating the travel times in downstream reaches.

(Res. 40-08 (§ 703.2), 3-19-08)

28.28.060 Precipitation losses.

Two methods for calculating precipitation losses are presented below, the SCS curve number and the Green-Ampt methods, both of which can be used for the SCS unit hydrograph method.

Land surface interception, depression storage and infiltration are referred to as precipitation losses. Interception and depression storage represent the surface storage of water by trees or grass, in local depressions in the ground surface, in cracks and crevices in parking lots or roofs, or in a surface area where water is not free to move as overland flow. Infiltration represents the movement of water through the soil beneath the land surface.

Three important factors should be noted about precipitation loss computations. First, precipitation which does not contribute to the runoff process is considered to be lost from the system. Second, the equations used to compute the losses do not provide for soil moisture or surface storage recovery (i.e., contribute to surface runoff); therefore, the calculated amount of runoff is conservatively high. Finally, precipitation losses are considered to be uniformly distributed over an entire sub-watershed.

(Res. 40-08 (§ 704), 3-19-08)

28.28.070 SCS curve number method.

The National Resources Conservation Service (NRCS, formerly SCS), U.S. Department of Agriculture, has instituted a soil classification system for use in soil survey maps across the country. Based on experimentation and experience, the agency has been able to relate the watershed characteristics of soil groups to a curve number, CN (SCS, 1985). The NRCS provides information relating soil group type to the curve number as a function of soil cover, land use type and antecedent moisture conditions, which can be determined from the soil name.

Precipitation loss is calculated based on supplied values of CN and IA, which are related to a total runoff depth for a storm by the following relationships:

$$Q = (P - IA)^2 / ((P - IA) + S) \quad (28.28\text{-}5)$$

$$S = (1{,}000 / CN) - 10 \quad (28.28\text{-}6)$$

$$IA = 0.2\ S \quad (28.28\text{-}7)$$

Where:

Q	=	Accumulated excess (in.)
P	=	Accumulated rainfall depth (in.)
IA	=	Initial abstraction (in.)
S	=	Currently available soil moisture storage deficit (in.)
CN	=	SCS curve number

Note that initial abstraction, IA, (i.e., soil surface storage capacity) is based on empirical evidence established by the NRCS, and is the default value in HEC-1 Program (HEC, 1988).

Since the SCS method results in total excess for a storm, the incremental excess (the difference between rainfall and precipitation loss) for a time period is computed as the difference between the accumulated excess at the end of the current period and the accumulated excess at the end of the previous period.

(Res. 40-08 (§ 704.1), 3-19-08)

28.28.080 CN determination.

The SCS curve number method uses a soil cover curve number (CN) for computing excess precipitation. The curve number CN is related to hydrologic soil group (A, B, C, or D), land use, treatment class (cover), and antecedent moisture condition.

The soil group is determined from published soil maps for the area, which correlates each soil name with the soil group. Land use and treatment class are determined during field visits or from aerial photographs. Procedures for determining land use and treatment class are found in Chapter 8 of National Engineering Handbook, Section 4 (SCS, 1985). Antecedent moisture condition of the watershed is explained as follows:

The amount of rainfall in a period of five to 30 days preceding a particular storm is referred to as antecedent rainfall, and the resulting condition of the watershed in regard to potential runoff is referred to as an antecedent moisture condition. In general, higher amounts of antecedent rainfall result in greater amounts of runoff from a given storm. The effects of infiltration and evapotranspiration during the antecedent period are also important, as they may increase or lessen the effect of antecedent rainfall. Because of the difficulties of determining antecedent storm conditions from data normally available, the conditions are reduced to three cases, AMC-I, AMC-II and AMC-III. For the Mesa County area, an AMC-II condition is recommended for determining storm runoff.

Having determined the soil group, land use and treatment class and the antecedent moisture condition, CN values can be determined from **Table 28.28.080**, which is reproduced from Table 2-2 in TR-55 (SCS, 1986).

When land uses shown in **Table 28.28.080** are not applicable or when more detailed land use information is available, CN values can be calculated directly from imperviousness estimates using the following equation.

$$CN = 98*Imp + X*(1-Imp) \qquad (28.28\text{-}8)$$

Where:

Imp = Imperviousness as a decimal

X = Adjustment factor based on NRCS Soil Type

NRCS Soil Type	Adjustment Factor
A	39
B	61
C	74
D	80

Note that Equation 28.28-8 was derived from the data plotted on Figure 2-3 in TR-55 (SCS 1986) and applies when impervious surfaces are connected. Adjustment for disconnected impervious surfaces can be made using Figure 2-4 in TR-55. This adjustment is not required as the connected impervious surface assumption will result in conservatively high CN values.

STORMWATER MANAGEMENT MANUAL

RUNOFF CURVE NUMBERS

Land Use or Surface Characteristic	Average Imperv. (%)	Runoff Curve Number Soil Complex A	B	C	D
Business					
Commercial Areas	85	89	92	94	95
Neighborhood Areas	70	80	87	91	93
Residential					
Single Family (note 1)	(note 1)				
Multi-unit (detached)	60	74	83	88	91
Multi-unit (attached)	75	83	89	92	94
Apartments	80	86	91	93	94
Industrial					
Light	80	86	91	93	94
Heavy	90	92	94	96	96
Parks, cemeteries	5	42	63	75	81
Playgrounds	10	45	65	76	82
Schools	50	69	80	86	89
Railroad yards	15	48	67	78	83
Irrigated Areas					
Lawns, parks, golf course	0	39	61	74	80
Agriculture	0	39	61	74	80
Undeveloped Areas					
Pre-development conditions	2	40	62	74	80
Greenbelts, agriculture	2	40	62	74	80
Off-site analysis when land use Unknown	45	66	78	85	88
Outcrops	70	80	87		94
Streets/Roads					
Paved	100	98	98	98	98
Gravel	40	63	76	84	87
Drives/Walks	90	92	94	96	96
Roofs	90	92	94	96	96

NOTE:
ESTIMATE IMPERVIOUS FROM FIGURES 28.28.020(a), 28.28.020(b), 28.28.020(c). THEN COMPUTE CURVE NUMBER, CN, FROM EQUATION 28.28-8, BASED ON NRCS SOILS TYPE. USE OF THIS TABLE IS LIMITED TO EVALUATION OF IMPERVIOUSNESS FOR FUTURE DEVELOPMENT PROJECTIONS WITHIN REGIONAL WATERSHED MASTER PLANS, OR IN CONCEPTUAL DRAINAGE PLANS.

Revision	Date
ORIGINAL ISSUE	3/27/06

WRC ENGINEERING, INC.

REFERENCE: SCS TECHNICAL RELEASE NO. 55 (1986)

TABLE 28.28.080

(Res. 40-08 (§ 704.2), 3-19-08)

28.28.090 Green and Ampt method.

The Green-Ampt method models infiltration by combining an unsaturated flow form of Darcy's law with requirements of mass conservation. The Green-Ampt method involves the simulation of rainfall loss as a two-phase process. The first phase of rainfall loss is called initial abstraction (IA) or surface retention loss, which involves vegetation interception, evaporation, and surface depression storage. Typical surface retention loss values are shown in **Table 28.28.090(a)**.

Table 28.28.090(a): Surface – Retention Loss

Land Use and/or Surface Cover	Surface Retention Loss, IA (inches)
Natural	
Desert and rangeland, flat slope	0.35
Desert hillslopes	0.15
Mountain with vegetated surface	0.25
Developed (residential/commercial)	
Lawn and turf	0.20
Desert landscape	0.10
Pavement	0.05
Agricultural, tilled fields and irrigated pasture	0.50

The second phase of the rainfall loss process is infiltration of rainfall into the soil. The infiltration is assumed to begin after the surface retention loss is completely satisfied. Excess precipitation is computed using the Green-Ampt equations after the initial loss is satisfied. Required parameters are then the hydraulic conductivity of the soil at saturation, volumetric moisture deficit at the beginning of rainfall, and wetting front capillary action.

Typical values for Green-Ampt parameters were obtained from the *Drainage Design Manual for Maricopa County Hydrology* (Maricopa County 2003 (draft)), available at:

http://www.fcd.maricopa.gov/Resources/HydrologyManual.asp.

(a) Soil Hydraulic Conductivity. The soil hydraulic conductivity is based on soil texture classification. Typical values for different soil type are listed in **Table 28.28.090(b)**. For watershed areas of subwatersheds consisting of several different soil textures, a composite value for Green-Ampt parameters should be used.

Table 28.28.090(b): Soil Hydraulic Conductivity Values (for bare ground)

Soil Texture Classification	Hydrologic Soils Group	Soil Hydraulic Conductivity (in/hr)
Loamy-sand and sand	A	1.20
Sandy-loam	B	0.40
Loam	B	0.25
Silty-loam	C	0.15
Sandy clay-loam	C	0.06
Clay-loam	D	0.04

Table 28.28.090(b): Soil Hydraulic Conductivity Values (for bare ground) (Continued)

Soil Texture Classification	Hydrologic Soils Group	Soil Hydraulic Conductivity (in/hr)
Silty clay-loam	D	0.04
Sandy-clay	D	0.02
Silty-clay	D	0.02
Clay	D	0.01

Hydraulic conductivity is affected by several factors besides soil texture, including soil crusting, tillage, ground cover, and canopy cover and should be adjusted. Ground cover, such as grass, litter, and gravel, will generally increase the infiltration rate over that of bare ground conditions. Canopy cover, such as from trees, brush, and tall grasses, also increases the bare ground infiltration rate. A simplified procedure for adjusting bare ground hydraulic conductivity to account for vegetation cover is provided in Equation 28.28-9:

$$Ck = (Vc-10)/90 + 1.0 \qquad (28.28\text{-}9)$$

Where:

Ck = Hydraulic conductivity ratio to bare ground conductivity

Vc = Vegetated cover as a percentage

(b) Volumetric Soil Moisture Deficit. The soil moisture deficit is a volumetric measure of the soil moisture-storage capacity that is available at the start of the rainfall. The volumetric moisture deficit is a function of the effective porosity of the soil and its value is in the range of near zero to the effective porosity. If the soil is saturated at the start of rainfall, then the moisture deficit equals zero. If the soil is devoid of moisture at the start of rainfall, then the moisture deficit is essentially the effective porosity of the soil.

Three conditions for soil moisture deficit have been defined for use based on the antecedent soil moisture condition that could be expected to exist at the start of the design rainfall. These three conditions are:

(1) "Dry" for antecedent soil moisture near the vegetation wilting point;

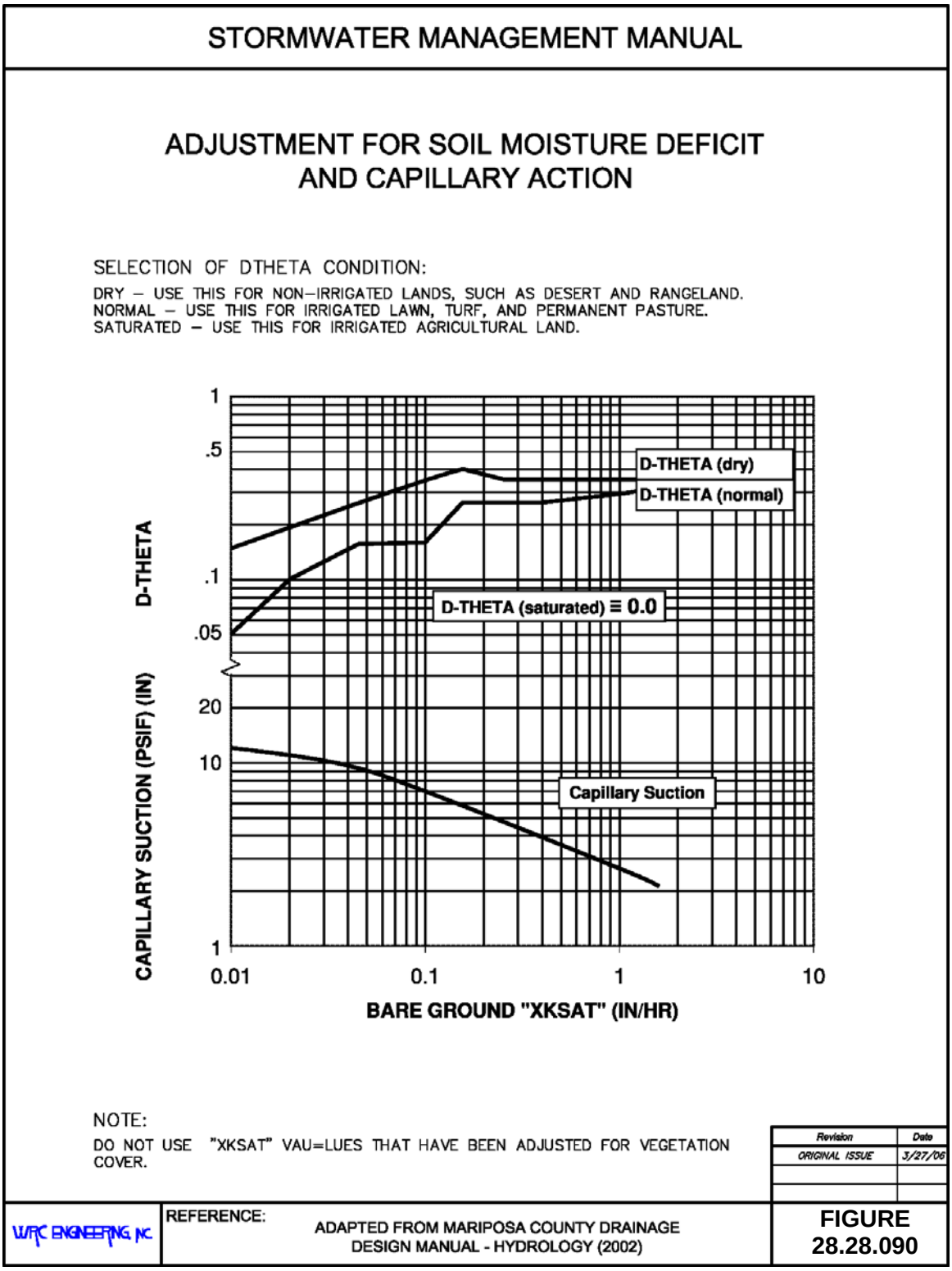
(2) "Normal" for antecedent soil moisture condition near field capacity due to previous precipitation or land irrigation; and

(3) "Saturated" for antecedent soil moisture near effective saturation due to recent precipitation or land irrigation.

Typical volumetric soil moisture deficit values for the above three defined conditions may be taken from **Figure 28.28.090**. For Mesa County, the recommended condition is "normal," which is consistent with antecedent moisture condition II.

(c) Wetting Front Capillary Action. This parameter is relatively insensitive to ground cover, and is a function of the average bare soil type hydraulic conductivity. Typical values may be taken from **Figure 28.28.090**.

Figure 28.28.090: Adjustment for Soil Moisture Deficit and Capillary Action



(Res. 40-08 (§ 704.3), 3-19-08)

28.28.100 Rational formula method.

For watersheds that are not complex and have small watershed areas, the design storm runoff may be analyzed using the rational formula method. This method is widely used due to its simplicity and level of general acceptance. The rational formula method, when properly applied in a consistent manner, results in drainage facilities sizes that adequately convey storm runoff with minimal consequences.

(a) Methodology. The rational method is based on the formula:

$$Q = CIA \qquad (28.28\text{-}10)$$

Where:

Q	=	Maximum rate of runoff in cubic feet per second (cfs)
C	=	Runoff coefficient
I	=	Average intensity of rainfall in inches per hour
A	=	Contributing watershed area in acres

(b) Assumptions. The basic assumptions made when applying the rational formula method are as follows:

(1) The computed maximum rate of runoff to the design point is a function of the average rainfall rate during the time of concentration to that point.

(2) The maximum rate of rainfall occurs during the time of concentration, and the design rainfall depth during the time of concentration is converted to the average rainfall intensity for the time of concentration.

(3) The maximum runoff rate occurs when the entire area is contributing flow.

(c) Limitations on Methodology. The rational formula method adequately estimates the peak rate of runoff from a rainstorm in a given watershed, but does not provide information on the full hydrograph and only approximates the runoff volume.

Typical design procedures assume that all of the design flow is collected at the design point and that there is no carry-over water running overland to the next design point. The problem becomes one of routing the surface and subsurface hydrographs which have been separated by the storm drain system. In general, this sophistication is not warranted and a conservative assumption is made that the entire routing occurs through the storm drain system when the system is present.

Because of the limitations of the rational method, the following guidelines on its application are provided:

(1) The individual sub-watershed sizes should not be greater than 20 acres.

(2) The aggregate of all sub-watershed areas should not be greater than 160 acres.

(3) The sub-watersheds should be reasonably homogeneous for existing and for projected land use.

(d) Rainfall Intensity. The rainfall intensity, I, is the average rainfall rate in inches per hour for the period of maximum rainfall of a given frequency having a duration equal to the time of concentration. Development of rainfall intensities for the rational method is described in Chapter 28.24 GJMC.

(e) Runoff Coefficient. The runoff coefficient, C, represents the integrated effects of infiltration, evaporation, retention, flow routing, and interception, all of which affect the time distribution and peak

rate of runoff. Determination of the coefficient requires judgment and understanding on the part of the engineer.

The first step is to determine the composite imperviousness of the watershed using recommended values in **Table 28.28.020**. Once the imperviousness is determined, recommended C values for various recurrence interval storms are determined from **Table 28.28.090** or can be calculated using the following equations:

$$C_{CD} = K_{CD} + (0.858*i^3 - 0.786*i^2 + 0.774*i + 0.04) \quad (28.28\text{-}11)$$

$$C_A = K_A + (1.31*i^3 - 1.44*i^2 + 1.135*i - 0.12) \quad (28.28\text{-}12)$$

$$C_B = (C_A + C_{CD})/2 \quad (28.28\text{-}13)$$

Where:

C_{CD}	=	Runoff coefficient for C and D soils*
C_A	=	Runoff coefficient for A soils*
C_B	=	Runoff coefficient for B soils*
i	=	Imperviousness as a decimal
K_{CD}	=	Coefficient adjustment for C and D soils
K_A	=	Coefficient adjustment for A soils

*If C is not greater than or equal to zero, it should be set to zero.

Table 28.28.100: Adjustment Factors for Runoff Coefficient Equations (values of K_A and K_{CD} based on rainfall intensity (i) in inches/hour)

NRCS Soil	2-year	5-year	10-year	25-year	50-year	100-year
C and D	0	-0.10i+0.11	-0.18i+0.21	-0.28i+0.33	-0.33i+0.40	-0.39i+0.46
A	0	-0.08i+0.09	-0.14i+0.17	-0.19i+0.24	-0.22i+0.28	-0.25i+0.32

Composite imperviousness is computed on the basis of the percentage of different types of surfaces or land uses in the watershed area. This procedure is often applied to typical sample blocks as a guide to selection of reasonable values of the coefficient for an entire area.

The equations for runoff coefficients as a function of imperviousness and recurrence interval were obtained from the *Urban Storm Drainage Criteria Manual* by the Urban Drainage and Flood Control District (UDFCD 2001), which can be obtained in .pdf format on the following website:

http://www.udfcd.org/

(f) Application of the Rational Formula Method. The first step in applying the rational formula method is to obtain a topographic map and define the boundaries of all the relevant watersheds. Watersheds to be defined include all watersheds tributary (i.e., off-site areas) to the area of study and sub-watersheds in the study area. A field check is recommended and field surveys may be required in some cases. At this stage of planning, the possibility for the diversion of watershed runoff should be identified.

The major storm watershed does not always coincide with the minor storm watershed. This is often the case in urban areas where a low flow will stay within the gutter and follow the lowest grade, but when a large flow occurs, the flow will be sufficiently deep or flowing with a high velocity such that part of the runoff will overflow street crown and flow into a new sub-watershed.

(g) Major Storm Analysis. When analyzing the major runoff occurring on an area that has a storm drain system sized for the minor storm, care must be used when applying the rational formula method. Normal application of the rational formula method assumes that all of the runoff is collected by the storm drain. For the minor storm design, the time of concentration is dependent upon the flow time in the drain. However, during the major storm runoff, the drains will probably be at capacity and could not carry the additional water flowing to the inlets. This additional water then flows overland past the inlets, generally at a lower velocity than the flow in the storm drains.

If a separate time of concentration analysis is made for the pipe flow and surface flow, a time lag between the surface flow peak and the pipe flow peak will occur. This lag, in effect, will allow the pipe to carry a larger portion of the major storm runoff than would be predicted using the minor storm time of concentration. The basis for this increased benefit is that the excess water from one inlet will flow to the next inlet downhill, using the overland route. If that inlet is also at capacity, the water will often continue on until capacity is available in the storm drain. The analysis of this aspect of the interaction between the storm drain system and the major storm runoff is complex. The simplified and conservative approach of using the minor storm time of concentration for all frequency analyses is acceptable for the Mesa County area.

(Res. 40-08 (§ 705), 3-19-08)

28.28.110 SCS unit hydrograph method.

The SCS unit hydrograph was derived from a large number of natural unit hydrographs from watersheds varying widely in size and geographic location.

(a) Methodology. The SCS unit hydrograph method, which uses the unit hydrograph theory as a basis for runoff computations, computes a hydrograph for a unit amount of rainfall excess applied uniformly over a sub-watershed for a given unit of time (or unit duration). The rainfall excess hydrographs are then transformed to a sub-watershed hydrograph by superimposing each excess hydrograph lagged by the unit duration.

The shape of the SCS unit hydrograph is based on studies of various natural unit hydrographs. The basic governing parameters of this curvilinear hydrograph are as follows:

(1) The time-to-peak, T_p, of the unit hydrograph approximately equals 0.2 times the time-of-base, T_b.

(2) The point of inflection of the falling leg of the unit hydrograph approximately equals 1.7 times T_p.

(b) Assumptions. The basic assumptions made when applying the SCS unit hydrograph method (and all other unit hydrograph methods) are as follows:

(1) The effects of all physical characteristics of a given watershed are reflected in the shape of the storm runoff hydrograph for that watershed.

(2) At a given point on a stream, discharge ordinates of different unit graphs of the same unit time of rainfall excess are mutually proportional to respective volumes.

(3) A hydrograph of storm discharge that would result from a series of bursts of excess rain or from continuous excess rain of variable intensity may be constructed from a series of overlapping unit graphs each resulting from a single increment of excess rain of unit duration.

(c) Lag Time. Input data for the SCS dimensionless unit hydrograph method (SCS, 1985) consists of a single parameter, T_{LAG}, which is equal to the lag (in hours) between the center of mass of rainfall excess and the peak of the unit hydrograph.

For small watersheds (less than one square mile) in the Mesa County area, the lag time is related to the time of concentration, t_c, by the following empirical relationship:

$$T_{LAG} = 0.6\ t_c \quad (28.28\text{-}14)$$

Where:

T_{LAG} = The time (hours) between the center of mass of the rainfall excess and the peak of the unit hydrograph.

t_c = The time of concentration (minutes, see GJMC 28.28.030 through 28.28.050).

For large watersheds (greater than one square mile), the lag time (and t_c) is generally governed mostly by the concentrated flow travel time, not the initial overland flow time. In addition, as the watershed gets increasingly larger, the average flow velocity (and associated travel time) becomes more difficult to estimate. Therefore, for these watersheds, the following lag equation is recommended for use in computing T_{LAG}:

$$T_{LAG} = 22.1\ K_n\ (L\ L_c / S^{0.5})^{0.33} \quad (28.28\text{-}15)$$

Where:

K_n = Manning's roughness factor for the watershed channels

L = Length of longest watercourse (miles)

L_c = Watercourse length from the outflow point to a point on the channel nearest the centroid of the watershed (miles)

S = Average slope of the longest watercourse (feet per mile)

This lag equation is based on the United States Bureau of Reclamation's (USBR) analysis of the above parameters for several watersheds in the Southwest desert, Great Basin, and Colorado Plateau area (USBR, 1989). This equation was developed by converting the USBR's S-graph lag equation to a dimensionless unit hydrograph lag equation.

For watersheds 1.0 square miles in size, it is recommended that the method which results in the shortest T_{LAG} value be used to be conservative.

(d) Roughness Factor. For consistency, recommended roughness factors, K_n, used in the lag time calculation are presented in **Table 28.28.110**. These factors are based on roughness factor analysis by the USACE (1982) and USBR (1989) as compared to the typical watershed channels found in the Mesa County area. The reader is referred to these documents for further discussion on selection of a proper roughness factor. For multiple land uses within a watershed, composite roughness factors should be determined.

Table 28.28.110: Lag Equation Roughness Factors

Land Use	Imperviousness %	K_n
Commercial, industrial, office and business	70 – 85	0.05
Residential		
Rural	10 – 15	0.08
Low density	20 – 25	0.07
Medium and high density	30 – 65	0.05
Irrigated grass, golf courses, parks and cemeteries	0 – 5	0.10

Table 28.28.110: Lag Equation Roughness Factors (Continued)

Land Use	Imperviousness %	K_n
Undeveloped areas:		
Rock outcroppings		0.04
Irrigated agriculture		0.10
Rangelands:		
Grass lands		0.08
Grass and shrubs		0.09
Shrub and brush		0.10
Forest, evergreen		0.15

(e) Unit Storm Duration. The minimum unit duration, Δt, is dependent on the time of concentration of a given watershed. As a general rule, the unit storm duration, Δt, should be no greater than $T_c/3$. For small watersheds (i.e., less than one square mile), the recommended duration is five minutes. For larger watersheds, larger unit durations may be used, but should not exceed 15 minutes.

(f) Sub-Watershed Sizing. The determination of the peak rate of runoff at a given design point is affected by the number of sub-watersheds within a larger watershed. Typically, the more discrete the analysis of a given watershed (more sub-watersheds), the more representative the resulting peak flow is of actual runoff conditions. The improved predictive capability of multiple sub-watersheds is due to better homogeneity of the sub-watershed characteristics, as compared to analysis of the watershed with no sub-watersheds. Recommended guidelines are:

(1) For watersheds up to 100 acres in size, the maximum sub-watershed size should be approximately 20 acres.

(2) For watersheds over 100 acres in size, increasingly larger sub-watersheds may be used as long as the land use and surface characteristics within each sub-watershed are homogeneous. In addition, the sub-watershed sizing should be consistent with the level of detail needed to determine peak flow rates at various design points within a given watershed.

(Res. 40-08 (§ 706), 3-19-08)

28.28.120 Channel routing of hydrographs.

Whenever a large or a nonhomogeneous watershed is being investigated, the watershed should be divided into smaller and more homogeneous sub-watersheds. The storm hydrograph for each sub-watershed is then routed through the channel and combined with individual sub-watershed hydrographs to develop a storm hydrograph for the entire watershed. For hydrograph routing, the Muskingum, kinematic wave, and Muskingum-Cunge methods are recommended for use in the Mesa County area.

The kinematic wave method is recommended when the watershed has well defined channels. The Muskingum-Cunge method is recommended for poorly defined channels that have cross-sections that can be determined from detailed topography or from a cross-section survey, otherwise the Muskingum method is recommended.

(a) Muskingum Method. The Muskingum method estimates some channel storage effects and, as a result, the storm hydrograph shape is modified in translation along a channel reach. The basic equation for the Muskingum method as described by HEC-1 (HEC, 1988) is as follows:

$$O_2 = (C_1 - C_2)I_1 + (1 - C_1)O_1 + C_2I_2 \qquad (28.28\text{-}16)$$

Where:

O_2	=	Outflow from the reach at the end of the unit time increment (beginning of the next time increment)
O_1	=	Outflow from the reach at the beginning of the time increment
I_1	=	Inflow into the reach at the beginning of the time increment
I_2	=	Inflow into the reach at the end of the time increment
C_1, C_2	=	Coefficients defined in Equations 28.28-17 and 28.28-18, respectively

And

$$C_1 = (2\Delta t)/[2K(1-X)] + \Delta t \quad (28.28\text{-}17)$$

$$C_2 = (\Delta t-2KX)/[2K(1-X)] + \Delta t \quad (28.28\text{-}18)$$

$$K = L/(3{,}600V) \quad (28.28\text{-}19)$$

Where:

K	=	Muskingum storage time constant in hours
L	=	Channel reach length in feet
V	=	Translation velocity in fps
Δt	=	Unit time increment in hours
X	=	Muskingum weighting factor

The velocity used in Equation 28.28-19 is the wave velocity, which can be estimated for various channel shapes as a function of average velocity, V, for steady uniform flow using Manning's equation. The approximate wave velocities for different channel shapes are provided below:

Wave Velocities for Muskingum Method

Channel Shape	Wave Velocity
Wide rectangular	5/8 V
Triangular	4/3 V
Wide parabolic	11/9 V

Where V is the velocity from application of the Manning's equation.

The weighting factor (X) in the Muskingum routing method accounts for the peak flow reduction caused by channel routing. The weighting factor generally varies from 0.0 to 0.5, with 0.0 representing a reservoir type peak reduction and 0.5 representing no peak reduction.

Weighting Factors for Muskingum Method

Channel Condition	Weighting Factor "X"
Some storage in over bank but few obstructions (i.e., alluvial fans)	0.15
Overbanks with severe obstruction	0.10

The reader is referred to the USBR Flood Hydrology Manual (USBR, 1989) for further discussion on the selection of an appropriate Muskingum weighting factor (X).

The storage constant (K) in the Muskingum routing method accounts for the peak flow translation along a channel reach. This constant is therefore directly related to the reach length and the mean channel flow velocity as shown in Equation 28.28-19. An estimate of the mean channel flow velocity may be obtained using Manning's formula with the hydraulic radius estimated as being equal to the flow depth. The flow depth (and thus channel flow velocity) is estimated based on the channel cross-sectional shape and the design discharge for the selected flood frequency.

The routing procedure may be repeated for several sub-reaches so the total travel time through the reach is equal to K. To ensure the method's computational stability and the accuracy of computed hydrograph, the routing reach should be chosen so that:

$$1/[2(1-X)] \leq K/(\Delta T \cdot NSTPS) \leq 1/(2X) \qquad (28.28\text{-}20)$$

Where ΔT is the time increment in hours.

(b) Kinematic Wave Method. In the kinematic wave interpretation of the equations of motion, it is assumed that the bed slope and water surface slope are equal and acceleration effects are negligible.

Thus flow at any point in the channel can be computed from Manning's formula:

$$Q = (1.486/n)\, R^{2/3}\, S_o^{1/2}\, A \qquad (28.28\text{-}21)$$

Where:

Q	=	Flow rate, cfs
R	=	Hydraulic radius, ft.
S_o	=	Channel bed slope, ft./ft.
A	=	Cross-sectional area, square feet
n	=	Manning's resistance factor

Equation 28.28-21 can be simplified to:

$$Q = \alpha A^m \qquad (28.28\text{-}22)$$

Where α and m are related to flow geometry and surface roughness. This is the form of the equation used to route hydrographs through channels.

The kinematic wave method in HEC-1 does not allow for explicit separation of main channel and overbank areas. Therefore, a flood wave routed by the kinematic wave technique through a channel reach is translated, but does not attenuate (although a small degree of attenuation is introduced by the finite difference solution). Consequently, the kinematic wave routing technique is most appropriate in channels where flood wave attenuation is not significant, as is typically the case in urban areas. Otherwise, flood wave attenuation can be modeled empirically by using the Muskingum method or other applicable storage routing techniques.

(c) Muskingum-Cunge Method. The Muskingum-Cunge routing method is similar to the Muskingum method, but is a physically based method whose parameters are determined from actual channel characteristics. Because it does not require calibration to streamflow data, it is suited for use in ungaged watersheds. One limitation to the use of Muskingum-Cunge routing is that this method does not account for backwater and storage in the channel.

Muskingum-Cunge routing is based on wave diffusion theory and is nonlinear in nature. In Muskingum-Cunge routing, the amount of diffusion is matched to physical diffusion determined using physical channel characteristics. This is compared to Muskingum routing which uses the X parameter to control diffusion without any relation to physical channel characteristics. Additional detail about the theory behind the Muskingum-Cunge routing method is presented in the HEC-1 User's Manual (HEC, 1990).

Data required for use with HEC-1 include representative channel cross-section, reach length, Manning's roughness coefficients for main channel and overbanks, and channel bed slope.

The representative channel cross-sections are not limited to the standard prismatic shapes required for kinematic wave routing so eight-point cross-sections can be used to define the channel and overbanks as with normal-depth storage routing.

The results obtained using Muskingum-Cunge routing in HEC-1 should be checked for reasonableness. The increments of time and distance selected internally by HEC-1 and used in the finite-difference computation can affect the accuracy of the results.

(Res. 40-08 (§ 707), 3-19-08)

28.28.130 Reservoir routing of hydrographs.

Storm runoff detention is required for new development (GJMC 28.16.090) and therefore detention reservoirs will be required (see Chapter 28.56 GJMC). In some instances, the sizing of the detention storage will be based upon hydrograph storage routing techniques rather than direct calculation of volume and discharge requirements. The modified Puls methodology for reservoir routing, which is computerized in the HEC-1 and other programs, is recommended.

The procedure for the original Puls method was developed in 1928 by L.G. Puls of the United States Army Corps of Engineers (USACE). The method was modified in 1949 by the USBR simplifying the computational and graphic requirements. The method is also referred to as the storage indication or Goodrich Reservoir routing method. The differences, if any, are mainly in the form of the equation and means of initializing the routing. The procedures presented herein were obtained from Hydrology for Engineers (Linsley, 1975).

The principle of mass continuity for a channel reach can be expressed by the equation:

$$(I-D)\Delta t = \Delta S \qquad (28.28\text{-}23)$$

I is the inflow rate, D is the discharge rate, Δt is the time interval, and ΔS is the change in storage. If the average rate of flow during a given time period is equal to the average of the flows at the beginning and end of the period, the equation can be expressed as follows:

$$(I_1 + I_2)\,\Delta t / 2 - (D_1 + D_2)\,\Delta t / 2 = S_2 - S_1 \qquad (28.28\text{-}24)$$

Where the subscripts 1 and 2 refer to the beginning and end of time period t. Rearranging the equation gives the following form used for the modified Puls method:

$$I_1 + I_2 + ({}_2S_1 / \Delta t - D_1) = ({}_2S_2 / \Delta t + D_2) \qquad (28.28\text{-}25)$$

(Res. 40-08 (§ 708), 3-19-08)

Chapter 28.32

OPEN CHANNELS

Sections:

28.32.010 Introduction.
28.32.020 Parameters and terms commonly used in open channel analysis and design.
28.32.030 General open channel flow.
28.32.040 Uniform flow computation.
28.32.050 Critical flow computation.
28.32.060 Design procedures – Subcritical flow.
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28.32.080 Design procedures – Superelevation.
28.32.090 Transitions.
28.32.100 Types of open channels and their selection.
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28.32.120 Channel morphology.
28.32.130 Channel restoration.
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28.32.150 Channel type selection.
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28.32.280 Grass-lined channels.
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28.32.310 Design criteria – Concrete-lined channels.
28.32.320 Design criteria – Other channel linings.
28.32.330 Design standards for minor artificial drainageways.
28.32.340 Channel appurtenances.
28.32.350 Example application.

28.32.010 Introduction.

Presented in this chapter are the technical criteria and design standards for hydraulic evaluation and design of open channels (natural and artificial). Open channel flow can be extremely complex, and often entire textbooks are devoted to the subject. Discussions and hydraulic standards are provided for different channel types that are most likely to be found in Mesa County.

The ultimate responsibility for the design of a safe and stable channel rests with the professional design engineer. A good understanding of the site conditions is vital to the production of a stable channel design. The information presented in this chapter must be considered to be the minimum standards upon which channel evaluation and design shall be based. Additional analysis that goes beyond the scope of this man-

ual may be necessary for unique or unusual channel conditions. For additional information, the users of this manual are encouraged to refer to other textbooks and technical publications addressing this subject.

(Res. 40-08 (§ 801), 3-19-08)

28.32.020 Parameters and terms commonly used in open channel analysis and design.

Several terms and parameters are used and must be understood when analyzing open channel flows. These are described below.

Area (A). The area always means the cross-sectional area of the flow, and is measured perpendicular to the direction of flow.

Critical depth (dc). This refers to the depth of flow under critical flow conditions.

Critical flow. This refers to flow at critical depth or velocity, where the specific energy is a minimum for a given discharge. Critical flow is very unstable.

Critical slope. This refers to the slope which, for a given cross-section and flow rate, results in critical flow.

Critical velocity. This refers to the velocity of flow under critical flow conditions.

Depth (d). If not specified otherwise, depth of flow refers to the maximum depth of water in the cross-section.

Energy grade line (EGL). The grade line of the water surface profile plus the velocity head, or the specific energy line.

Froude number (Fr). This is a dimensionless number, equal to the ratio of the velocity of flow to the velocity of very small gravity waves, the latter being equal to the square root of the product of the acceleration of gravity and the flow depth, or:

$$Fr = \frac{V}{\left(\frac{gA}{T}\right)^{0.5}} = \frac{V}{(gDh)^{0.5}} \qquad (28.32\text{-}1)$$

Where:

Fr<1.0, flow is subcritical;

Fr = 1.0, flow is critical; and

Fr>1.0, flow is supercritical

V = velocity (fps)

A = cross-sectional area of flow (sf)

T = top width of flow (ft.)

Dh = hydraulic depth (ft.)

Gradually varied flow. Varied flow in which the depth does not change abruptly over a comparatively short distance.

Hydraulic depth (Dh). The hydraulic depth is the ratio of area in flow to the width of the channel at the fluid surface, or Dh=A/T.

Hydraulic grade line (HGL). In an open channel, the hydraulic grade line is the profile of the free water surface.

Hydraulic gradient (Hg). The slope of the hydraulic grade line is the profile of the free water surface.

Hydraulic radius (Rh). The hydraulic radius is the cross-sectional area of flow divided by the wetted perimeter, or Rh=A/Pw.

Normal depth. When the flow depth is constant along a channel reach; that is, when neither the flow depth nor velocity is changing, the depth is said to be normal.

Slope (S). Slope may refer to the channel bed, the hydraulic grade line, or energy grade line.

Surface spread (T). The surface spread is the width at the top of the flow, measured perpendicular to the flow direction.

Uniform flow. Uniform flow occurs when flow has a constant water area, depth, discharge, and average velocity through a reach of channel.

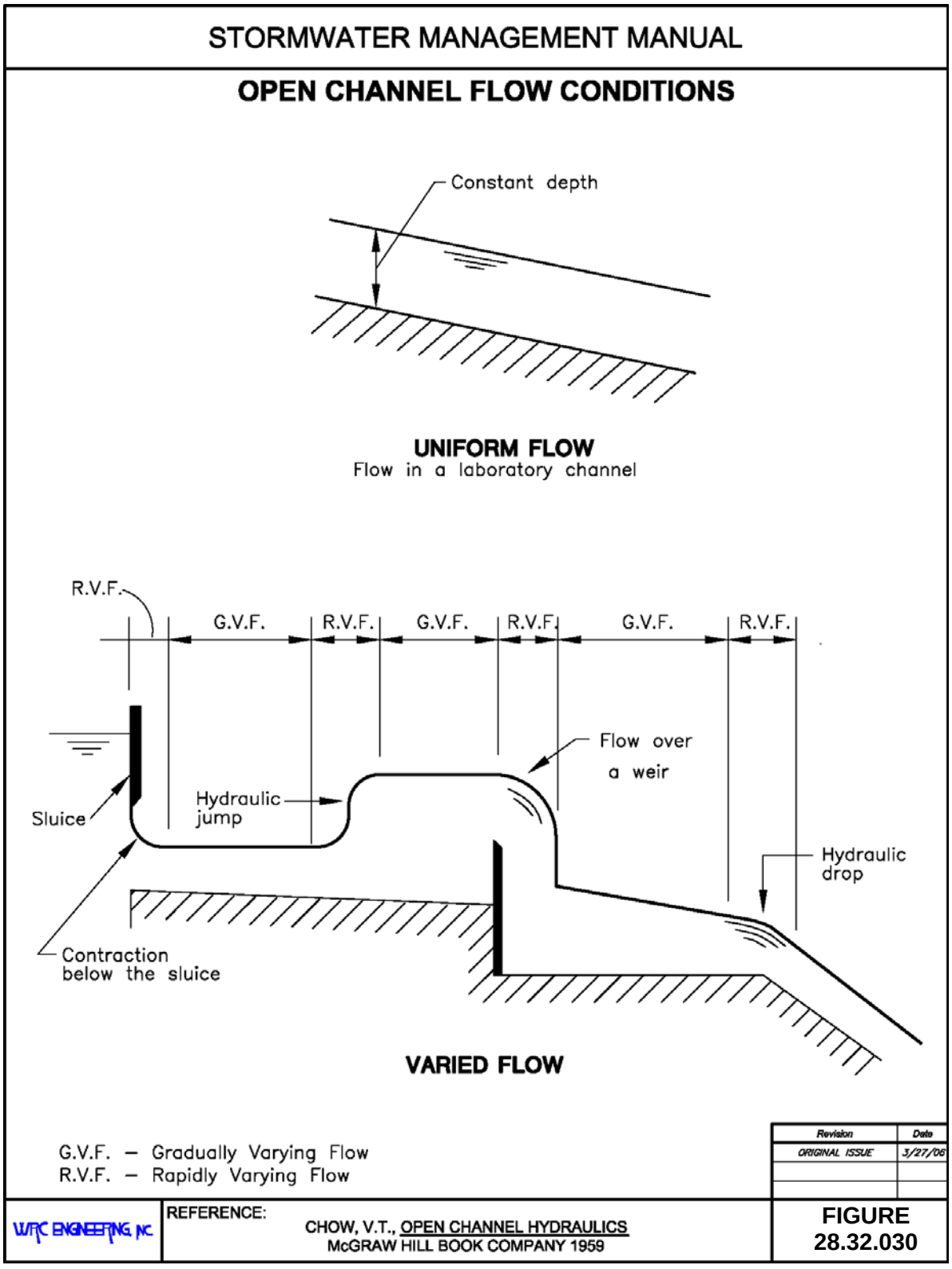
Wetted perimeter (Pw). The wetted perimeter is the portion of the perimeter of a flow conveyance facility that is in contact with the flowing water.

(Res. 40-08 (§ 802), 3-19-08)

28.32.030 General open channel flow.

Any water flow that is conveyed in such a manner that top surface is exposed to the atmosphere is defined as open channel flow. This type of flow occurs in all channel types described in GJCM 28.32.100 including canals, ditches, drainage channels, culverts, and pipes under partially full flow conditions. The hydraulics of an open channel can be very complex, encompassing many different flow conditions from steady-state uniform flow to unsteady, rapidly varying flow. Most of the problems in stormwater drainage involve uniform, gradually varying or rapidly varying flow states. Examples of these flow conditions are illustrated in **Figure 28.32.030**. Steady uniform flow is most commonly treated flow in open channel hydraulics, in which the depth of flow remains constant over the time interval studied. The calculations for uniform and gradually varying flow are relatively straightforward and are based upon similar assumptions (e.g., parallel streamlines). Rapidly varying flow computations (e.g., hydraulic jumps and flow over spillways), however, can be very complex, and the solutions are generally empirical in nature.

Presented in this chapter are the basic equations and computational procedures for uniform, gradually varying and rapidly varying flow. The user is encouraged to review the many hydraulics textbooks written on this subject.



(Res. 40-08 (§ 803), 3-19-08)

28.32.040 Uniform flow computation.

Open-channel flow is uniform if the depth of flow is the same at every section of the channel. For a given channel geometry, roughness, discharge and slope, there is only one possible depth for maintaining uniform flow. This depth is referred to as the "normal depth." For uniform flow within a prismatic channel (i.e., uniform cross-section), the water surface will be parallel to the channel bottom. While uniform flow rarely occurs in nature and is difficult to achieve in a laboratory, a uniform-flow approximation is generally adequate for planning and design purposes.

The computation of uniform flow and normal depth shall be based upon the Manning or uniform flow equation:

$$Q = \frac{1.49}{n} A^{5/3} P^{-2/3} \sqrt{S} = \frac{1.49}{n} A R^{2/3} \sqrt{S} \qquad (28.32\text{-}2)$$

Where:

Q	=	flow rate ($ft.^3/s$)
n	=	Manning roughness coefficient
A	=	area ($ft.^2$)
P	=	wetted perimeter (ft.)
R	=	hydraulic radius, R = A/P (ft.)
S	=	slope of the energy grade line (ft./ft.)

For prismatic channels, the energy grade line (EGL), hydraulic grade line (HGL), and the bottom can be assumed parallel for uniform, normal depth flow conditions.

The variables dependent on channel cross-section geometry (i.e., area and hydraulic radius) can be lumped together as the conveyance (K) of the channel. This simplifies the uniform flow equation to the following expression:

$$Q = K\sqrt{S} \qquad (28.32\text{-}3)$$

Table 28.32.040(a) presents equations for calculating many of the parameters required for hydraulic analysis of different uniform channel sections.

Tables 28.32.040(b), **28.32.040(c)**, **28.32.040(d)**, and **28.32.040(e)** provide a list of Manning roughness coefficient values for many types of conditions that may occur in Mesa County. The uniform flow equation and its constituent parameters are readily computed using handheld calculators and personal computers.

STORMWATER MANAGEMENT MANUAL

GEOMETRIC ELEMENTS OF CHANNEL SECTIONS

GEOMETRIC ELEMENTS OF CHANNEL SECTIONS

SECTION	AREA, A	WETTED PERIMETER, P	HYDRAULIC RADIUS, R	TOP WIDTH, T	HYDRAULIC DEPTH, D	SECTION FACTOR, Z
Rectangle	by	$b+2y$	$\frac{by}{b+2y}$	b	y	$by^{1.5}$
Trapezoid	$(b+zy)y$	$b+2y\sqrt{1+z^2}$	$\frac{(b+zy)y}{b+2y\sqrt{1+z^2}}$	$b+2zy$	$\frac{(b+zy)y}{b+2zy}$	$\frac{[(b+zy)y]^{1.5}}{\sqrt{b+2zy}}$
Triangle	zy^2	$2y\sqrt{1+z^2}$	$\frac{zy}{2\sqrt{1+z^2}}$	$2zy$	$\frac{y}{2}$	$\frac{\sqrt{2}}{2}zy^{2.5}$
Circle	$\frac{1}{8}(\theta-\sin\theta)d_0^2$	$\frac{1}{2}\theta d_0$	$\frac{1}{4}\left(1-\frac{\sin\theta}{\theta}\right)d_0$	$(\sin\frac{1}{2}\theta)d_0$ or $2\sqrt{y(d_0-y)}$	$\frac{1}{8}\left(\frac{\theta-\sin\theta}{\sin\frac{1}{2}\theta}\right)d_0$	$\frac{\sqrt{2}}{32}\frac{(\theta-\sin\theta)^{1.5}}{(\sin\frac{1}{2}\theta)^{0.5}}d_0^{2.5}$
Parabola	$\frac{2}{3}Ty$	$T+\frac{8}{3}\frac{y^2}{T}$ *	$\frac{2T^2y}{3T^2+8y^2}$ *	$\frac{3}{2}\frac{A}{y}$	$\frac{2y}{3}$	$\frac{3}{8}\sqrt{6}\,Ty^{1.5}$
Round-cornered rectangle ($y>r$)	$\left(\frac{\pi}{2}-2\right)r^2+(b+2r)y$	$(\pi-2)r+b+2y$	$\frac{(\pi/2-2)r^2+(b+2r)y}{(\pi-2)r+b+2y}$	$b+2r$	$\frac{(\pi/2-2)r^2}{b+2r}+y$	$\frac{[(\pi/2-2)r^2+(b+2r)y]^{1.5}}{\sqrt{b+2r}}$
Round-bottom triangle	$\frac{T^2}{4z}-\frac{r^2}{z}(1-z\cot^{-1}z)$	$\frac{T}{z}\sqrt{1+z^2}-\frac{2r}{z}(1-z\cot^{-1}z)$	$\frac{A}{P}$	$2[z(y-r)+r\sqrt{1+z^2}]$	$\frac{A}{T}$	$A\sqrt{\frac{A}{T}}$

*Satisfactory approximation for the interval $0<x\leq 1$, where $x=4y/T$. When $x>1$, use the exact expression $P=(T/2)[\sqrt{1+x^2}+1/x\ln(x+\sqrt{1+x^2})]$

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TABLE 28.32.040(a)

STORMWATER MANAGEMENT MANUAL

TYPICAL ROUGHNESS COEFFICIENTS FOR OPEN CHANNELS

TYPE OF CHANNEL AND DESCRIPTION	MINIMUM	NORMAL	MAXIMUM
EXCAVATED OR DREDGED			
a. Earth, straight and uniform			
1. Clean, recently completed	0.016	0.018	0.020
2. Clean, after weathering	0.018	0.022	0.025
3. Gravel, uniform section, clean	0.022	0.025	0.030
4. With short grass, few weeds	0.022	0.027	0.033
b. Earth, winding and sluggish			
1. No vegetation	0.023	0.025	0.030
2. Grass, some weeds	0.025	0.030	0.033
3. Dense weeds or aquatic plans in deep channels	0.030	0.035	0.040
4. Earth bottom and rubble sides	0.028	0.030	0.035
5. Stony bottom and weedy banks	0.025	0.035	0.040
6. Cobble bottom and clean sides	0.030	0.040	0.050
c. Dragline-excavated or dredged			
1. No vegetation	0.025	0.028	0.033
2. Light brush on banks	0.035	0.050	0.060
d. Rock cuts			
1. Smooth and uniform	0.025	0.035	0.040
2. Jagged and irregular	0.035	0.040	0.050
e. Channels not maintained, weeds and brush			
1. Dense weeds, high as flow depth	0.050	0.080	0.120
2. Clean bottom, brush on sides	0.040	0.050	0.080
3. Same as above, but highest state of flow	0.045	0.070	0.110
4. Dense brush, high state	0.080	0.100	0.140

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TABLE 28.32.040(b)

STORMWATER MANAGEMENT MANUAL

TYPICAL ROUGHNESS COEFFECIENTS FOR OPEN CHANNELS

TYPE OF CHANNEL & DESCRIPTION	MINIMUM	NORMAL	MAXIMUM
Brass, smooth	0.009	0.010	0.013
Steel:			
Lockbar and welded	0.010	0.012	0.014
Riveted and spiral	0.013	0.016	0.017
Cast Iron:			
Coated	0.010	0.013	0.014
Uncoated	0.011	0.014	0.016
Wrought Iron:			
Black	0.012	0.014	0.015
Galvanized	0.013	0.016	0.017
Corrugated Metal:			
Sub-drain	0.017	0.019	0.021
Storm Drain	0.021	0.024	0.030
Lucite	0.008	0.009	0.010
Glass	0.009	0.010	0.013
Cement:			
Neat, surface	0.010	0.011	0.013
Mortar	0.011	0.013	0.015
Concrete:			
Culvert, straight and free of debris	0.010	0.011	0.013
Culvert with bends, connections, and some debris	0.011	0.013	0.014
Finished	0.011	0.012	0.014
Sewer with manholes, inlet, etc., straight	0.013	0.015	0.017
Unfinished, steel form	0.012	0.013	0.014
Unfinished, smooth wood form	0.012	0.014	0.016
Unfinished, rough wood form	0.015	0.017	0.020
Wood:			
Stave	0.010	0.012	0.014
Laminated, treated	0.015	0.017	0.020
Clay:			
Common drainage tile	0.011	0.013	0.017
Vitrified sewer	0.011	0.014	0.017
Vitrified sewer with manholes, inlet, etc.	0.013	0.015	0.017
Vitrified subdrain with open joint	0.014	0.016	0.018
Brickwork:			
Glazed	0.011	0.013	0.015
Lined with cement mortar	0.012	0.015	0.017
Sanitary sewers coated with sewage slime with bends and connections	0.012	0.013	0.016
Paved invert, sewer, smooth bottom	0.016	0.019	0.020
Rubble masonry, cemented	0.018	0.025	0.030

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TABLE 28.32.040(c)

STORMWATER MANAGEMENT MANUAL

TYPICAL ROUGHNESS COEFFICIENTS FOR OPEN CHANNELS

TYPE OF CHANNEL AND DESCRIPTION	MINIMUM	NORMAL	MAXIMUM
LINED OR BUILT-UP CHANNELS			
a. CONCRETE			
1. TROWEL FINISH	0.011	0.013	0.015
2. FLOAT FINISH	0.013	0.015	0.016
3. GUNITE, GOOD SECTION	0.016	0.019	0.023
4. GUNITE, WAVY SECTION	0.018	0.022	0.023
b. CONCRETE BOTTOM FLOAT FINISHED WITH SIDE OF			
1. DRESSED STONE IN MORTAR	0.015	0.017	0.020
2. RANSOM STONE IN MORTAR	0.017	0.020	0.024
3. DRY RUBBLE OR RIPRAP	0.020	0.030	0.035
c. GRAVEL BOTTOM WITH SIDES OF			
1. FORMED CONCRETE	0.017	0.020	0.025
2. RANDOM STONE IN MORTAR	0.020	0.023	0.026
3. DRY RUBBLE OR RIPRAP	0.023	0.033	0.036
d. ASPHALT			
1. SMOOTH	0.013	0.013	--
2. ROUGH	0.016	0.016	--
e. GRASSED	0.030	0.040	0.050

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TABLE 28.32.040(d)

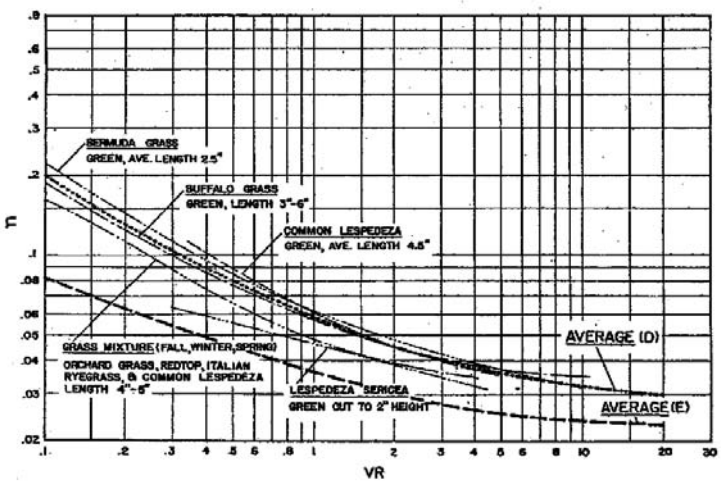
STORMWATER MANAGEMENT MANUAL

TYPICAL ROUGHNESS COEEFICIENTS FOR OPEN CHANNELS

GRASSED CHANNELS WITH LOW RETARDANCE COEFFICIENT*

Retardance	Cover	Condition
D Low	Bermuda grass	Good stand, cut to 2.5 in. height
	Common lespedeza	Excellent stand, uncut (av 4.5 in.)
	Buffalo grass	Good stand, uncut (3 to 6 in.)
	Grass-legume mixture—fall, spring (orchard grass, redtop, Italian rye grass, and common lespedeza)	Good stand, uncut (4 to 5 in.)
	Lespedeza sericea	After cutting to 2 in. height, very good stand before cutting
E Very low	Bermuda grass	Good stand, cut to 1.5 in. height
	Bermuda grass	Burned stubble

STAND=DENSITY OF GRASS(NUMBER OF STEMS PER SQUARE FOOT)



V=MEAN VELOCITY
R=HYDRAULIC RADIUS

* THE 'n' ROUGHNESS COEFFICIENT FOR GRASSED CHANNELS IS KNOWN AS RRETARDANCE COEFFICIENT.

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REFERENCE: U.S. SOIL CONSERVATION SERVICES, SCS-TP-61

TABLE 28.32.040(e)

(a) Gradually Varying Flow. The most common occurrence of gradually varying flow in storm drainage is the backwater created by culverts, storm drain inlets, or channel constrictions. For these conditions, the flow depth will be greater than normal depth in the channel, and the water surface profile (a.k.a. "backwater curve") is computed using either the direct-step or standard step method.

(1) Direct-Step Method. The direct-step method is best suited to the analysis of open prismatic channels. Water surface profiles in simple prismatic channels can be computed manually. Chow (1959) presents the basic method for applying the direct-step analysis. The direct-step method is also available in many handheld and personal computer programs. The most general and widely used programs are the U.S. Army Corps of Engineers' *HEC-2 Water Surface Profiles* and *HEC-RAS River Analysis System*. The design engineer may use these programs or proprietary computer software to compute water surface profiles for channel and floodplain analyses.

(2) Standard-Step Method. The standard-step method is required for the analysis of irregular or nonuniform cross-sections. Because the standard-step method involves a more tedious iterative process, this manual recommends that design engineers use computer programs such as HEC-RAS to accomplish these calculations.

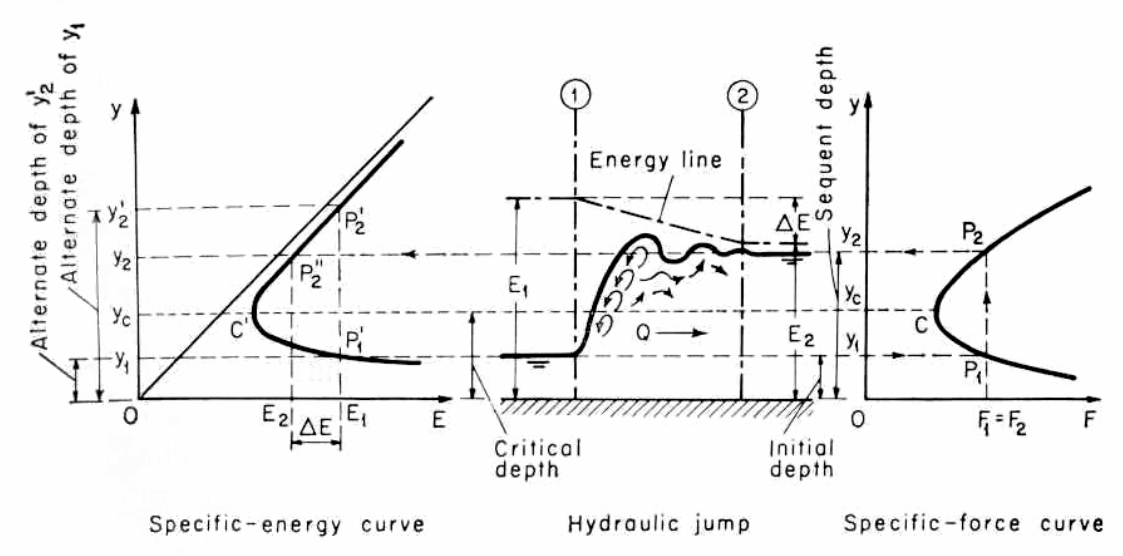

Figure 28.32.040: Specific Energy Curve

(b) Rapidly Varying Flow. Rapidly varying flow is characterized by very pronounced curvature of the water surface profile. The change in water surface profile may become so abrupt as to result in a state of high turbulence. Calculation methods for gradually varying flow (e.g., direct-step and standard-step methods) do not apply for rapidly varying flow. There are mathematical solutions to some specific cases of rapidly varying flow, but the solutions to most rapidly varying flow problems rely on empirical data.

The most common occurrence of rapidly varying flow in storm drainage applications involves weirs, orifices, hydraulic jumps, nonprismatic channel sections (transitions, culverts and bridges), and nonlinear channel alignments (bends). Each of these flow conditions requires detailed calculations to properly identify the flow capacities and depths of flow in the given section. The design engineer must be cognizant of the design requirements for rapidly varying flow conditions and shall include all necessary calculations as part of the design submittal documents. The design engineer is referred to the hydraulic references for the proper calculation methods to use in the design of drainage facilities with rapidly varying flow facilities.

(Res. 40-08 (§ 803.1), 3-19-08)

28.32.050 Critical flow computation.

(a) The critical flow through a channel is characterized by several important conditions regarding the relationship between the flow, specific energy, and slope of a particular hydraulic cross-section (**Figure 28.32.040**). Critical state is characterized by the following conditions:

(1) The specific energy ($E=y+v^2/2g$) is at a minimum for a given discharge (Q).

(2) The discharge (Q) is a maximum for a given specific energy (E).

(3) The specific force is a minimum for a given discharge (Q).

(4) The velocity head ($v^2/2g$) is equal to half the hydraulic depth (D/2) in a channel of small slope.

(5) The Froude number (Fr) is equal to 1.0.

(b) Typically, channels must not be designed to flow at or near critical state ($0.80<Fr<1.2$). If the critical state of uniform flow exists throughout an entire reach, the channel flow is critical and the channel slope is at critical slope (S_c). A slope less than S_c will cause subcritical flow. A slope steeper than S_c will cause supercritical flow. A flow at or near the critical state is unstable. Factors creating minor changes in specific energy, such as channel debris or minor variation in roughness, will cause a major change in depth.

(c) The criteria of minimum specific energy for critical flow results in the definition of the Froude number (Fr) as follows:

$$Fr = \frac{v}{\sqrt{gD}} \qquad (28.32\text{-}4)$$

Where:

Fr	=	Froude number (dimensionless)
v	=	velocity (ft./s)
g	=	gravitational acceleration (32.2 ft./s^2)
A	=	channel flow area ($ft.^2$)
T	=	top width of flow area (ft.)
D	=	hydraulic depth, D=A/T (ft.)

(d) The critical depth in a given trapezoidal channel section with a known flow rate can be determined using the following method:

(1) Step 1. Compute the section factor (Z).

$$Z = \frac{Q}{\sqrt{g}} \qquad (28.32\text{-}5)$$

Where:

Z	=	section factor
Q	=	flow rate (cfs)
g	=	gravitational acceleration (32.2 ft./s^2)

(2) Step 2. Determine the critical depth in the channel (d_c) from **Figure 28.32.050**, using appropriate values for the section factor (Z), the channel bottom width (b), and the channel side slope (z).

For other prismatic channel shapes, Equation 28.32-5 determines the critical depth using the section factors provided in **Table 28.32.040(a)**.

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CRITICAL DEPTH FOR TRAPEZOIDAL AND CIRCULAR SECTIONS

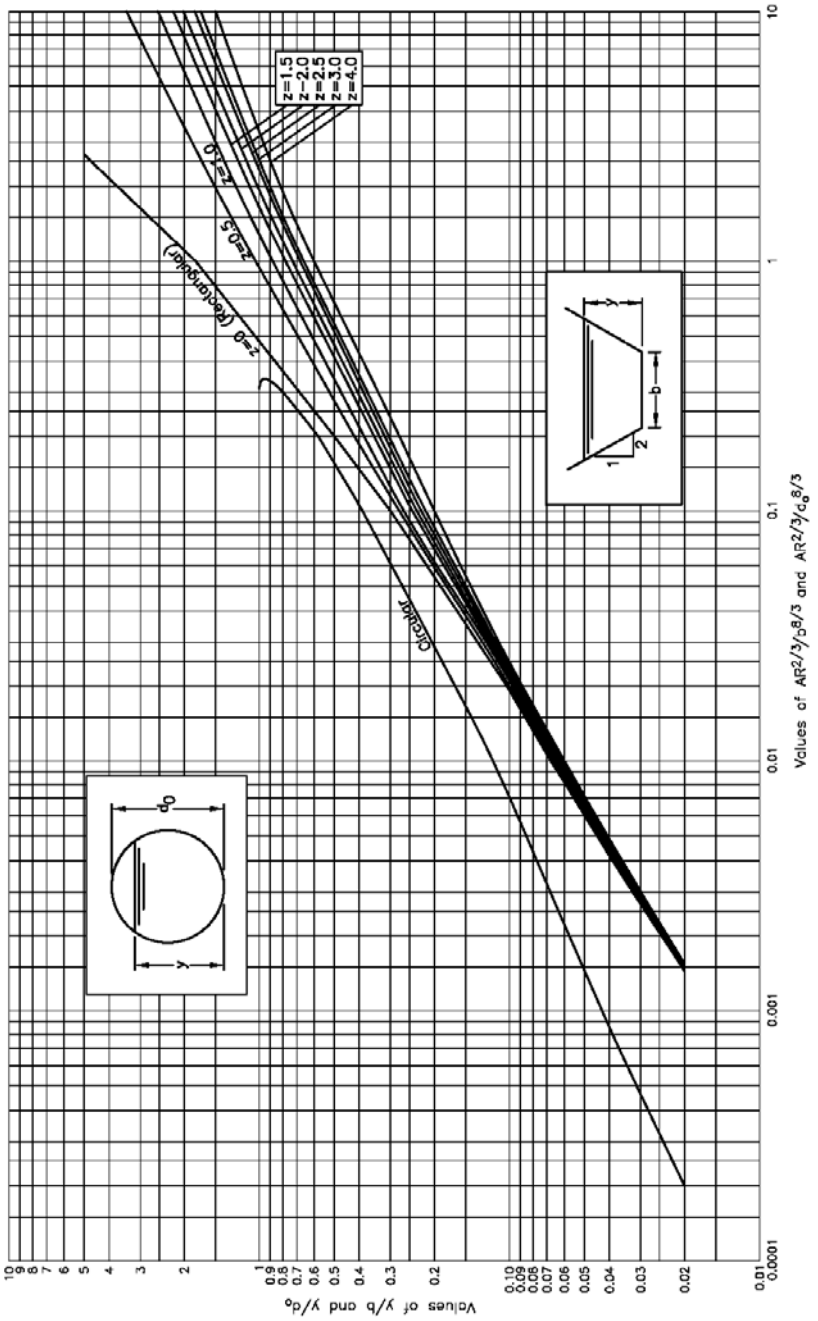

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FIGURE 28.32.050

(Res. 40-08 (§ 803.2), 3-19-08)

28.32.060 Design procedures – Subcritical flow.

All open channels shall be designed with the limits as stated in GJMC 28.32.140 through 28.32.330. The following design procedures shall be used when the design runoff in the channel is flowing in a subcritical condition (Fr<1.0).

(a) Transitions. Subcritical transitions occur when transitioning one subcritical channel section to another subcritical channel section (expansion or contraction), or when a subcritical channel section is steepened to create a supercritical flow condition downstream (e.g., a sloping spillway entrance).

Figure 28.32.060 presents a number of typical subcritical transition sections. The warped transition section, although most efficient, shall only be used in extreme cases where minimum loss of energy is required since the section is very difficult and costly to construct. Conversely, the square-ended transition shall only be used when either a straight-line transition or a cylinder-quadrant transition cannot be used due to topographic constraints or utility conflicts.

(b) Contractions. The energy loss created by a contracting section may be calculated using the following equation:

$$H_t = K_{tc}\left(\frac{V_2^2}{2g} - \frac{V_1^2}{2g}\right) \qquad (28.32\text{-}6)$$

Where:

H_t	=	energy loss (ft.);
K_{tc}	=	contraction transition coefficient
V_1	=	upstream velocity (ft./s); and
V_2	=	downstream velocity (ft./s); and
g	=	gravitational acceleration (32.2 ft./s^2)

Figure 28.32.060 shows contraction loss coefficient (K_{tc}) values for the typical open-channel transition section.

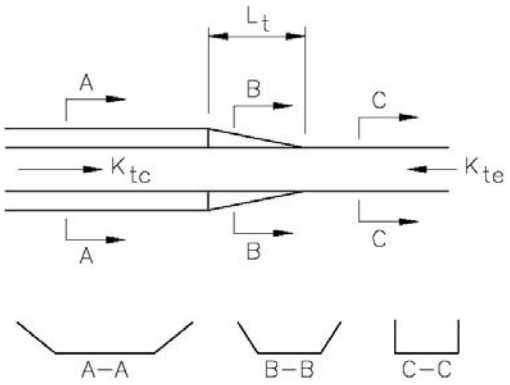
(c) Expansions. The energy loss created by an expanding transition section may be calculated using the following equation:

$$H_t = K_{te}\left(\frac{V_1^2}{2g} - \frac{V_2^2}{2g}\right) \qquad (28.32\text{-}7)$$

Figure 28.32.060 also shows expansion loss coefficients (K_{tc}) values for typical open-channel transition sections.

STORMWATER MANAGEMENT MANUAL

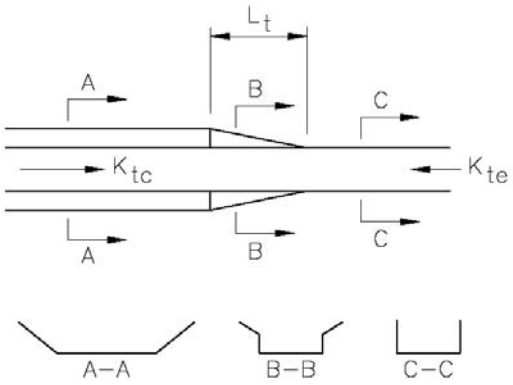
TYPICAL SUBCRITICAL TRANSITION SECTIONS AND LOSS COEFFICIENTS (K_{tc})



WARPED TRANSITION

K_{tc} (CONTRACTION)=0.1

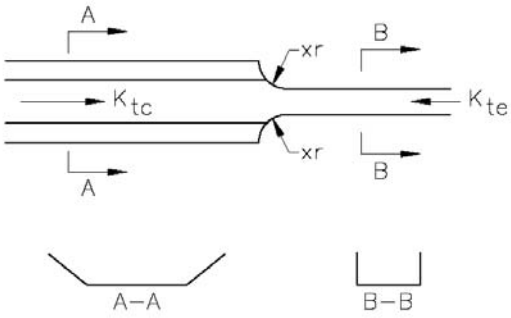
K_{te} (EXPANSION)=0.2



STRAIGHT–LINE TRANSITION

K_{tc} (CONTRACTION)=0.3

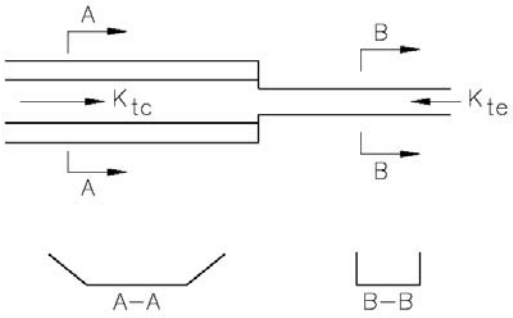
K_{te} (EXPANSION)=0.5



CYLINDER–QUADRANT

K_{tc} =0.15

K_{te} =0.25



SQUARE–ENDED TRANSITION

K_{tc} =0.30

K_{te} =0.75

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REFERENCE:

FIGURE 28.32.060

(d) Transition Length. The length of the transition section shall be long enough to keep the streamlines smooth and nearly parallel throughout the expanding (contracting) section. Experimental data and performance of existing structures have been used to estimate the minimum transition length necessary to maintain the stated flow conditions. Based on this information, guidelines for the minimum length of the transition section are as follows:

$$L_t \geq 0.5 L_c (\Delta T_w) \qquad (28.32\text{-}8)$$

Where:

L_t = minimum transition length (feet);

L_c = length coefficient (dimensionless); and

ΔTw = difference in the top width of the normal water surface upstream and downstream of the transition (feet).

Table 28.32.060 below summarizes the transition length coefficients for subcritical flow conditions. These transition length guidelines are not applicable to cylinder-quadrant or square-ended transitions.

For flow approach velocities of 12 ft./sec. or less, the transition length coefficient (L_c) shall be 4.5. This represents a 4.5L:1W expansion or contraction, or about a 12.5-degree divergence from the channel centerline. For flow approach velocities of more than 12 feet/second, the transition length coefficient (L_c) shall be 10. This represents a 10L:1W expansion or contraction, or about a 5.75-degree divergence from the channel centerline.

Table 28.32.060: Transition Length Coefficients for Subcritical Open Channels

Flow Approach Velocity (v) (ft/s)	Transition Length Coefficient (L_c)
= 12	4.5
> 12	10

(Res. 40-08 (§ 803.3), 3-19-08)

28.32.070 Design procedures – Supercritical flow.

Mesa County and the City of Grand Junction do not encourage supercritical channels, which typically are concrete-lined. The information presented herein is for completeness and in anticipation that analysis of a supercritical channel may be necessary in the future. All supercritical channels shall be designed within the limits as stated in GJMC 28.32.140 through 28.32.330. The following design procedures shall be used when channels are designed to flow in a supercritical condition (Fr>1.0).

Supercritical flow can become unstable in response to relatively minor disturbances to the channel cross-section; even small obstruction can sometimes cause a hydraulic jump. Good design practice is to test supercritical flow stability during events smaller than the design flow by evaluating flows of specific more frequent storm events (e.g., 10-year, two-year, etc.), or testing successive fractions (e.g., one-half, one-quarter, and further if necessary) of the design flow. Also, the designer shall test for small variations in n-value as well. However, only calculations for the full design flow are required to be submitted for review.

(a) Transitions. The design of supercritical flow transitions is more complicated than subcritical transition design due to the potential damaging effects of the oblique jump created by the transition. The oblique jump results in cross waves and higher flow depths that can cause damage if not properly accounted for in the design. Supercritical transitions can be avoided by designing a hydraulic jump, which must also be carefully designed to assure the jump will remain where the jump is designed to occur. Hydraulic jumps shall be designed to take place only within concrete-lined portions of the channel, such as energy dissipation or drop structures.

(b) Contractions. **Figure 28.32.070(a)** presents an example of a supercritical contracting transition, with upstream flow contracted from width b_1 to b_3 and a wall diffraction angle of θ. The oblique jump occurs at the points A and B where the diffraction angles start. Wave fronts generated by the oblique jumps on both sides propagate toward the centerline with a wave angle ß1. Since the flow pattern is symmetric, the centerline acts as if there was a solid wall that causes a subsequent oblique jump and generates a backward wave front toward the wall with another angle ß2. These continuous oblique jumps result in turbulent fluctuations in the water surface.

To minimize the turbulence, the first two wave fronts are designed to meet at the center and then end at the exit of the contraction. Using the contraction geometry, the length of the transition shall be as follows:

$$L_T = \frac{b_1 - b_3}{2\tan\theta} \qquad (28.32\text{-}9)$$

Where:

L_T = transition length (ft.);
b_1 = upstream top width of flow (ft.);
b_3 = downstream top width of flow (ft.);
θ = wall angle as related to the channel centerline (degrees).

Using the continuity principle,

$$\frac{b_1}{b_3} = \left(\frac{y3}{y1}\right)^{3/2}\left(\frac{F_{R_3}}{F_{R_1}}\right) \qquad (28.32\text{-}10)$$

Where:

y1 = upstream depth of flow (ft.)
y3 = downstream depth of flow (ft.)
F_{R_1} = upstream Froude number
F_{R_3} = downstream Froude number

Also, by the continuity and momentum principles, the following relationship between the Froude number, wave angle, and wall angle is:

$$\tan\theta = \frac{\tan\beta_1\left[\left(1+8F_{R1}^2\sin^2\beta_1\right)^{1/2}-3\right]}{2\tan^2\beta_1+\left(1+8F_{R1}^2\sin^2\beta_1\right)^{1/2}-1} \qquad (28.32\text{-}11)$$

Where:

$ß_1$ = Initial wave angle (degrees)

By trial and error, this design procedure can be used to determine the transition length and wall angle. **Figure 28.32.070(b)** offers a faster solution than trial and error using Equation 28.32-10 and Equation 28.32-11 (above). **Figure 28.32.070(b)** can also be used to determine the wave angle (ß),

or may be used with the equations to determine the required downstream depth or width parameter if a certain transition length is desired or required.

To minimize the length of the transition section, the ratio of downstream and upstream flow depths should generally be greater than 2.0 and less than 3.0 ($2.0<y_3/y_1<3.0$). The downstream Froude number should generally be greater than 1.7 to help avoid undulating hydraulic jumps downstream. For further discussion on oblique jumps and supercritical contractions, refer to Chow (1959).

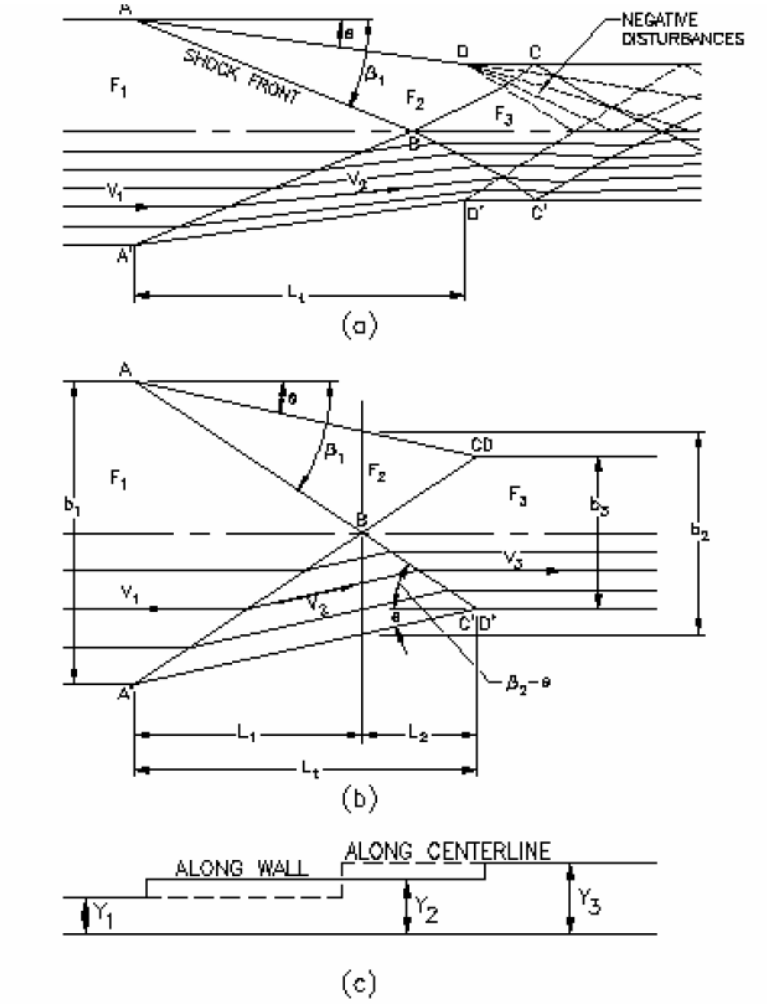


Figure 28.32.070(a): Supercritical Contraction Transition and Angle Definitions

(c) Expansions. A properly designed expansion transition expands the flow boundaries at approximately the same rate as the natural flow expansion. Based on experimental and analytical data results, the minimum length of a supercritical expansion shall be as follows:

$$L_t \geq 1.5(\Delta W)Fr \qquad (28.32\text{-}12)$$

Where:

L_t = minimum transition length (ft.);

ΔW = difference in the top width of the normal water surface upstream and downstream of the transition

Fr = Upstream Froude number

(d) Transition Curves. A transition curve may be used to reduce the required amount of freeboard or radius of curvature in a rectangular channel. The length of the transition curve measured along the channel centerline shall be determined as follows:

$$L_c = 2D = 0.32\frac{WV}{\sqrt{y}} \quad (28.32\text{-}13)$$

Where:

L_C = length of transition curve (ft.);

D = distance from the start of curve to point of first maximum superelevation (ft.). Typically $D=3L_w$; see description of how to apply superelevation allowance in GJMC 28.32.080;

W = top width of design water surface (ft.);

V = mean design velocity (ft./s); and

y = depth of design flow (ft.).

The radius of the transition curves shall be twice the radius of the main bend. Transition curves shall be located both upstream and downstream of the main bend.

(e) Slug Flow and Roll Waves. Steep channels with significantly rapid flows (Fr>2.0) are prone to developing pulsating flow profiles, often called slug flows or roll waves. These standing waves can cause flow to exceed freeboard limits and possible damage to the channel lining. The design engineer may resolve pulsating flow issues either by adjusting the channel slope to prevent the development of these waves or providing additional freeboard to account for the height of the standing waves.

Theoretically, slug flow will not occur when the Froude number is less than 2.0. To avoid slug flow when the Froude number is greater than 2.0, the channel slope shall be as follows:

$$S \leq \frac{12}{R_E} \quad (28.32\text{-}14)$$

Where:

S = channel slope (feet per feet);

R_E = Reynolds Number, $R_E = \frac{uR}{v}$

u = mean design velocity (feet per second);

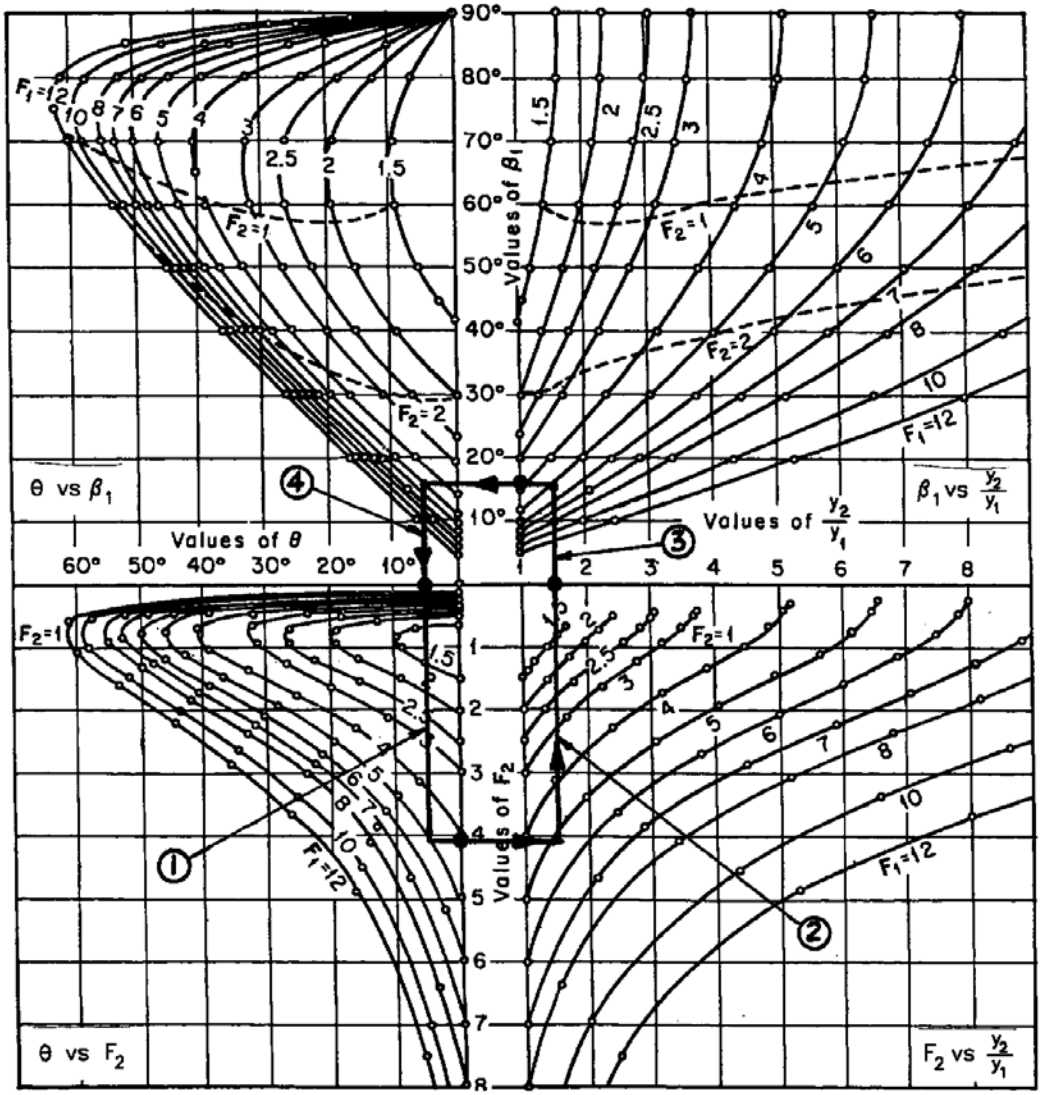
R = hydraulic radius (feet); and

v = kinematic viscosity of water (ft^2/s).

More detailed discussion of pulsating flow is beyond the scope of this manual. Several references, including Chow (1959) and Clark County (2000), provide further discussion of this topic. The Los Angeles County Flood Control District (1982) has developed nomographs for determining the appropriate freeboard allowance for roll wave height based on empirical research at the California Institute of Technology (Brock, 1967).

STORMWATER MANAGEMENT MANUAL

DESIGN NOMOGRAPH FOR SUPERCRITICAL CONTRACTION TRANSITION LENGTH AND WAVE ANGLE



EXAMPLE: For θ = 5° and F_1 = 5.0

① Read F_2 = 4.1
② Read y_2/y_1 = 1.5
③ Read β_1 = 16°
④ Read θ = 5° (check)

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WRC ENGINEERING, INC.

REFERENCE: CHOW, V.T., OPEN CHANNEL HYDRAULICS, McGRAW HILL BOOK COMPANY, 1959

FIGURE 28.32.070(b)

(Res. 40-08 (§ 803.4), 3-19-08)

28.32.080 Design procedures – Superelevation.

Superelevation is the transverse rise in water surface that occurs around a channel bend, measured between the theoretical water surface at the centerline of a channel and the water surface elevation on the outside of the bend. Superelevation in bends shall be estimated from the following equation:

$$\Delta y = \frac{CV^2W}{rg} \qquad (28.32\text{-}15)$$

Where:

r	=	radius of curvature at centerline of channel (ft.);
C	=	curvature coefficient (see **Table 28.32.080**);
Δy	=	rise in water surface between design water surface at centerline of channel and outside water surface elevation (ft.);
W	=	top width at the design water surface at channel centerline (ft.);
V	=	mean channel velocity (ft./s); and
g	=	gravitational acceleration (ft./s^2).

The curvature coefficient C shall be 0.5 for subcritical flow conditions. For supercritical flow conditions, the curvature coefficient shall be 1.0 for all trapezoidal channels and for rectangular channels without transition curves, and 0.5 for rectangular channels with transition curves. **Table 28.32.080** provides superelevation curvature coefficients for various flow regimes, cross-section shapes, and types of curves.

Bends in supercritical channels create cross-waves and superelevated flow in the bend section as well as further downstream from the bend. In order to minimize these disturbances, best design practice is to design the channel radius of curvature to limit the superelevation of the water surface to 2.0 feet or less. This can be accomplished by modifying Equation 28.32-15 to determine the allowable radius of curvature of a channel for a given superelevation value.

Table 28.32.080: Superelevation Curvature Coefficients

Flow Type	Cross-Section	Type of Curve	Curvature C
Subcritical	Rectangular	No Transition	0.5
Subcritical	Trapezoidal	No Transition	0.5
Supercritical	Rectangular	No Transition	1.0
Supercritical	Trapezoidal	No Transition	1.0
Supercritical	Rectangular	with Spiral Transition	0.5
Supercritical	Trapezoidal	with Spiral Transition	1.0
Supercritical	Rectangular	with Spiral Banked Transition	0.5
Source: Corps EM 1110-2-1601 (July 1991)			

(Res. 40-08 (§ 803.5), 3-19-08)

28.32.090 Transitions.

(a) Channel transitions occur in open channel design whenever there is a change in channel slope or shape and at junctions with other open channels or storm sewers. The goal of a good transition design is to minimize the loss of energy as well as minimize surface disturbances from cross-waves and turbulence. Special cases of transitions where excess energy is dissipated by design are drop structures and hydraulic jumps. Channel drop structures are discussed in GJMC 28.32.340(d)(2).

(b) Transitions in open channels are generally designed for the following four flow conditions.

(1) Subcritical flow to subcritical flow.

(2) Subcritical flow to supercritical flow.

(3) Supercritical flow to subcritical flow (hydraulic jump).

(4) Supercritical flow to supercritical flow.

(c) For definition purposes, the conditions in subsections (b)(1) and (2) of this section will be considered as subcritical transitions and are later discussed in GJMC 28.32.110 through 28.32.130. The conditions in subsections (b)(3) and (4) of this section will be considered as supercritical transitions and are later discussed in GJMC 28.32.110 through 28.32.130.

(Res. 40-08 (§ 803.6), 3-19-08)

28.32.100 Types of open channels and their selection.

Open channels can be categorized as either natural or engineered (artificial). Natural channels include all watercourses that are carved and shaped by the erosion and sediment transport process. Engineered channels are those constructed by human efforts. Open channels can be separated into six different types:

(a) Natural Channels. Watercourses are carved and shaped by natural erosion processes before urbanization occurs. As the channel's tributary watershed urbanizes, natural channels often experience erosion and may need grade control checks and localized bank protection to stabilize.

Natural channels are also strongly influenced by urbanization in the watershed, which significantly alters the hydrology and therefore, the geometry of the natural channels. If the watershed imperviousness exceeds around 10 percent, it is likely that channel geometry will be altered such that a natural channel is no longer viable and mitigation measures will be required, such as bank and bed stabilization measures.

(b) Grass-Lined Channels. Among various types of constructed or modified drainageways, grass-lined channels are most desirable. They provide channel storage, lower velocities, groundwater recharge, and various multiple-use benefits. Low-flow areas may need to be concrete, rock-lined, or otherwise reinforced with vegetation to minimize erosion and maintenance problems.

(c) Wetland Vegetation Bottom Channels. A subset of grass-lined channels that are designed to encourage the development of wetlands or certain types of riparian vegetation in the channel bottom. These channels offer potential benefits that may include wildlife habitat, groundwater recharge and water quality enhancement. In low-flow areas, the banks may need supplemental reinforcement to protect against undermining.

(d) Concrete-Lined Channels. Concrete-lined channels are high velocity artificial drainageways that are not encouraged. However, in retrofit situations where existing flooding problems need to be solved and where right-of-way is limited, concrete channels may offer advantages over other types of open drainageways. Special attention shall be taken to provide safety measures (i.e., fence) around the concrete-lined channels.

(e) Riprap-Lined Channels. Riprap-lined channels offer a compromise between a grass-lined channel and a concrete-lined channel. They can reduce right-of-way needs as compared to grass-lined chan-

nels and avoid the higher costs of concrete-lined channels. Riprap-lined channels are not encouraged.

(f) Other Lined Channels. A variety of artificial channel liners are on the market, all intended to protect the channel walls and bottom from erosion at higher velocities. These include gabion, interlocked concrete blocks, concrete revetment mats formed by injecting concrete into double layer fabric forms, and various types of synthetic fiber liners. As with rock and concrete liners, all of these types are best considered for helping to solve existing urban flooding problems and are not recommended for new developments. Each type of liner has to be scrutinized for its merits, applicability, how it meets other community needs, its long-term integrity, and maintenance needs and costs. Channels lined with artificial materials are not permitted in new development areas of Mesa County, including the City of Grand Junction, except by variance to or deviation from these criteria.

(g) Selection of Channel Type. Mesa County and the City of Grand Junction do not have a preference for any particular channel-lining system, as long as it is properly evaluated on its merits. Each type of channel must be evaluated for its longevity, integrity, maintenance requirements and costs, and general suitability for community needs, among other factors. Selection of a channel type that is most appropriate for the conditions that exist at a project site shall be based on a multi-disciplinary evaluation, which may include hydraulic, structural, environmental, sociological, maintenance, economic, and regulatory factors.

(Res. 40-08 (§ 804), 3-19-08)

28.32.110 Natural channel systems.

(a) In general, a natural channel system continually changes its position and shape as a result of hydraulic forces acting on its bed and banks. These changes may be slow or rapid and may result from natural environmental changes or from changes caused by human activities. When a natural channel is modified locally, the change frequently causes alteration in channel characteristics both upstream and downstream. The response of a natural channel to human-induced changes often occurs in spite of attempts to control the natural channel environment.

(b) Natural and human-induced changes in natural channels frequently set in motion responses that can be propagated for long distances. In spite of the complexity of these responses, all natural channels are governed by the same basic forces but to varying degrees. It is necessary that a natural channel system design be based on adequate knowledge of:

(1) Geologic factors, including soil conditions;

(2) Hydrologic factors, including possible changes in flow and runoff, and the hydrologic effects of changes in land use;

(3) Geometric characteristics of the stream, including the probable geometric alterations that developments will impose on the channel;

(4) Hydraulic characteristics such as depth, slope, velocity of streams, sediment transport, and the changes that may be expected in these characteristics over space and time; and

(5) Ecological/biological changes that will result from physical changes that may in turn induce or modify physical changes.

(c) Effects of development in natural channels, flood control measures, and constructed channel structures have proven the need for considering the immediate, delayed, and far-reaching effects of alterations imposed on natural channel systems. Variables affecting natural channels are numerous and interrelated. Their nature is such that, unlike rigid-boundary hydraulic problems, it is not possible to isolate and study the role of each individual variable. Because of the complexity of the processes occurring in natural flows that influence the erosion and deposition of material, a detached analytical approach to the problem may be difficult and time consuming. Most relationships describing

natural channel processes have been derived empirically. The major factors affecting natural channel geometry are:

(1) Stream discharge;

(2) Sediment load;

(3) Longitudinal slope;

(4) Characteristics of bed and bank material;

(5) Bank and bed resistance to flow;

(6) Vegetation or lack thereof;

(7) Geology, including type of sediment; and

(8) Constructed improvements.

(Res. 40-08 (§ 805), 3-19-08)

28.32.120 Channel morphology.

(a) When seeking to utilize or modify a natural channel, an understanding of the mechanism of its morphology is important. Without incorporating a thorough understanding of the geomorphic conditions of the stream and the watershed, alterations to channels or to their watersheds can lead to unexpected instabilities, bring about unwanted erosion or aggradation, and cause significant damage to fluvial systems.

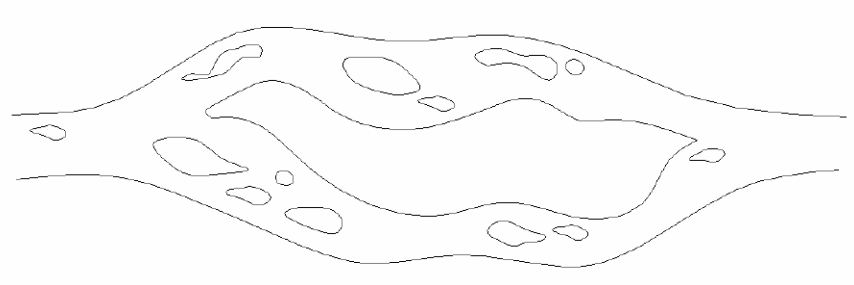
The morphology of a stream is a result of the variables that determine the quantity of water and sediment it carries, including the geology, soils and vegetation of the stream and watershed, the hydrology and dominant discharge of the system, and the slope of the stream. The following is a short discussion of some fundamentals of fluvial geomorphology. The users of this manual are encouraged to review the related textbooks and other technical literatures on the subject for more detailed discussions. The following is a partial list of some of the related publications:

- Dave Rosgen, illustrated by Hilton Lee Silvey, Applied River Morphology, 1996.
- Lane, E.W., 14957. A study of the shape of channels formed by natural streams flossing in erodible material: M.R., D. Sediment Series No. 9, U.S. Army Engineer Division, Missouri River, Corps of Engineers, Omaha, NE.
- Ritter, Dale F., 1986. Process Geomorphology. Wm C. Brown Publishers, Dubuque, Iowa.
- Simons Li and Associates, 1982. Engineering Analysis of Fluvial Systems.

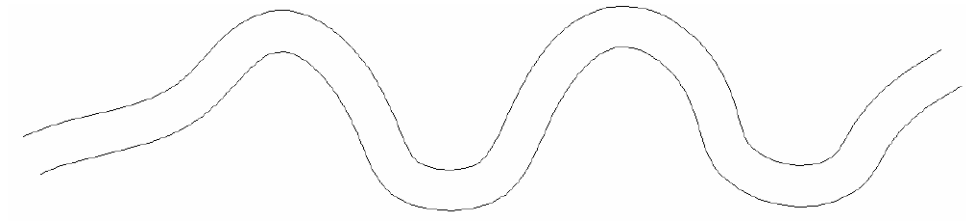
(b) There are three general principles governing the geomorphology of a natural stream system. First, riverine systems are dynamic. Erosion and aggradation can occur over a relatively short period of time (as sudden as one storm event) and can result from unstable conditions brought about by changing hydrologic or sediment-supply conditions (either natural or human induced). However, because all systems are dynamic, normal progression of a stream is not always a result or a symptom of instability. Second, the responses resulting from changes to a channel or its watershed are complex. Morphologic responses can be anticipated but cannot always be quantitatively predicted, even by the most experienced engineers. Additionally, short reaches of streams cannot be looked at individually; a change to a short stretch or even to a single area of the stream can cause unwanted or unexpected alterations upstream or downstream of the change. Third, most geomorphic boundaries within a riverine system can be classified as thresholds. Gradual changes to a channel or its watershed will not always bring about gradual responses. Instead, gradual changes may build up to a threshold so that a small-scale occurrence, such as a moderately large flood, will seemingly cause a catastrophic result. (Simons Li and Associates, 1982)

(c) Natural streams can be classified generally into three prevailing patterns. These patterns, straight, meandering and braided, are characteristics of the responses of a system to its prevailing discharge and load.

Braided Channel



Meandering Channel



Straight Channel

(d) Straight and meandering streams are two manifestations of similar dynamics. The thalwegs in both shift from bank to bank and sediment deposition and erosion within the channel bottom establish a series of riffles and pools. Straight channels have relatively straight banks; meandering streams have sinuous banks. Straight channels are fairly rare; most natural channels have some degree of sinuosity. Although meandering and straight streams can be in quasi-equilibrium, their thalwegs, meanders and riffle-pool sequences migrate in predictable patterns if left untouched. Braided systems, unlike meandering and straight, do not have a single trunk; they have a network of branches and series of islands. The single branches usually meander to some degree. Braided channels convey low to medium flows in the series of branches; large flows intermingle into a single floodplain. Meandering and straight systems are generally more stable than braided. Braided channels tend to carve new channels and deposit islands at a relatively fast pace and be horizontally unstable. The divisions between the three classifications are imprecise and relatively indistinct. A given stream can have reaches of each classification, and given reaches can include characteristics of one or more pattern. (Ritter, 1986)

(e) Any change to a variable of a natural stream system, such as the slope or dominant discharge, can change the morphology and/or the existing stream pattern according to the three principles outlined above. These changes can be somewhat predicted; much work has been done to establish relationships between the variables and characteristics of natural streams. Two general relationships for predicting morphological responses to changes in riverine variables are as follows:

$$Q \cong \frac{b, d, \lambda}{S} \qquad (28.32\text{-}16)$$

and

$$Qs \cong \frac{b, \lambda, \lambda}{d, P} \quad \text{(SLA, 1982)} \qquad (28.32\text{-}17)$$

Where:

Q	=	Average discharge
Qs	=	Sediment supply
b	=	Channel width
d	=	Channel depth
λ	=	Meander wavelength
S	=	Bed slope
P	=	Sinuosity

(f) An increase in mean annual discharge will generally cause an increase in channel depth, width, and meander wavelength and a decrease in bed slope. An increase in sediment supply will generally cause an increase in channel width, meander wavelength and bed slope and a decrease in sinuosity and channel width. Because the average flow rate is usually directly related to sediment supply, these relationships can become complex when both flow and sediment supply increase or flow increases and sediment supply decreases, or vice versa. Additionally, changes to one or more channel morphology characteristics can cause changes to other characteristics. An increase in slope can cause a decrease in channel depth or a decrease in meander wavelength. Further complicating these relationships are variables such as the average grain-size and type of sediment, the percentage of sediment carried as bed load, and the geology of the valley, all which can affect the responses of the stream and contribute to unexpected or seemingly counterintuitive results.

(g) A general relationship between slope, mean annual discharge and the tendency of a system to be meandering or braided has been established by Lane (1957). They found that if a stream's $SQ^{1/4}$ is less than or equal to 0.0017, it tends to be meandering. If $SQ^{1/4}$ is greater than or equal to 0.01, systems tend toward a braided pattern. Streams that have $SQ^{1/4}$ between 0.0017 and 0.01 are in an intermediate zone and can be either braided or meandering with a greater tendency to respond to flow and slope alterations with a change in river pattern. These relationships are complicated and not absolute.

(h) Some specific examples of man-induced changes to the natural stream/river systems that could cause undesired responses by channel morphology are as follows:

(1) Change in Flow. As demonstrated in the above relationships, a decrease in flow due to diversion or reservoir routing change can cause a decrease in channel width, depth, and sinuosity and an increase in slope; an increase in flow due to development can have the opposite effect. In addition to these changes, the corresponding decrease or increase of average stage of the main stem of a river can have significant effects on the streams' tributaries. If the average stage decreases, the tributaries' energy slopes will increase, increasing the ability of the trib-

utary to transport sediment, which can cause degradation of its channel, commonly referred to as headcutting. Similarly, an increase in stage in the main stem can lead to aggradation within its tributaries. Both of these scenarios can do serious damage to the tributary channel and increase its horizontal instability. Headcutting can cause bank destabilization and failure. Aggradation can cause increased flooding potential and rerouting of the channel.

(2) Channelization. The channelization of a natural stream to allow increased conveyance often straightens channels and cuts off meanders, causing an increase in slope through the improved stretch. This can increase velocities and degradation through the stretch and then decrease slopes and increase aggradation downstream of the stretch. The increase in slope and average discharge can also cause a meandering system to tend toward a braided configuration that can lead to further horizontal and vertical instabilities. In addition, by lowering the average stage, channelization will affect the stream's tributary channels in the same manner as the first example.

(3) Construction of Dams. The construction of both large- and small-scale dams can have far-reaching effects on a stream system. Without a design approach that will allow frequent flows to travel through the dam unadulterated, some suspended sediment and most bed load will be deposited upstream of the dam. This will decrease slopes and change channel configuration upstream and release clear water and potentially cause scour and degradation in the downstream reach.

(4) Construction of Bridges and Culverts. The construction of bridges and culverts, in addition to the well-documented local scour issues, can cause more regional channel morphology problems. An undersized bridge or culvert can decrease velocity and increase average stage upstream of the bridge, causing deposition and affecting the tributaries' channels. Scour around the bridges can cause an increase in sediment supply in the channel, leading to deposition downstream.

(i) There are many additional examples of morphological problems that can be caused by manmade changes on a natural stream system. Any substantial modification to a natural channel system shall be evaluated carefully to determine the potential adverse impacts on the stream system both upstream and downstream of the proposed modification.

(Res. 40-08 (§ 805.1), 3-19-08)

28.32.130 Channel restoration.

The practice of channel restoration is becoming more common in the United States as the negative effects of urbanization, channelization, and other hydraulic "improvements" have taken their toll on the sediment balance, channel stability, biological habitats, and the aesthetic and recreational benefits of the impacted rivers and streams.

Although it may not be feasible to restore a disturbed stream/river system back to its original condition, channel restoration projects can help expedite the natural channel recovering process and help to recreate an environment that closely resembles the original configuration of the stream system. Channel/river restoration projects typically involve reconnection of the floodplain back to its channel, establishment of wetland areas around the channel, restoration of meanders, point-bars and riffle-pool sequences, and recreation of the chemical and biological complexity that exists in the natural channel system. Benching, allowing for a low-flow meandering channel with terraced banks above the low-flow channel, is a popular technique that allows for expansive riparian plant and wildlife habitat, recreation opportunities, and unique flood control options. Channel restoration usually involves a significant degree of both planting and seeding native, wetland, and self-sustainable vegetations within the channel and along the banks.

A design team comprised of hydraulic engineers, fluvial geomorphologists, biologists and botanists who are highly knowledgeable of the system should be involved in the channel restoration design process. Furthermore, due to the advantage of irregular alignments and channel cross-sections, the construction

phase shall be carefully managed and overseen to ensure that the design is fully incorporated into the final improvement.

(Res. 40-08 (§ 805.2), 3-19-08)

28.32.140 General design criteria for improved open channels.

GJMC 28.32.140 through 28.32.260 present general design standards that apply to all improved channels. GJMC 28.32.270 provides specific design criteria for natural and alluvial bed channels. GJMC 28.32.280 through 28.32.320 provide specific design criteria for fixed-bed type channels that include: grass-lined channels, wetland bottom channels, riprap-lined channels, concrete-lined channels, and channels with other types of linings.

Depending on the local conditions, the specific requirements for a particular type channel may be more strict than the general criteria outlined in this chapter. In addition, unique and unusual site conditions may require additional design analysis be performed to verify the suitability of the proposed channel design for the project site.

(Res. 40-08 (§ 806), 3-19-08)

28.32.150 Channel type selection.

Six general different types of open channels were presented in GJMC 28.32.100. In general, the use of concrete-lined and riprap-lined channels is discouraged. The selection of a channel type was presented in general terms in GJMC 28.32.100(g). The following multi-disciplinary factors shall be used if selecting the channel that is most suitable for a specific site:

(a) Hydraulic Factors.

(1) Slope of thalweg.

(2) Right-of-way.

(3) Capacity needed.

(4) Basin sediment yield.

(5) Topography.

(6) Ability to drain adjacent lands.

(b) Structural Factors.

(1) Cost.

(2) Availability of material.

(3) Areas for wasting excess excavated material.

(4) Seepage and uplift forces.

(5) Shear stresses.

(6) Pressures and pressure fluctuations.

(7) Momentum transfer.

(c) Environmental Factors.

(1) Neighborhood character.

(2) Neighborhood aesthetic requirements.

(3) Need for new green areas.

(4) Street and traffic patterns.

(5) Municipal or county policies.

(6) Wetland mitigation.

(7) Wildlife habitat.

(8) Water quality enhancement.

(d) Sociological Factors.

(1) Neighborhood social patterns.

(2) Neighborhood children population.

(3) Pedestrian traffic.

(4) Recreational needs.

(e) Maintenance Factors.

(1) Life expectancy.

(2) Repair and reconstruction needs.

(3) Maintainability.

(4) Proven performance.

(5) Accessibility.

(f) Regulatory Factors.

(1) Federal regulations.

(2) State regulations.

(3) Local regulations.

(Res. 40-08 (§ 806.1), 3-19-08)

28.32.160 Hydraulic capacity.

All new open channels shall be designed, at a minimum, to safely confine and convey the runoff from the 100-year design event.

(Res. 40-08 (§ 806.2), 3-19-08)

28.32.170 Manning roughness coefficient.

Selection of an appropriate channel roughness value for a given channel section is important for the hydraulic capacity analysis and design of open channel. The roughness value can vary significantly depending on the channel type and configuration, density and type of vegetation, depth of flows, and other hydraulic properties.

Tables 28.32.040(b), **28.32.040(c)**, **28.32.040(d)** and **28.32.040(e)** show recommended values for the Manning roughness coefficient for various channel types and conditions. Manning roughness coefficients for riprap channels shall be computed based on the criteria outlined in GJMC 28.32.040.

(Res. 40-08 (§ 806.3), 3-19-08)

28.32.180 Uniform flow.

Open channel drainage systems shall be designed assuming uniform flow conditions. GJMC 28.32.040 presents the uniform flow equation and methods for calculating uniform flow.

(Res. 40-08 (§ 806.4), 3-19-08)

28.32.190 Vertical and horizontal alignment.

Open channels shall have a minimum longitudinal gradient of 0.5 percent whenever practical. Flatter grades may be approved with prior consultation with Mesa County or applicable governing agencies. Open channels with grades flatter than 0.5 percent shall have provisions for the drainage of nuisance low flows.

Horizontal alignment changes of two degrees or less may be accomplished without the use of a circular curve for subcritical flow designs (Fr<1.0, see GJMC 28.32.060). Curves must be used for supercritical flow designs (Fr>1.0), no matter the degree of change in horizontal alignment. Curved channel alignments shall have superelevated banks in accordance with GJMC 28.32.080.

Spiral transition curves shall be used upstream and downstream of curves for supercritical channel designs with reverse curves or horizontal alignments with consecutive circular curves. Spiral curves may also be used to reduce required superelevation allowances and cross-wave disturbances.

(Res. 40-08 (§ 806.5), 3-19-08)

28.32.200 Maximum permissible velocity.

The design of open channels shall be governed by maximum permissible velocity. This design method assumes that a given channel section will remain stable up to a maximum permissible velocity; provided, that the channel is designed in accordance with the standards presented in this manual. **Table 28.32.200** presents the maximum permissible velocities for several types of natural, improved, unlined, and lined channels.

Regardless of these maximum permissible velocities, the channel section shall be designed to remain stable at the final design flow rate and velocity. The design flow may not always be based on the highest flow velocity. Therefore, best practice is to confirm channel section stability during events smaller than the design flow. This may be accomplished by evaluating flows of specific more frequent storm events (e.g., 10-year, two-year, etc.), or testing successive fractions (e.g., one-half, one-quarter, and further if necessary) of the design flow. However, only calculations for the full design flow are required to be submitted for review.

Additional geotechnical and geomorphologic investigation and analyses may be required for natural channels or improved unlined channels to verify that the channel will remain stable based on the maximum design velocities.

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MAXIMUM PERMISSIBLE MEAN CHANNEL VELOCITY

MATERIAL / LINING	MAXIMUM PERMISSIBLE MEAN VELOCITY (FPS)
NATURAL AND IMPROVED UNLINED CHANNELS	
Erosive Soils:	
Loams, Sands, Noncolloidal Silts	3.0
Less Erosive Soils:	
Clays, Shales, Cobbles, Gravel	5.0
FULLY-LINED CHANNELS	
Unreinforced Vegetation	5.5
Loose Riprap	
Angular Rock	15.0
Semi-Angular Rock	12.0
Rounded Rock	See Note #4
Grouted Riprap	15.0
Gabions	15.0
Soil Cement	15.0
Concrete	20.0

NOTES:

1. For composite lined channels, us the lowest of the maximum mean velocities for the materials used in the composite lining.
2. Deviations from the above values are only allowed with appropriate engineering analysis and/or suitable agreements for maintenance responsibilities.
3. Maximum permissible velocities based upon non-clear water conditions.
4. Suitability of rounded rock as loose riprap material shall be determined by rock particle resistance to movement as a result of shear forces as calculated with a factor of safety of 1.5.

Revision	Date
ORIGINAL ISSUE	3/27/06

WRC ENGINEERING, INC.	REFERENCE: NATURAL-MODIFIED FROM FORTIER AND SCOBEY, 1926 FULLY LINED-VARIOUS RESOURCES	**TABLE 28.32.200**

(Res. 40-08 (§ 806.6), 3-19-08)

28.32.210 Subcritical and supercritical flow.

Flow can be classified as critical, subcritical, or supercritical according to the level of energy in the flow. This energy is commonly expressed in terms of a Froude number (Fr) and critical depth (d_c). GJMC 28.32.050 discusses the characteristics of critical flow and describes methods for determining Froude number and critical depth. All channel design submittals shall include the calculated Froude number (Fr) and critical depth (d_c) for each unique reach of channel to identify the flow state and verify compliance with these criteria.

Flow at or near the critical state (Fr=1.0 or $d=d_c$) is unstable. As a result, minor factors such as channel debris have the potential to cause severe and acute changes in flow depth. Whenever practicable, channels shall be designed to convey their design flow following the flow energy limitations described in **Table 28.32.210**. When necessary to convey flows at or near critical state (0.86<Fr<1.13), flow instabilities may be accommodated by providing additional freeboard.

Table 28.32.210: Limitations on Flow Energy for Rectangular and Trapezoidal Channels

Design Flow Condition	Froude Number
Subcritical	Fr<0.86
Supercritical	Fr>1.13

In rare cases, the specific energy relationship of a cross-section might result in a situation where flows less than the design flow may have a greater depth than the depth calculated for the design flow. The design engineer shall check supercritical channel designs to evaluate whether the channel will maintain freeboard requirements (GJMC 28.32.220) during flows less than the design flow (see suggested method in GJMC 28.32.200).

(Res. 40-08 (§ 806.7), 3-19-08)

28.32.220 Freeboard.

(a) In the context of this manual, freeboard is the additional height of a flood control facility (e.g., channel, levee, or embankment) measured above the design water surface elevation. In this way, the freeboard will provide a factor of safety when designing open channels.

(b) Open channel facilities conveying a design flow of less than 10 cfs shall have a minimum freeboard of 0.5 feet. Open-channel facilities conveying a design flow of 10 cfs or more shall have a design freeboard based on a minimum freeboard of 1.0 foot, with allowances for velocity, superelevation, standing waves, and/or other water surface disturbances such as slug flow. GJMC 28.32.060 and 28.32.070 provide design methods for calculating these allowances. Equation 28.32-18 and Equation 28.32-19 describe the minimum design freeboard for subcritical and supercritical flow design, respectively:

$$(h_{fr})_{SUBCRITICAL} = \max\left(1.0,0.5 + \frac{v^2}{2g} + \frac{Cv^2W}{rg} + \Delta y\right) \quad (28.32\text{-}18)$$

$$(h_{fr})_{SUPERCRITICAL} = 1.0 + 0.025vd^{1/3} + \frac{Cv^2W}{rg} + \Delta y \quad (28.32\text{-}19)$$

Where:

h_{fr} = minimum required freeboard (ft.);

v = flow velocity (ft./s);

g = gravitational acceleration (32.2 ft./s^2);

$\frac{Cv^2W}{rg}$ = superelevation allowance (ft.), see GJMC 28.32.080; and

Δy = allowances for other hydraulic phenomenon (ft.), (e.g., standing waves, slug flow – see GJMC 28.32.070(e)).

(c) Superelevation allowance is a function of flow velocity, channel geometry, and channel alignment. Applying transition curves to the alignment may reduce the required superelevation allowance. GJMC 28.32.080 discusses the calculations of superelevation allowance in more detail. The superelevation allowance shall be applied to both banks of the channel. The superelevation allowance shall be applied to channel bends in the following manner:

(1) Begin at a point 5.0 times the characteristic wave length of the design flow ($5L_w$), measured from the downstream tangent point of the curve, with no superelevation allowance.

(2) Taper uniformly to the full superelevation allowance at a point 3.0 times the characteristic wave length of the design flow ($3.0L_w$), measured from the downstream tangent point of the curve.

(3) Maintain the full superelevation allowance through the curve.

(4) Continue the top of bank elevation level from the upstream tangent point of the curve to its intersection with the normal top of bank.

(d) Equation 28.32-20 and Equation 28.32-21 describe the characteristic wavelengths for subcritical and supercritical flow, respectively.

$$(L_w)_{SUBCRITICAL} = 2W \qquad (28.32\text{-}20)$$

$$(L_w)_{SUPERCRITICAL} = 2W\sqrt{F_r^{\,2} - 1} \qquad (28.32\text{-}21)$$

The freeboard under the lowest chord of bridge deck (i.e., the soffit elevation) shall be a minimum of 1.0 foot during the 100-year design event. In cases where the bridge has been designed to withstand hydraulic forces of floodwaters and impact from large floating debris, the water surface elevation upstream of the bridge shall maintain a freeboard of at least 1.0 foot below the roadway crest and the finished floors of structures within the zone influenced by the bridge headwater.

This manual only describes Mesa County's and the City of Grand Junction's minimum freeboard requirements for open channel design. Major drainageways involving road crossings or other types of crossings, streams that the Federal Emergency Management Agency (FEMA) has mapped as special flood hazard areas, might have significantly different freeboard requirements.

(Res. 40-08 (§ 806.8), 3-19-08)

28.32.230 Flow transitions.

Channel transitions occur in open channel design whenever there is a change in channel slope or shape and at junctions with other open channels or storm drains. Properly designed flow transitions mimic the

expansion or contraction of natural flow boundaries as best as possible, as well as minimize surface disturbances from cross-waves and turbulence. Drop structures and hydraulic jumps are special transitions where excess energy is dissipated by design. Transitions in open channels are generally designed for either subcritical or supercritical flow transitions.

Hydraulic jumps shall be designed to take place only within energy dissipation or drop structures, and not within an erodible channel. Subcritical transitions shall satisfy the minimum transition lengths described in GJMC 28.32.060. Supercritical transitions shall satisfy the minimum transition lengths described in GJMC 28.32.070. Special transitions such as drop structures and hydraulic jumps shall satisfy the specifications described in GJMC 28.32.340.

(Res. 40-08 (§ 806.9), 3-19-08)

28.32.240 Access and safety.

(a) Access. Any easement encompassing a channel shall be wide enough to provide for the channel structure and adequate maintenance access. Easements shall be placed on one side of lot or ownership lines in new developments and in existing developments where conditions permit.

(1) The minimum width of any channel easement shall be the top width of channel plus four feet on each side of channel.

(2) Channels with a top width of less than 40 feet require a minimum 12-foot-wide service road parallel to one side of the channel and a four-foot-wide access on the opposite side, whenever practicable.

(3) Channels 40 feet or more in top width require service roads on both sides of the channel that are a minimum of 12 feet wide, whenever practicable.

In all cases, vehicular access to the channel facility must be provided at intervals of 1,000 feet or less, whenever practical. Access easements must be at least 12 feet wide, with a maximum grade of 10 percent.

Access ramps shall slope down in the down-gradient direction whenever practicable. Access ramps designed for personnel access shall have a maximum slope of 10 percent. When designed to accommodate vehicular traffic, maintenance access ramps shall be designed to Mesa County or the local jurisdiction private road standards, whichever is applicable.

(b) Safety. Specific safety requirements shall be determined on a case-by-case basis in consultation with Mesa County or the applicable local jurisdiction. As a minimum, guardrails or other approved traffic barriers as described in the Mesa County Road and Bridge Specifications shall be provided when a channel is located next to traffic and according to the AASHTO official guidance.

Fencing or access barriers, as required by the governing agency, are required for channels abutting residential developments, schools, parks, and pedestrian walkways as follows:

(1) Fencing is required for all concrete-lined or riprapped channels where the design frequency storm produces a velocity that exceeds 5.0 feet per second or 2.0 feet in depth. Fencing is also required when velocity times the depth exceeds 10.0 within 5.0 feet of the flow water's edge.

(2) Fencing or access barriers required for all unlined alluvial-bed, grass-lined, and wetland-bottom channels with side slopes steeper than 4H:1V where the design frequency storm produces a velocity that exceeds 5.0 feet per second or 2.0 feet in depth. Fencing is also required when velocity times the depth exceeds 10.0 within 5.0 feet of the flow water's edge.

Gates shall be provided for maintenance and emergency access at regular intervals, with 20-foot-wide gates placed 1,000 feet on center and four-foot gates placed 500 feet on center or portion thereof. Fencing or access barriers shall be located at a minimum of six inches inside the easement boundary lines unless otherwise approved.

(Res. 40-08 (§ 806.10), 3-19-08)

28.32.250 Environmental permitting.

Open channel facilities are often located within or adjacent to sensitive environmental areas. The design engineer must investigate which permits might be necessary from various agencies, such as the U.S. Army Corps of Engineers (e.g., GJMC 28.16.140 through 28.16.190, wetland permit). It is important that the final permits and/or permit conditions allow for the future and perpetual maintenance of a channel facility without the necessity of returning to a permitting agency for regular maintenance activities.

(Res. 40-08 (§ 806.11), 3-19-08)

28.32.260 Maintenance.

Where failure of an open-channel facility might cause flooding of a public road or structure, the facility shall have an operation and maintenance plan. These operation and maintenance plans shall specify regular inspection and maintenance at specific time intervals (e.g., annually before the wet season) and/or maintenance indicators when maintenance will be triggered (e.g., vegetation more than six inches in height). Operation and maintenance plans shall ensure that vegetation is removed or maintained on a regular basis to maintain the function of the facility.

Flood control channels require lifetime maintenance. The project owner and design engineer shall consult with Mesa County and the local jurisdiction to determine which maintenance mechanism is required for a particular project. At a minimum, privately owned and maintained detention facilities shall have a recorded easement agreement with a covenant binding on successors or other mechanism acceptable to Mesa County and the local jurisdiction.

(Res. 40-08 (§ 806.12), 3-19-08)

28.32.270 Design criteria for natural and alluvial-bed (erodible) channels.

Natural open channels are important drainage elements that contribute to the image and livability in an urban environment. The areas around open channels may have other uses that facilitate trails, open space areas, and wildlife habitat.

(a) Typical Open Channel Design Sections for Natural Channels. Typical open channel design sections for natural channels are presented in **Figure 28.32.270**. The selection of a design section for a natural channel is generally dependent on the value of developable land versus the cost to remove the land from a floodplain. The costs for removal depend on the rate of flow, slope, alignment and depth of the channel as well as material and fill costs for construction of the encroachment. The design section discussed herein varies from no encroachment to the level of encroachment at which point an improved channel (unlined or lined) becomes more economical or is required to adequately protect the proposed development. The design standards of natural channels are the same for both major and minor drainageways.

For natural channel sections, the engineer shall identify, through stable channel (normal depth) calculations, the stability or instability of the channel to contain the major storm flows. If this analysis demonstrates that either bank erosion outside of the designated flow path (easement and/or right-of-way) or channel degradation is likely to occur, then an analysis of the magnitude and extent of the erosion may be necessary. In such a condition, the design engineer shall meet with the local official to determine:

(1) What additional analysis will be prepared to estimate the potential extent of lateral and vertical channel movement;

(2) What is the estimate of the potential risk to the proposed development from channel degradation and/or bank failure;

(3) What solutions and/or remedies are available which can mitigate the potential risk to the proposed development; and

(4) What improvements and/or reduction in encroachment in or adjacent to the subject channel will be required to allow approval of the subject development.

(b) General Design Considerations and Evaluation Techniques for Natural Channels.

(1) The channel and overbank areas shall have adequate conveyance capacity for the major storm runoff.

(2) Natural channel segments with a calculated flow velocity greater than the allowable flow velocity shall be analyzed for erosion potential with a suitable methodology using standard engineering practice. Additional erosion protection may be required.

(3) The water surface profiles shall be defined so that the 100-year floodplain can be delineated.

(4) Filling of the floodplain fringe may reduce valuable storage capacity and may increase downstream runoff peaks, and therefore shall be avoided.

(5) Erosion control structures, such as drop structures or check dams, may be required to control flow velocities for both the minor storm and major storm events.

(6) Plan and profile information (i.e., HEC-2 or HEC-RAS output) for both existing and proposed floodplain site conditions shall be prepared.

(7) The engineer shall verify, through stable channel (normal depth) calculations, the suitability of the floodplain to contain the flows. If this analysis demonstrates erosion outside of the designated flow path (easement and/or right-of-way), an analysis of the equilibrium slope and degradation or aggregation depths is required and suitable improvements identified.

With many natural channels, erosion control structures may need to be constructed at regular intervals to decrease the thalweg slope and to minimize erosion. However, these channels shall be left in as near a natural state as possible. For that reason, extensive modifications shall not be pursued unless they are found to be necessary to avoid excessive erosion with substantial deposition downstream.

The usual rules of freeboard depth, curvature, and other rules, which are applicable to artificial channels, do not apply for natural channels. There are significant advantages that occur if the designer incorporates into his planning the overtopping of the channel and localized flooding of adjacent areas, which remain undeveloped for the purpose of being inundated during the major runoff peak.

If a natural channel is to be modified or encroached upon for a development, then the applicant shall meet with the agencies with jurisdiction over the channel to discuss the design concept and to obtain the requirements for planning, design analysis, and documentation. Channel stability analysis must be based on peak runoff rates from the long-term projected, urbanized watershed tributary to the channel.

(c) Natural Unencroached Channels. Natural encroached channels are defined as channels where overlot grading from the development process does not encroach into the 100-year floodplain of a given channel. Although the development does not alter the flow carrying capacity of the floodplain, the development must be protected from movement of the floodplain boundaries due to erosion and scour. Therefore, the designer needs to identify locations susceptible to erosion and scour and provide a design that reinforces these locations to minimize potential damage to the proposed development. For natural channels with velocities that exceed stable velocities, erosion protection may include the construction of buried grade control/check structures to minimize head-cutting and subsequent bank failures.

(d) Natural Encroached Channels. Natural encroached channels are defined as channels where the development process has encroached into the 100-year floodplain fringe. This definition includes both excavation and/or fill in the floodplain fringe. The designer shall prepare a design that will minimize damage to the development from movement of the floodplain boundaries due to erosion

and scour. Consideration of erosion protection is similar to that for unencroached channels with emphasis on protection of the fill embankment.

(e) Bank-Lined Channels. Bank-lined channels are channels where the banks will be lined but the channel bottom will remain in a natural state with minimal regrading. The concerns with bank-lined channels are to minimize scour of the channel bottom at the bank lining interface as well as maintaining a stable natural channel. The designer shall prepare a design that addresses scour depths at the lining interface to assure that the lining extends below this depth to avoid undermining of the lining.

(f) Partially Lined Channels. Partially lined channels are defined as channels in which half of the channel is lined and the other half is left in a natural or unimproved condition. The concerns with partially lined channels are twofold. First, the improvement and lining of one side of the channel will cause changes to the hydraulic parameters of the unlined section which could increase erosion and scour in the unlined section. Second, floods which occur during the temporary condition may damage the improved channel section and require avoidable costly repairs.

Partially lined channels will only be allowed if:

(1) The bottom paving is bonded, or there is another mechanism in place to pay for the bottom paving once the channel is completed.

(2) Erosion in the unlined section is addressed to the satisfaction of the local official.

(3) Scour below the lining is addressed to the satisfaction of the local official.

The analysis and design shall show that the proposed temporary channel does not adversely impact the hydraulic parameters and stability of the unlined section in a significant way.

(g) Bio-Engineered Channels. Bio-engineering is an applied science that integrates structural, biological and ecological principles to construct living structures (plant communities) for erosion, sediment, and flood control purposes. In many instances, bio-engineered channel stabilization measures can be safely utilized to supplement other stabilization measures. Successful application of bio-engineered stabilization measures depends upon accurate diagnosis of the causes of channel stability problems, rather than just treating visible problem areas. The references section of this manual (Chapter 28.72 GJMC) provides useful resources on bio-engineered solutions for natural channel stabilization.

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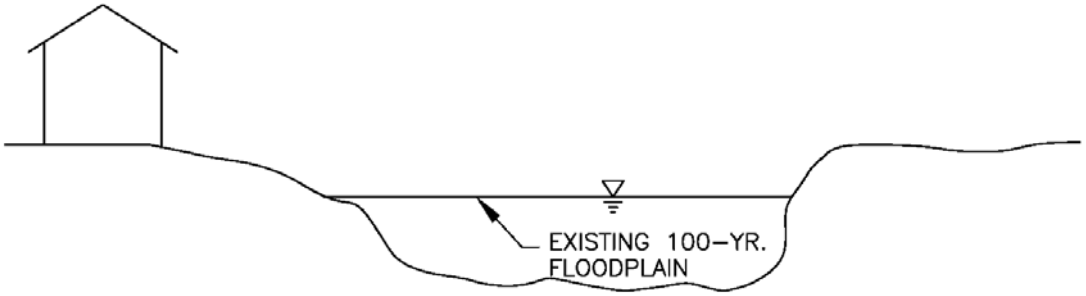
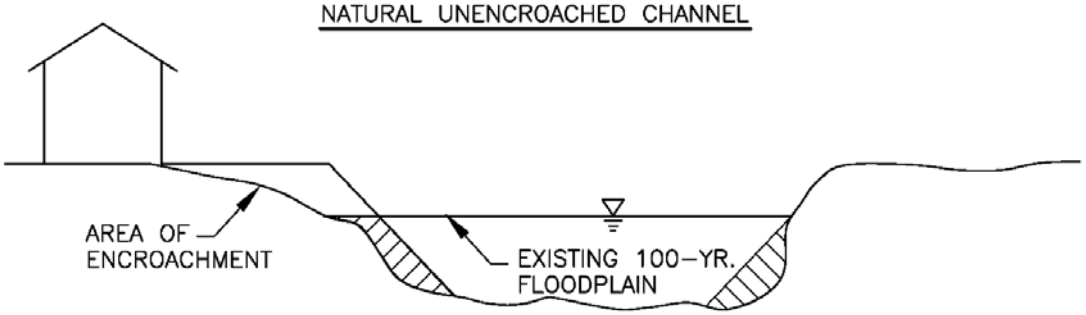
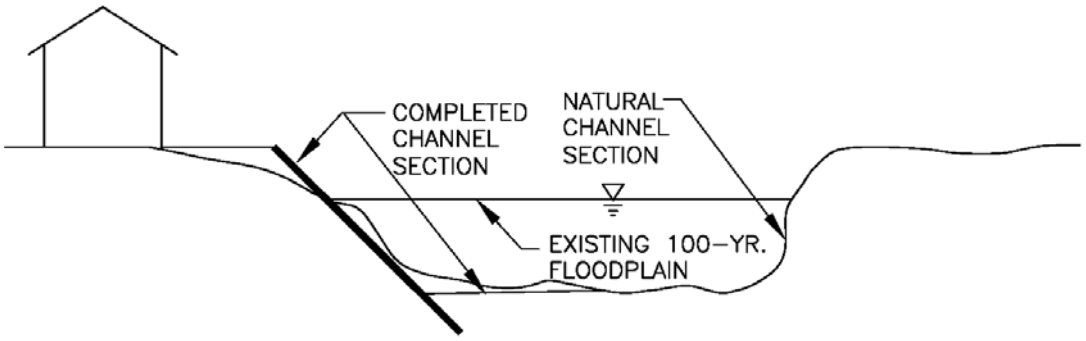
TYPICAL NATURAL OPEN CHANNEL DESIGN SECTIONS



NATURAL UNENCROACHED CHANNEL



NATURAL ENCROACHED CHANNEL



BANK LINED AND TEMPORARY UNLINED CHANNEL

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ORIGINAL ISSUE	3/27/06

WRC ENGINEERING, INC.	REFERENCE:	**FIGURE 28.32.270**

(Res. 40-08 (§ 807), 3-19-08)

28.32.280 Grass-lined channels.

Grass-lined channels are desirable artificial channels from an aesthetic point of view. The engineer shall design grass-lined channels in accordance with the criteria presented herein, and any special considerations due to project site specific requirements.

Applicable design parameters include:

(a) Longitudinal Channel Slopes. In a grass-lined channel, slopes are determined by the maximum permissible velocity requirements. A minimum longitudinal gradient of 0.5 percent shall be provided whenever practical.

(b) Roughness Coefficients. **Tables 28.32.040(d)** and **28.32.040(e)** present roughness coefficients for grass-lined channels. The design engineer is to assume a mature channel that has substantial vegetation with minimal maintenance.

(c) Trickle and Low-Flow Channels. After urbanization, because of lawn irrigation return flows and runoff from directly connected impervious areas, it is not uncommon to see dry waterways having a continuous flow. A trickle channel is required on all urban grass-lined channels. Properly designed earth trickle channels are acceptable. Because of low maintenance and limited infiltration, concrete trickle channels are also acceptable. In the case of larger streams and rivers, a low-flow channel may be more appropriate than a trickle channel.

(1) Trickle Channels. Trickle channels are recommended for grass-lined channels with a 100-year design flow less than or equal to 200 cfs. The trickle channel capacity shall convey five percent of the 100-year design flow rate or five cfs, whichever is greater. There is no freeboard requirement for trickle channels. The flow capacity of the main channel shall be determined without considering the flow capacity of the trickle channel. Care shall be taken to ensure that low flows enter the trickle channel without flow paralleling the trickle channel or bypassing inlets to the channel.

Trickle channels are not typically required for swales and other minor drainageways and grass-lined channels conveying a 100-year peak runoff of 20 cfs or less. For these smaller channels, the design engineer shall evaluate the factors such as drainage slope, flow velocity, soil type, and upstream impervious area, and specify a trickle channel when needed based on their engineering judgment.

(i) Concrete Trickle Channel. Concrete trickle channels help minimize erosion, silting, and excessive plant growth. **Figure 28.32.280** illustrates a typical concrete trickle channel. The concrete trickle channel shall have a minimum depth of six inches. A Manning roughness coefficient value of n equals 0.015 will be used to design the concrete trickle channel.

(ii) Rock-Lined Trickle Channel. Rock-lined trickle channels shall have a minimum depth of 12 inches, with the Manning roughness coefficient determined as described in GJMC 28.32.170. The minimum stone size for rock-lined trickle channels shall be six inches.

(2) Low-Flow Channels. Low-flow channels are used to contain relatively frequent flows within a recognizable channel section. Low-flow channels are recommended for channels with a 100-year flow greater than 200 cfs, and at a minimum have the capacity to convey the two-year flow event with no freeboard. The overall flow capacity of the channel shall include the capacity of the low-flow channel.

Low-flow channels shall have a minimum depth of 12 inches. The maximum side slopes of the low-flow channel shall be 2.5H:1V. The main channel depth limitations (subsection (e) of this section) do not apply to the low-flow channel area of the overall channel cross-section.

(d) Bottom Width. The bottom width selected shall be based on factors such as possible wetland mitigation requirements, constructability, channel stability, maintenance requirements, and multi-use purposes.

The minimum channel bottom width shall be 5.0 feet for channels with a concrete trickle channel, 20 feet in channels with a riprap trickle channel, and 30 feet in channels with a low-flow channel.

(e) Flow Depth and Freeboard. Swales and grass-lined channels conveying a 100-year flow less than or equal to 10 cfs shall have a minimum freeboard of six inches. Grass-lined channels conveying larger discharges shall meet the minimum freeboard requirements outlined in GJMC 28.32.220.

The recommended design depth of flow for a grass-lined channel (outside the low-flow channel area) is 5.0 feet for a 100-year flow of 1,500 cfs or less whenever practical. Excessive depths shall also be avoided in channels with greater design flows to the maximum extent practicable. GJMC 28.32.220 discusses access and safety for open channels, including thresholds for flow depth and velocity.

(f) Side Slopes. Side slopes of a grass-lined channel shall be not steeper than 3H:1V.

(g) Grass Lining. Satisfactory performance of a grass-lined channel depends on constructing the channel with the proper shape and preparing the area in a manner to provide conditions favorable to vegetative growth. Between the time of seeding and the actual establishment of the grass, the channel is unprotected and subject to considerable damage unless interim erosion protection is provided. See Chapter 28.60 GJMC, Construction Site Stormwater Runoff Control, for requirements.

The grass lining for channels may be seeded or sodded with a grass species that is adapted to the local climate and will flourish with minimal irrigation. Channel vegetation is usually established by seeding. In the more critical sections of some channels, it may be required to provide immediate protection by transplanting a complete sod cover. All seeding, planting, and sodding shall conform to local landscape recommendations.

(h) Horizontal Channel Alignment and Bend Protection. The potential for erosion increases along the outside bank of a channel bend due to the acceleration of flow velocities on the outside part of the bend. Thus, it is often necessary to provide supplemental erosion protection at bends in natural or grass-lined channels.

The minimum radius for channels with a 100-year runoff of 20 cfs or less shall be 25 feet. For channels carrying larger flows, horizontal channel alignment shall be limited based on the presence of erosion protection.

No channel bend protection is required along bends where the radius is greater than two times the top width of the 100-year water surface. Channels without bend protection shall have a radius of curvature greater than two times the 100-year flow top width or 100 feet, whichever is greater.

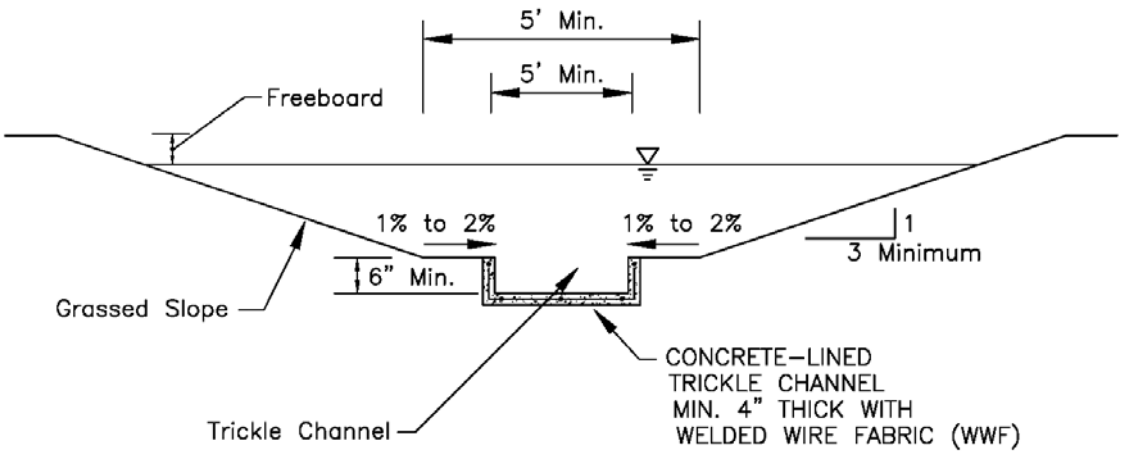
When erosion protection is provided, the minimum radius of curvature shall be 1.2 times the 100-year flow top width, or 50 feet, whichever is greater.

Erosion protection shall extend downstream from the end of the bend a distance that is equal to the length of the bend measured along the channel centerline.

(i) Maintenance. Grass-lined channels shall be maintained to ensure that vegetation is removed or maintained on a regular basis to maintain the function of the facility. The project owner shall ensure that appropriate mechanism is in place to provide maintenance for the lifetime of the facility.

STORMWATER MANAGEMENT MANUAL

TYPICAL CROSS-SECTION OF CONCRETE-LINED TRICKLE CHANNEL



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WRC ENGINEERING, INC.	REFERENCE: UDFCD MANUAL (V.1)	FIGURE 28.32.280

(Res. 40-08 (§ 808), 3-19-08)

28.32.290 Wetland-bottom channel.

This section presents minimum design criteria for wetland-bottom channels. The design engineer shall design wetland-bottom channels in accordance with the criteria presented herein, and any special considerations for a particular design situation.

Under certain circumstances, such as when existing wetland areas are affected or natural channels are modified, the Corps of Engineers Section 404 permitting process may mandate the use of channels with wetland vegetation. In other cases, a wetland bottom channel may better suit individual site needs if used to mitigate wetland damages somewhere else or if used to enhance urban runoff quality. Wetland-bottom channels are similar to grass-lined channels, except that wetland vegetation growth is encouraged by eliminating the concrete-lined trickle channel and flattening longitudinal slope so that low flows have low velocities.

There are potential benefits associated with a wetland bottom channel, such as wildlife and water quality enhancement as the base flows move through the marshy vegetation.

(a) Longitudinal Channel Slope. The longitudinal channel slope shall be set to the maximum permissible velocity criteria provided in **Table 28.32.200** is not violated. To prevent channel degradation, the channel slope shall be determined assuming there is not wetland vegetation on the bottom (i.e., "new channel"). In addition to the velocity requirements, the Froude number for the new channel condition shall be less than 0.7.

(b) Roughness Coefficients. The channel shall be designed for two flow roughness conditions. As previously mentioned, a Manning's roughness coefficient assuming there is no growth in the channel bottom is used to set the channel slope. This is referred to as the new channel condition. The mature channel condition assumes that wetland vegetation in the channel bottom has been established. The required channel depth including freeboard is determined assuming mature channel conditions.

A composite Manning's roughness coefficient shall be used for the new channel condition design and the mature channel condition design. The composite Manning's roughness coefficient is determined by the following equation (Chow, 1959):

$$n_c = \frac{\left(n_0^2 P_0 + n_w^2 P_w\right)^{0.5}}{\left(P_0 + P_w\right)} \qquad (28.32\text{-}22)$$

Where:

n_c = Manning's roughness coefficient for the composite channel (Dimensionless)

n_0 = Manning's roughness coefficient for areas above the wetland area (Dimensionless)

n_w = Manning's roughness coefficient for the wetland area (Dimensionless)

P_o = Wetland perimeter of channel cross-section above the wetland area (feet)

P_w = Wetland perimeter of the wetland channel bottom (feet)

For grass-lined areas above the wetland area, use a Manning's roughness coefficient n_0 equals 0.035. Manning's roughness coefficients for the wetland area (n_w) can be obtained from **Figure 28.32.290**.

(c) Low-Flow and Trickle Channel. Concrete trickle channels are not permitted in wetland bottom channels. Low-flow channels may be used when the 100-year flow exceeds 1,000 cfs. The design of the low-flow channel shall be according to GJMC 28.32.280(c)(2).

(d) Bottom Width. The following design factors shall be considered in selecting an appropriate channel bottom width:

(1) Wetland mitigation requirements.

(2) Constructability.

(3) Channel stability and maintenance.

(4) Multi-use purpose.

(5) Low-flow channel width.

(e) Flow Depth and Freeboard. Typically, the maximum design depth of flow (outside of the low-flow channel area) should not exceed 5.0 feet for a 100-year flow of 1,500 cfs or less. For greater flows, excessive depths shall be avoided to minimize high velocities and for public safety considerations.

Wetland bottom channels shall meet the minimum freeboard requirements outlined in GJMC 28.32.220.

(f) Side Slopes. Side slopes shall not be designed steeper than three horizontal to one vertical.

(g) Grass-Lining. The side slopes may be grass-lined according to the guidelines provided previously in GJMC 28.32.280(g).

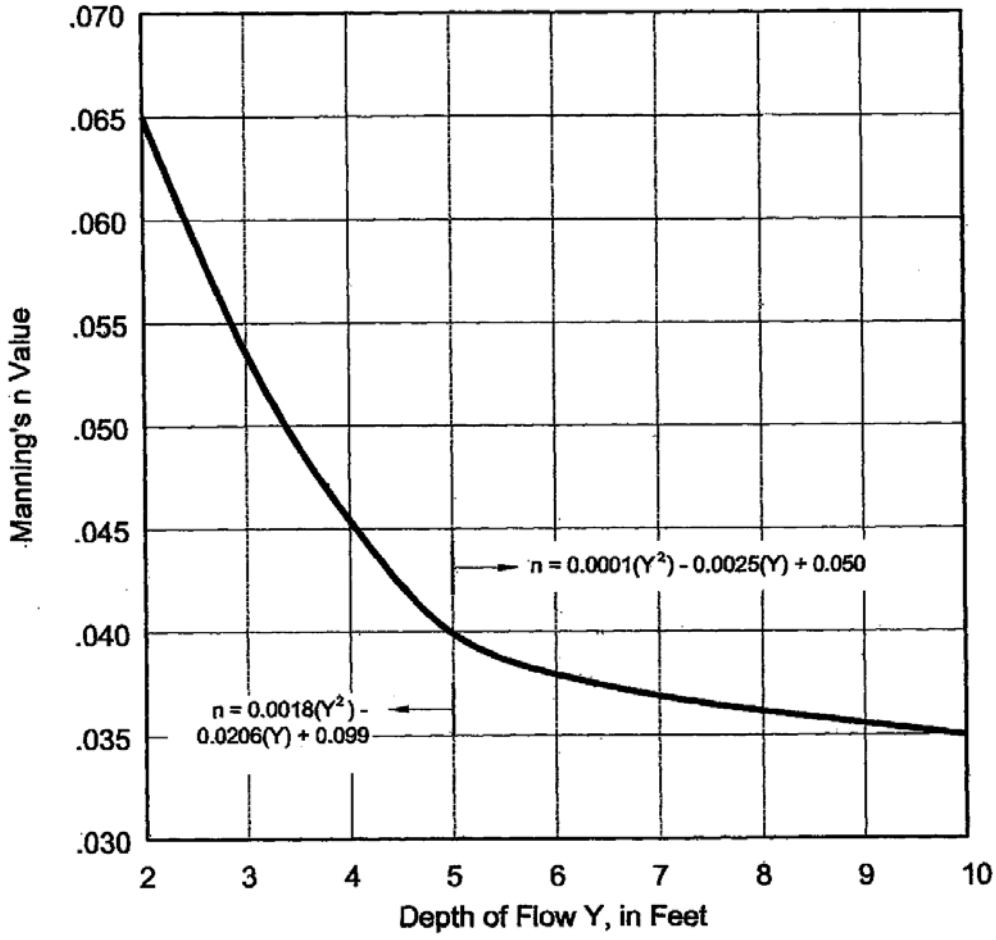
(h) Channel Bend Protection. Channel bends shall be designed according to the criteria discussed previously in GJMC 28.32.280(h).

(i) Channel Crossings. Whenever a wetland bottom channel is crossed by a road, railroad or a trail requiring a culvert or a bridge, a drop structure shall be provided immediately downstream of such a crossing. This will help reduce the silting-in of the crossing with sediments. A one-foot to two-foot drop is recommended. The designer shall determine the hydraulics of the crossing and the drop structure and design the structures to ensure the stability of the channel.

(j) Life Expectancy. Wetland bottom channels are expected to fill with sediment over time. This occurs because the bottom vegetation traps some of the sediments carried by the flow. The life expectancy of such a channel will depend primarily on the land use of the tributary watershed and could range anywhere from 20 to 40 years before major channel dredging is needed. However, life expectancy can be dramatically reduced, to as little as two to five years, if land erosion in the tributary watershed is not controlled. Therefore, land erosion practices need to be strictly controlled during new construction within the watershed and all facilities need to be built to minimize soil erosion in the watershed to maintain a reasonable economic life of a wetland bottom channel.

STORMWATER MANAGEMENT MANUAL

MANNING n VS. DEPTH FOR COMPOSITE CHANNEL AND LOW-FLOW SECTION DESIGN



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WRC ENGINEERING, INC.	REFERENCE: UDFCD MANUAL (V.1)	**FIGURE 28.32.290**

(Res. 40-08 (§ 809), 3-19-08)

28.32.300 Design criteria – Riprap-lined channels.

This section presents minimum design criteria for riprap-lined channels. The engineer shall design riprap-lined channels in accordance with the criteria presented herein, and any special considerations arising out of a particular design situation.

Riprap-lined channels are defined as channels in which riprap is used for lining of the channel banks and the channel bottom to control erosion. Design standards for riprap-lined channels shall also be used for transitions and bends when lined with riprap. Riprap is used to control erosion in both channel banks and beds, transition sections upstream and downstream of hydraulic structures, at bends, and bridges.

Loose or grouted riprap is cost effective for short channel reaches. Riprap lining might be appropriate for (1) flows that produce channel velocities in excess of allowable values; (2) channels where side slopes need to be steeper than 3:1; (3) at channel bends and transitions; and (4) low-flow channels.

Specific design parameters for riprap-lined channels include:

(a) Longitudinal Channel Slope. The maximum permissible velocity for riprap-lined channels is presented in **Table 28.32.200**. In steeper terrain, drop structures may be used to achieve the desired design velocities.

(b) Roughness Coefficients. The Manning's roughness coefficient, n, for hydraulic computations may be estimated for loose riprap using the following equation.

$$n = .0395(d_{50})^{1/6} \qquad (28.32\text{-}23)$$

Where:

d_{50} = mean stone size (feet)

This equation (Anderson, 1968) does not apply to grouted riprap (n equals 0.023 to 0.030) or to very shallow flow (hydraulic radius is less than or equal to two times the maximum rock size) where the roughness coefficient will be greater than indicated by the formula.

(c) Low-Flow Channel. The design criteria for the low-flow channel are discussed in GJMC 28.32.280(c)(2).

(d) Bottom Width. The following design factors shall be considered in selecting an appropriate channel bottom width.

(1) Constructability;

(2) Channel stability and maintenance;

(3) Multi-use purpose;

(4) Trickle/low-flow channel width.

(e) Flow Depth. As preliminary criteria, the design depth of flow for the major storm runoff flow shall not exceed 7.0 feet in areas of the channel cross-section outside the low-flow or trickle channel.

(f) Side Slopes. Due to stability, safety, and maintenance considerations, riprap-lined side slopes shall be two horizontal to one vertical or flatter.

(g) Toe Protection. Where only the channel sides are to be lined, additional riprap is needed to provide for long-term stability of the lining. In this case, the riprap blanket shall extend a minimum of three feet below the proposed channel bed, and the thickness of the blanket below the proposed channel bed shall be increased to a minimum of three times d_{50} to accommodate possible channel scour during floods. If the velocity exceeds the permissible velocity requirements of the soil comprising

the channel bottom, a scour analysis shall be performed to determine if the toe requires additional protection.

(h) Beginning and End of Riprap-Lined Channel. At the upstream and downstream termination of a riprap lining, the thickness shall be increased 50 percent for at least three feet to prevent undercutting. Depending on the site-specific conditions, concrete cutoff walls at both ends may be necessary.

(i) Loose Riprap Lining. Loose riprap, or simply riprap, refers to a protective blanket of large loose angular stones that are usually placed by machine to achieve a desired configuration. The term loose riprap has been introduced to differentiate loose stones from grouted riprap.

Many factors govern the size of the rock necessary to resist the forces tending to move the riprap. For the riprap itself, this includes the size and weight of the individual rock, the shape of stones, the gradation of the particles, the blanket thickness, the type of bedding under the riprap, and slope of the riprap layer. Hydraulic factors affecting riprap include the velocity, current direction, eddy action, and waves. **Figure 28.32.300(a)** provides typical cross-sections for riprap-lined channels.

Experience has shown that riprap failures generally result from undersized individual rocks in the maximum size range, improper gradation of the rock which reduces the interlocking of individual particles and improper bedding for the riprap which allows leaching of channel particles through the riprap blanket.

(1) Riprap Material. Rock used for loose riprap, grouted riprap, or wire enclosed riprap shall be hard, durable, angular in shape, and free from cracks, overburden, shale and organic matter. Neither breadth nor thickness of a single stone shall be less than one-third of its length and rounded stone shall be avoided. Rock having a minimum specific gravity of 2.65 is preferred; however, in no case shall the specific gravity of the individual stones be less than 2.50.

Classification and gradation for riprap are shown in **Table 28.32.300(a)** and are based on a minimum specific gravity of 2.50 for the rock. Because of its relatively small size and weight, riprap Class 150 must be buried with native topsoil and revegetated to protect the rock from vandalism.

Riprap lining requirements for a stable channel lining are based on the following relationship which resulted from model studies by Smith and Murray (Smith, 1965)

$$d_{50} = \frac{0.05v^2S^{0.34}}{(S_s - 1)^{1.332}} \qquad (28.32\text{-}24)$$

Where:

d_{50}	=	Rock size for which 50 percent of riprap by weight is smaller (feet)
V	=	Mean channel velocity (fps)
S	=	Longitudinal channel slope (feet/feet)
S_s	=	Specific gravity of rock (minimum S_s = 2.50) (dimensionless)

The riprap blanket thickness shall be at least 2.0 times d_{50} and shall extend up the side slopes to an elevation of the design water surface plus the calculated freeboard.

(2) Bedding Requirements. Long-term stability of riprap erosion protection is strongly influenced by proper bedding conditions. A large percentage of all riprap failures is directly attributable to bedding failures. Gradations for granular riprap bedding are shown in **Table 28.32.300(b)**.

STORMWATER MANAGEMENT MANUAL

GRADATION OF LOOSE RIPRAP

STONE SIZE d50[1] (INCHES)	% OF MATERIAL SMALLER THAN TYPICAL STONE[2]	TYPICAL STONE DIMENSIONS[3] (INCHES)	TYPICAL STONE WEIGHT[4] (POUNDS)
6	70–100	12	85
	50–70	9	35
	35–50	6	10
	2–10	2	0.4
9	70–100	15	160
	50–70	12	85
	35–50	9	35
	2–10	3	1.3
12	70–100	21	440
	50–70	18	275
	35–50	12	85
	2–10	4	3
18	100	30	1280
	50–70	24	650
	35–50	18	275
	2–10	6	10
24	100	42	3500
	50–70	33	1700
	35–50	24	650
	2–10	9	35

[1] d50 = NOMINAL STONE SIZE
[2] BASED ON TYPICAL ROCK MASS
[3] EQUIVALENT SPHERICAL DIAMETER
[4] BASED ON A SPECIFIC GRAVITY = 2.5

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REFERENCE: COLORADO DEPARTMENT OF TRANSPORTATION STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION, 2005

TABLE 28.32.300(a)

STORMWATER MANAGEMENT MANUAL

GRADATION FOR GRANULAR RIPRAP BEDDING

PERCENTAGE PASSING DESIGNATED SIEVES

U.S. STANDARD SIEVE SIZE (INCHES)	COARSE AGGREAGATE (1 ½" TO #4)	FINE AGGREGATE (#4 TO #100)
2	100	–
1 1/2	–	–
1	95–100	–
3/4	–	–
1/2	25–60	–
3/8	–	100
#4	0–10	95–100
#8	0–5	80–100
#16	–	50–85
#30	–	25–60
#50	–	10–30
#100	–	2–10

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TABLE 28.32.300(b)

Properly designed bedding provides a buffer of intermediate sized material between the channel bed and the riprap to prevent movement of soil particles through the voids in the riprap. Three types of bedding are in common use: generic single layer granular bedding, granular bedding based on the T-V (Terzughi-Vicksburg) methodology, and filter fabric.

(i) Granular Bedding – Generic Design. The gradation of a single layer bedding specification is based on the assumption that said bedding will generally protect the underlying soil from displacement during a flood event. The single layer bedding design does not require any soil information, but in order to be effective covering a wide range of soil types and sizes, this method requires a greater thickness than the T-V method.

A single 12-inch layer of said granular bedding can be used except at drop structures. At drop structures, filter fabric must be added below the 12-inch layer of granular bedding.

(ii) Granular Bedding – T-V Design. The T-V design establishes an optimum granular bedding gradation for a specific channel soil. Since this method designs the granular bedding for a particular soil, the allowable granular bedding thickness may be much less than the generic design.

The specifications for the T-V reverse filter method relate the gradation of the protective layer (filter) to that of the bed material (base) by the following inequalities:

$$D_{15(filter)} \leq 5d_{85(base)} \quad (28.32\text{-}25)$$

$$4d_{15(base)} \leq D_{15(filter)} \leq 20d_{15(base)} \quad (28.32\text{-}26)$$

$$D_{50(filter)} < 25d_{50(base)} \quad (28.32\text{-}27)$$

Where the capital "D" refers to the filter grain size and the lower case "d" to the base grain size. The subscripts refer to the percent by weight which is finer than the grain size denoted by either "D" or "d." For example, 15 percent of the filter material is finer than $D_{15(filter)}$ and 85 percent of the base material is finer than $d_{85(base)}$.

When the T-V method is used, the thickness of the resulting layer of granular bedding may be reduced to six inches. However, if a gradation analysis of the existing soils shows that a single layer of T-V method designed granular bedding cannot bridge the gap between the riprap specification and the existing soils, then two or more layers of granular bedding shall be used. The design of the bedding layer closest to the existing soils shall be based on the existing soil gradation. The design of the upper bedding layer shall be based on the gradation of the lower bedding layer. The thickness of each of the two or more layers shall be four inches.

(iii) Filter Fabrics. Filter fabric is not a complete substitute for granular bedding. Filter fabric provides filtering action only perpendicular to the fabric and has only a single equivalent pore opening between the channel bed and the riprap. Filter fabric has a relatively smooth surface which provides less resistance to stone movement. As a result, it is recommended that the use of filter fabric in place of granular bedding be restricted to slopes no steeper than 2.5 horizontal to one vertical, and that such filter fabric only replace the bottom layer in a multi-layer T-V method granular bedding design. The granular bedding shall be placed on top of the filter fabric to act as a cushion when placing the riprap. Tears in the fabric greatly reduce its effectiveness so that direct dumping of riprap on the filter fabric is not allowed and due care must be exercised during construction. Nonetheless,

filter fabric has proven to be an adequate replacement for granular bedding in many instances. Filter fabric provides adequate bedding for channel linings along uniform mild sloping channels where leaching forces are primarily perpendicular to the fabric.

At drop structures and sloped channel drops, where seepage forces may run parallel with the fabric and cause piping along the bottom surface of the fabric, special care is required in the use of filter fabric. Seepage parallel with the fabric may be reduced by folding the edge of the fabric vertically downward about two feet (similar to a cutoff wall) at 12-foot intervals along the installation, particularly at the entrance and exit of the channel reach. Filter fabric has to be lapped a minimum of 12 inches at roll edges with upstream fabric being placed on top of downstream fabric at the lap.

Fine silt and clay has been found to clog the openings in filter fabric. This prevents free drainage which increases failure potential due to uplift. For this reason, a granular filter is often more appropriate bedding for fine silt and clay channel beds.

(j) Grouted Riprap Lining. Grouted riprap provides a relatively impervious channel lining which is less subject to vandalism than loose riprap. Grouted riprap requires less routine maintenance by reducing silt and trash accumulation and is particularly useful for lining low-flow channels and steep banks. The appearance of grouted riprap is enhanced by exposing the tops of individual stones and by cleaning excess grout from the projecting rock with a wet broom prior to curing. **Figure 28.32.300(b)** provides a typical cross-section for a grouted riprap lining.

(1) Riprap Material. The rock used for grouted riprap is different from the standard gradation of riprap in that the smaller rock has been removed from the groundwater to allow larger void spaces and, therefore greater penetration by the grout. The riprap specifications are shown on **Table 28.32.300(c)**. Riprap smaller than Class 400 shall not be grouted.

(2) Bedding Material. The bedding material requirements are the same as for loose riprap.

(3) Cutoff Trench. As the riprap layer is placed, a cutoff trench shall be excavated around the rock section at the top of the slope and at the upstream and downstream edges. The trench shall be, at a minimum, the full depth of the riprap and bedding layer and at least one foot wide. This trench is filled with grout to prevent water from undermining the grouted rock mass.

(4) Grout. After the riprap has been placed to the required thickness and the trench excavated, the rock is sprayed with clean water which cleans the rock and allows better adherence by the grout. The rock is then grouted using a low pressure (less than 10 psi) grout pump with a two-inch maximum diameter hose. Using a low pressure grout pump allows the work crew time to move the hose and vibrate the grout. Vibrating the grout with a pencil vibrator assures complete penetration and filling of the voids. After the grout has been placed and vibrated, a small hand broom or gloved hand is used to smooth the grout and remove any excess grout from the rock. The finished surface is sealed with a curing compound.

The grout shall consist of six sacks (564 pounds) of cement per cubic yard, and the aggregate shall consist of 30 percent of 3/8-inch coarse gravel and 70 percent natural sand. The grout shall contain 7.5 percent plus or minus 1.5 percent air entrainment, have a 28-day compressive strength of at least 2,000 psi, and have a slump of seven inches plus or minus two inches. Fiber reinforcement shall be used such as 1.5 pounds per cubic yard of Fibermesh or an approved equivalent amount. A maximum of 25 percent fly ash may be substituted for the cementations material.

(k) Channel Bend Protection. When riprap protection is required for a straight channel, increase the rock size by one category (e.g., Class 300 to Class 400) through bends. The minimum radius for a riprap-lined bend is 1.2 times the top width and in no case less than 50 feet. Riprap protection shall extend downstream from the end of the bend a distance that is equal to the length of the bend measured along the channel centerline.

STORMWATER MANAGEMENT MANUAL

CLASSIFICATION AND GRADATION OF ROCK FOR GROUTED RIPRAP

STONE SIZE d50 (INCHES)	% SMALLER THAN GIVEN SIZE BY WEIGHT	INTERMEDIATE ROCK DIMENSION (INCHES)
d50=24"(TYPE HG)	100	30
	50–70	24
	0–5	18
d50=18"(TYPE HG)	70–100	21
	50–70	18
	0–5	12

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REFERENCE: COLORADO DEPARTMENT OF TRANSPORTATION STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION, 2005

TABLE 28.32.300(c)

(l) Transition Protection. Scour potential is amplified by turbulent eddies in the vicinity of rapid changes in channel geometry such at transitions and bridges. For these locations, the riprap lining thickness shall be increased by one size category.

Protection shall extend upstream from the transition entrance at least 5.0 feet and extend downstream from the transition exit at least 10 feet. See GJMC 28.32.060 and 28.32.070 for further discussions on transitions.

(m) Concrete Cutoff Walls. Transverse concrete cutoff walls may be required for riprap-lined channels where a resulting failure of the riprap lining may seriously affect the health and safety of the public. The designer shall consult with the local officials prior to design of riprap-lined channels to determine if concrete cutoff walls are required as well as their sizing and spacing, if required.

(n) Riprap-Lined Channels on Steep Slopes. Achieving channel stability on steep slopes usually requires some type of channel lining. The only exception is a channel constructed in durable bedrock.

On mild slopes, the water velocity is slow enough and the depth of flow is large enough (relative to the riprap size) that a reasonable estimate of the resistance to flow can be made. On steep channels, the riprap size required to stabilize the channel is on the same order of magnitude or greater than the flow depth, which invalidates the Manning's relation. Since the resistance to flow is unknown, an estimate of the velocity needed for the design of the riprap cannot be accurately estimated.

A graphically based methodology was developed for the U.S. Department of the Interior, Office of Surface Mining Reclamation and Enforcement (SIMONS, 1989) to design riprap-lined channels on steep slopes (supercritical flow). This methodology was based on a study by Bathurst, 1979, that analyzed the hydraulics of mountain rivers where roughness elements are on the same order of magnitude as the depth of flow. Using the resistance equation developed by Bathurst, the velocity can be estimated for a given riprap size. The velocity is then used to predict the stability of the riprap.

This procedure shall be used for all riprap-lined channels whose depth of flow is equal to or less than d_{50} as computed initially using Equation 28.32-24.

(1) Rock Size. Five sets of design curves (**Figures 28.32.300(c)** through **28.32.300(g)**) have been developed from Bathurst's relationship to simplify riprap design for steep channels. The design curves were developed for channels with two to one side slopes and bottom widths of zero feet, six feet, 10 feet, 14 feet, and 20 feet. The curves were terminated at the point where flow velocity exceeded 15 fps. A median rock diameter could be determined that would be stable at higher flows and velocities; however, rock durability at velocities greater than 15 fps becomes of greater concern.

For a given flow, channel slope, and channel width, **Figures 28.32.300(c)** through **28.32.300(g)** will provide the median riprap size. When the channel slope is not provided by one of the design curves, linear interpolation is used to determine the riprap size. This is done by extending a horizontal line at the given flow through the curves with slopes bracketing the design slope. A curve at the design slope is then estimated by visual interpolation. The design D_{50} size is then chosen at the point that the flow intercepts the estimated design curve. Linear interpolation can also be used to estimate the D_{50} size for bottom widths other than those supplied in the figures.

For practical engineering purposes, the D_{50} size specified for the design shall be given in 0.25-foot increments. The final minimum design size is determined using **Table 28.32.300(d)**.

(2) Riprap Gradation for Steep Slopes. **Table 28.32.300(e)** provides ratios used to determine the D_{10}, D_{20}, and D_{max} rock sizes from the D_{50} rock size determined in subsection (n)(1) of this section. It is important to establish a smooth gradation from the largest to the smallest sizes to prevent large voids between rocks.

STORMWATER MANAGEMENT MANUAL

DESIGN D_{50} VALUES FOR STEEP CHANNELS

D_{50} DETERMINED FROM DESIGN CURVE (FT)	MINIMUM DESIGN D_{50} (FT)
< 0.25	0.25
0.26 - 0.50	0.50
0.51 - 0.75	0.75
0.76 - 1.00	1.00
1.01 - 1.25	1.25
1.26 - 1.50	1.50
1.51 - 1.75	1.75
1.76 - 2.00	2.00
2.01 - 2.25	2.25
2.26 - 2.50	2.50
2.51 - 2.75	2.75
2.76 - 3.00	3.00

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REFERENCE:

TABLE 28.32.300(d)

STORMWATER MANAGEMENT MANUAL

RIPRAP GRADATION FOR STEEP SLOPES

$$\frac{D_{MAX}}{D_{50}} = 1.25$$

$$\frac{D_{50}}{D_{20}} = 2.0$$

$$\frac{D_{50}}{D_{10}} = 3.0$$

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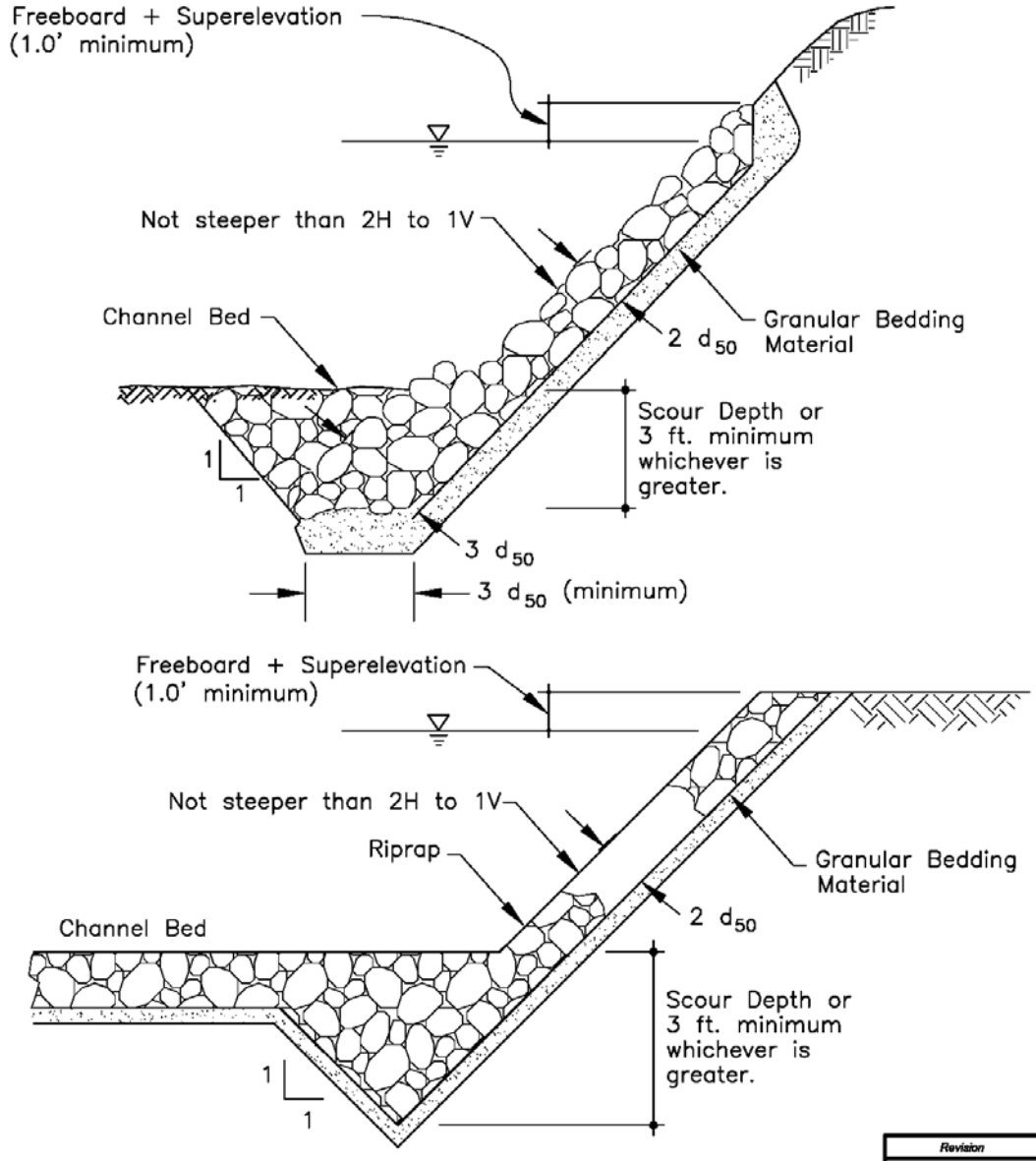
WRC ENGINEERING, INC.

REFERENCE: SIMONS, 1989

TABLE 28.32.300(e)

STORMWATER MANAGEMENT MANUAL

TYPICAL CROSS SECTIONS FOR RIPRAP-LINED CHANNELS



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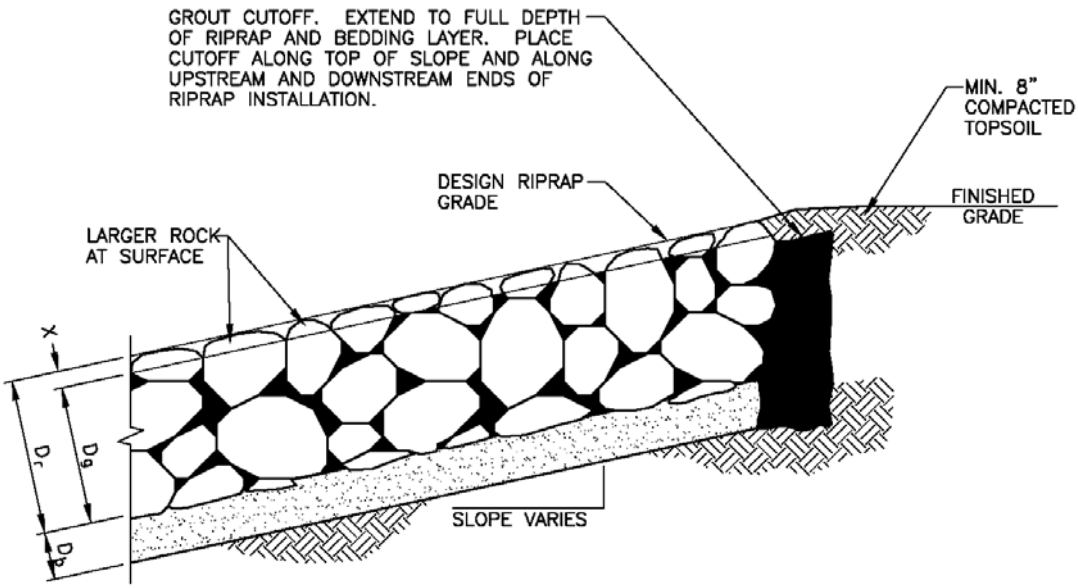
WRC ENGINEERING, INC.

REFERENCE: MODIFIED FROM H.E.C. NO. 11, USDOT, 1989

FIGURE 28.32.300(a)

STORMWATER MANAGEMENT MANUAL

TYPICAL CROSS SECTION FOR GROUTED RIPRAP LINING



LEGEND:

D_b = DEPTH OF BEDDING MATERIAL

D_g = DEPTH OF GROUT LAYER

D_r = DEPTH OF RIPRAP LAYER

X = DEPTH FROM RIPRAP SURFACE TO GROUT SURFACE

NOTES:

1. FINAL PLACEMENT OF RIPRAP TO BE APPROVED BY ENGINEER PRIOR TO GROUTING.
2. BEFORE GROUTING, CLEAN ALL DIRT AND MATERIALS FROM ROCK THAT COULD PREVENT THE GROUT FROM BONDING TO ROCK.
3. PLACE GROUT BY INJECTION METHODS AND USE A PENCIL VIBRATOR TO FILL VOIDS TO THE SPECIFIED GROUT DEPTH. CLEAN EXCESS GROUT FROM ALL EXPOSED SURFACES. PROVIDE A BROOM FINISH FOR GROUT SURFACE.
4. THE CONTRACTOR SHALL CONTROL GROUT MIX AND PLACEMENT PROCEDURES TO ACHIEVE THE SPECIFIED THICKNESS, PENETRATION AND GRADE OF THE GROUT LAYER.

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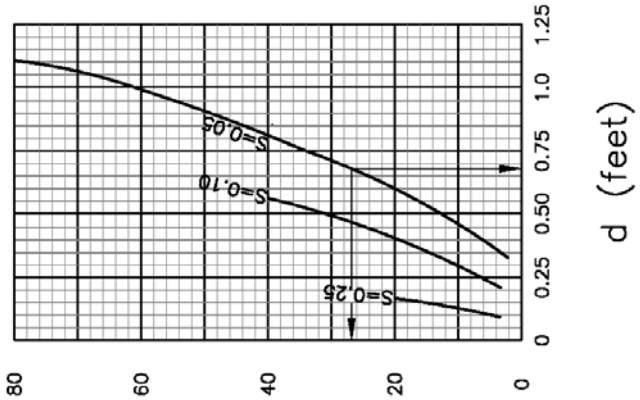
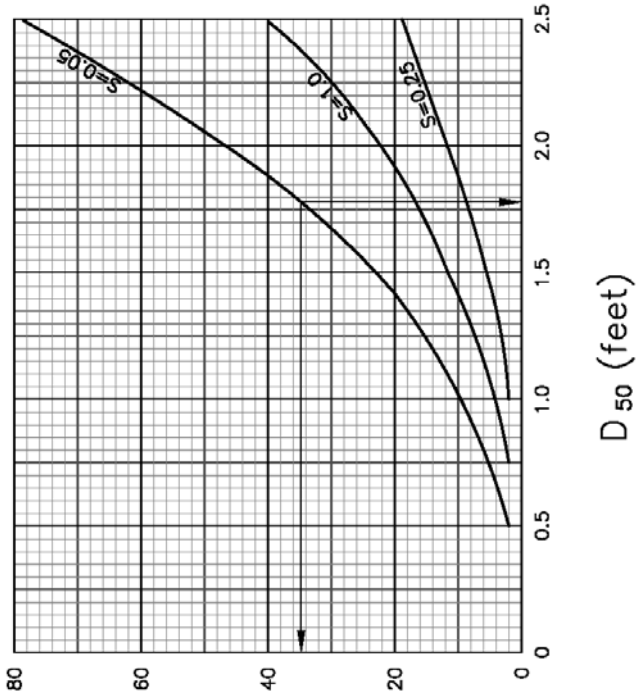
WRC ENGINEERING, INC.	REFERENCE: UDFCD, 1990	FIGURE 28.32.300(b)

STORMWATER MANAGEMENT MANUAL

STEEP SLOPE RIPRAP DESIGN, TRIANGULAR CHANNEL, 2:1 SIDE SLOPES





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REFERENCE: SIMON, LI AND ASSOC., 1989

FIGURE 28.32.300(c)

STORMWATER MANAGEMENT MANUAL

STEEP SLOPE RIPRAP DESIGN, TRAPEZOIDAL CHANNEL, 2:1 SIDE SLOPES, 6-FOOT BOTTOM WIDTH

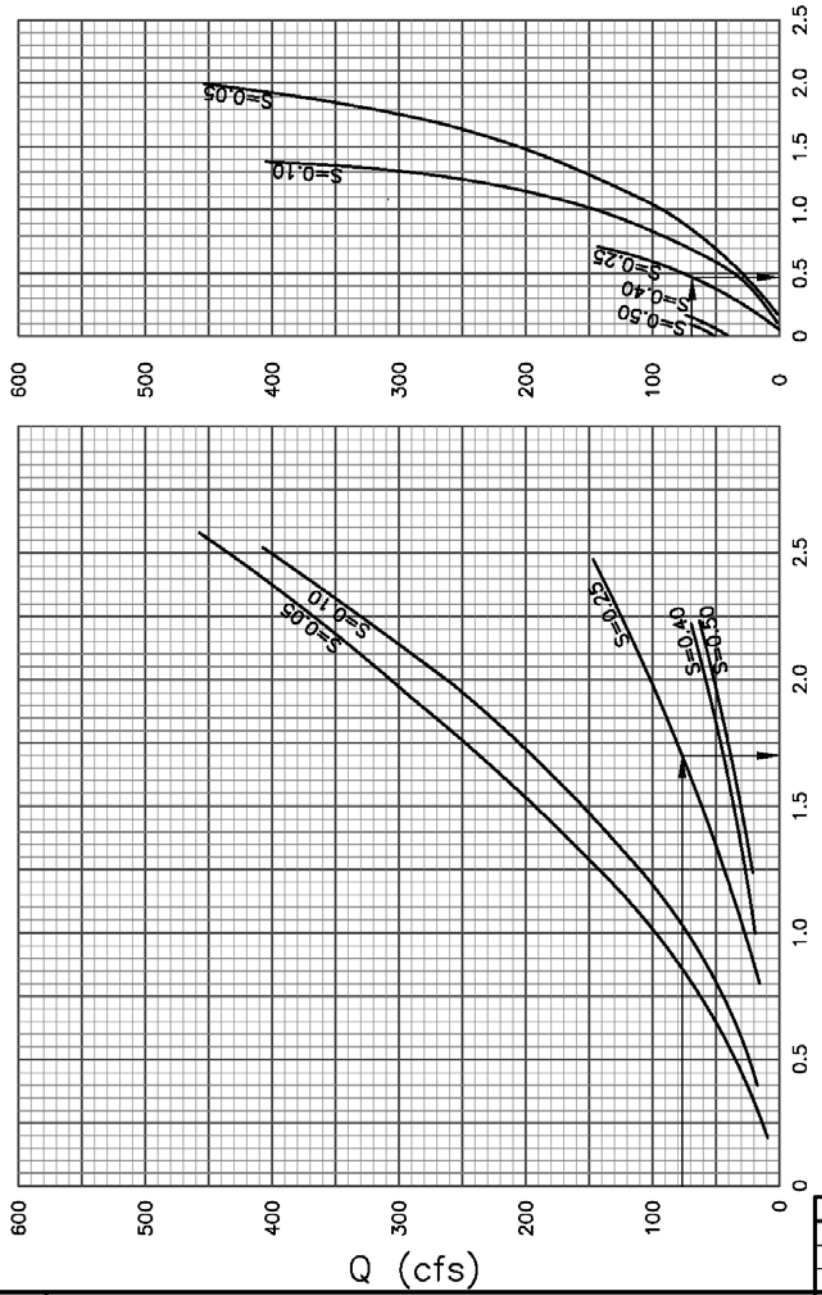

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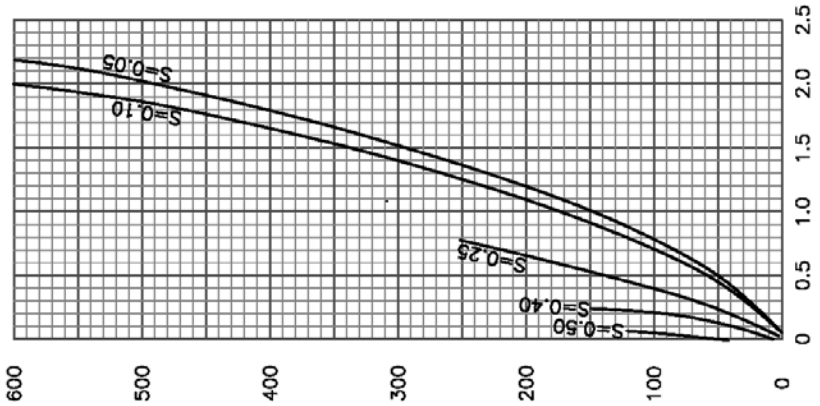
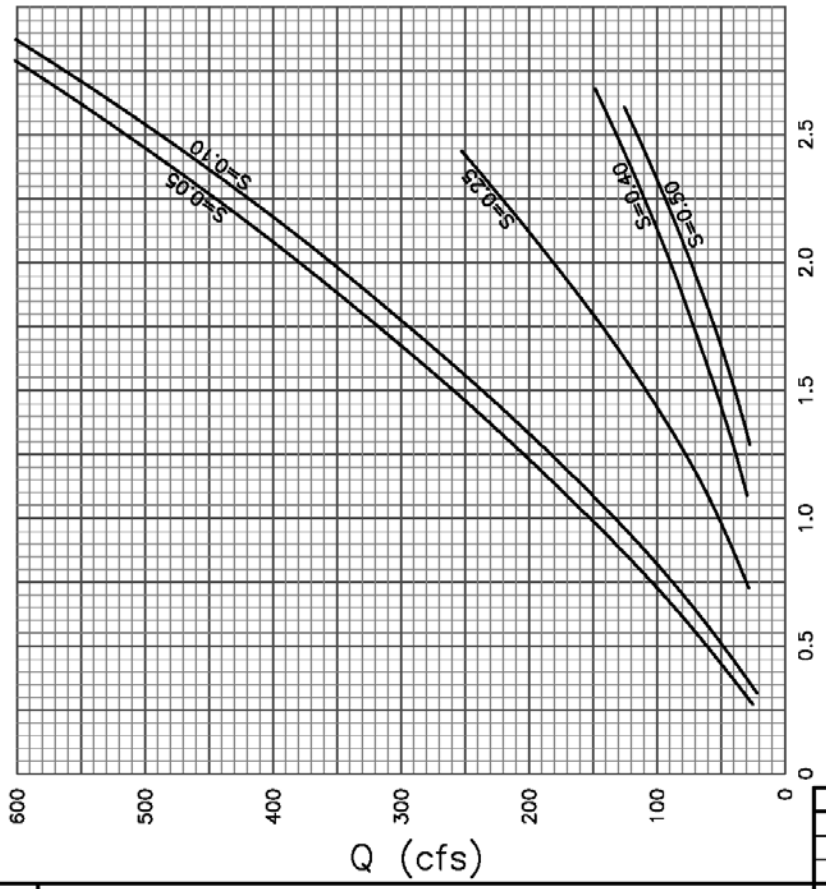
FIGURE 28.32.300(d)

STORMWATER MANAGEMENT MANUAL

STEEP SLOPE RIPRAP DESIGN, TRAPEZOIDAL CHANNEL, 2:1 SIDE SLOPES, 10-FOOT BOTTOM WIDTH





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REFERENCE: SIMON, LI AND ASSOC., 1989

FIGURE 28.32.300(e)

STORMWATER MANAGEMENT MANUAL

STEEP SLOPE RIPRAP DESIGN, TRAPEZOIDAL CHANNEL, 2:1 SIDE SLOPES, 14-FOOT BOTTOM WIDTH

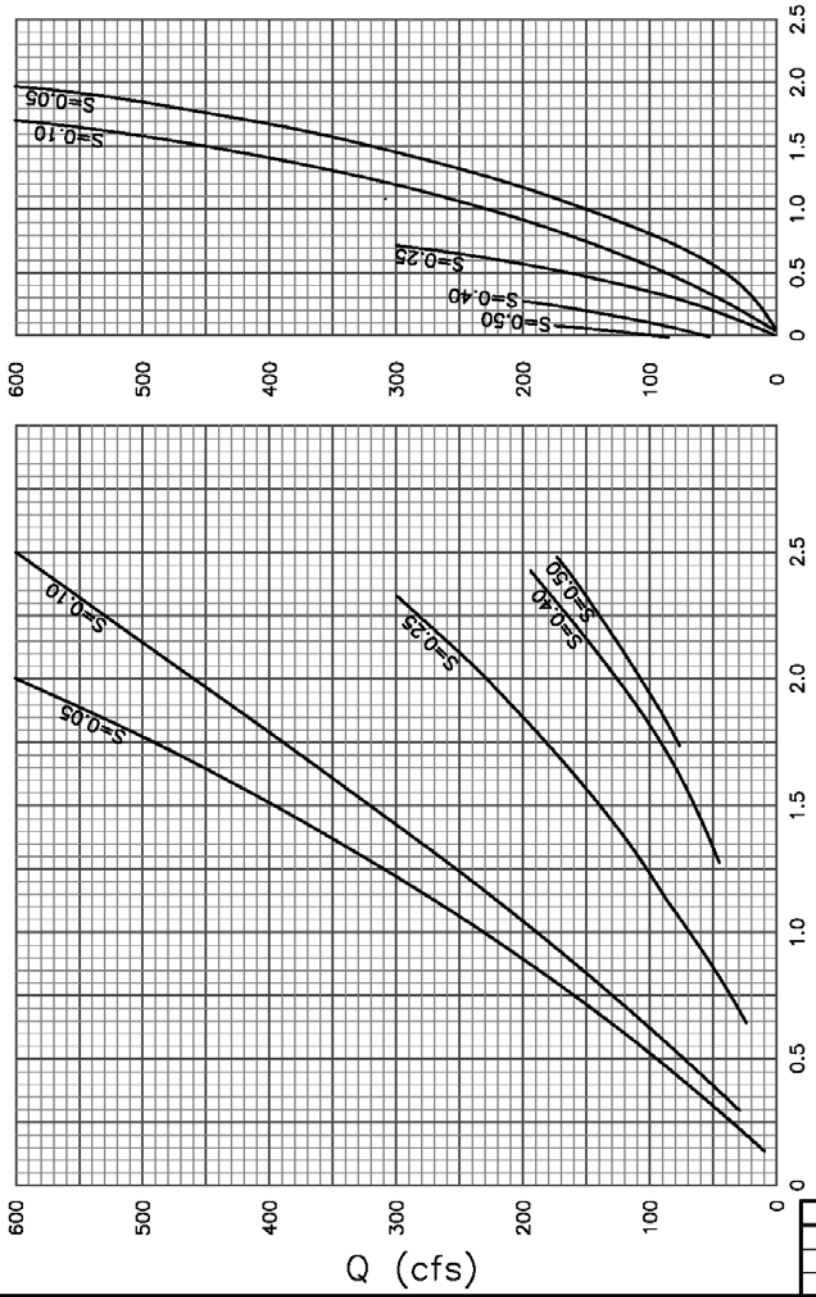

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FIGURE 28.32.300(f)

STORMWATER MANAGEMENT MANUAL

STEEP SLOPE RIPRAP DESIGN, TRAPEZOIDAL CHANNEL, 2:1 SIDE SLOPES, 20-FOOT BOTTOM WIDTH

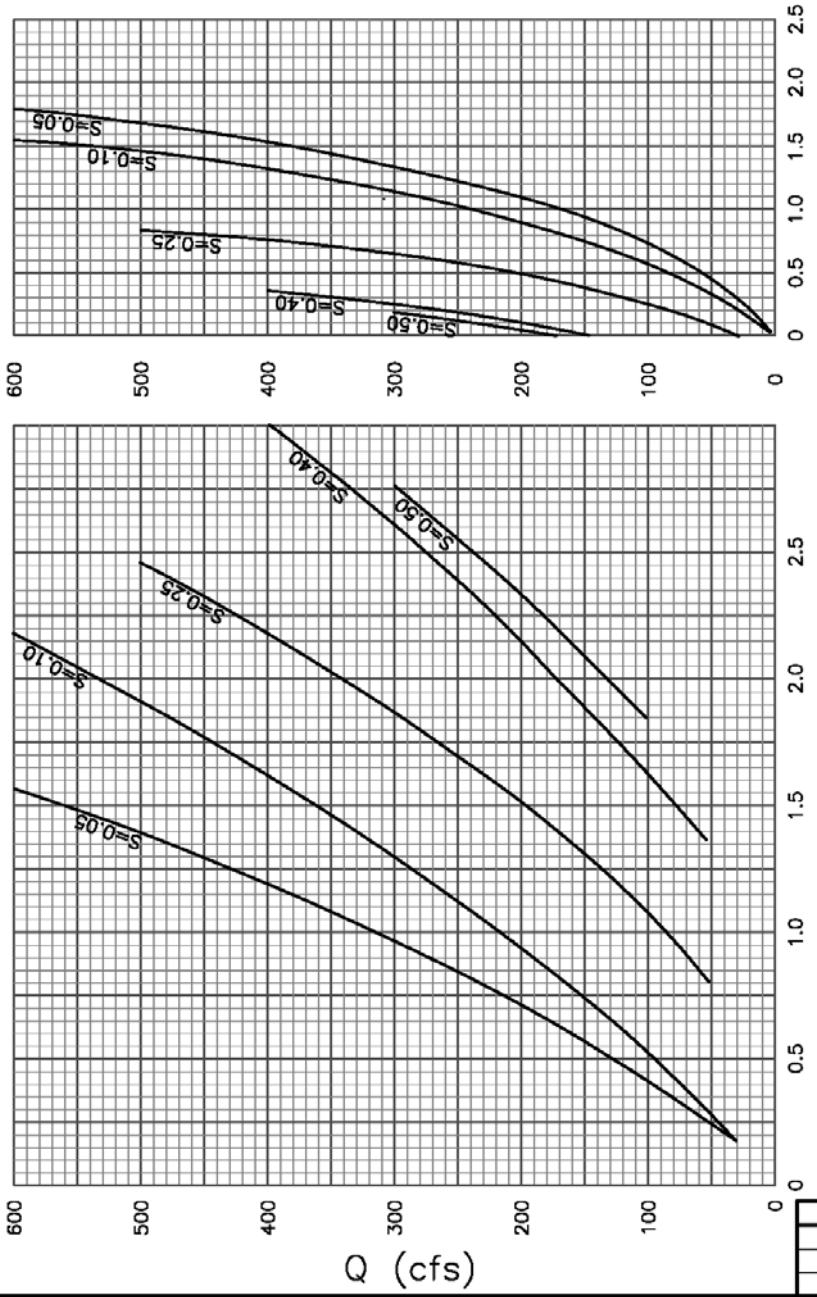

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FIGURE 28.32.300(g)

(3) Riprap Thickness for Steep Slopes. For riprap linings on steep slopes, a thickness of 1.25 times the median rock size is recommended. The maximum resistance to the erosive forces of flowing water occurs when all rock is contained within the riprap layer thickness. Oversize rocks that protrude above the riprap layer reduce channel capacity and reduce riprap stability.

(4) Riprap Placement on Steep Slopes. Improper placement is another major cause of failure in riprap-lined channels. To prevent segregation of rock sizes, riprap shall be dumped directly from trucks from the top of the embankment, and draglines with orange peel buckets, backhoes, and other power equipment to place riprap with minimal handwork.

(5) Freeboard. **Figures 28.32.300(c)** through **28.32.300(g)** also provide the depth of flow for a given flow rate, channel slope, and channel dimensions. The minimum required freeboard is given by Equation 28.32-18 for subcritical flow or 28.32-19 for supercritical flow. The velocity can be estimated by dividing the flow rate by the area of flow.

(6) Bedding Requirements on Steep Slopes. Either a granular bedding material or filter fabric may be used on steep slopes according to the requirements previously specified in subsection (i) of this section.

(Res. 40-08 (§ 810), 3-19-08)

28.32.310 Design criteria – Concrete-lined channels.

This section presents minimum design criteria for concrete-lined channels. The design engineer is responsible for confirming that a channel design meets these criteria, the general open channel criteria outlined in GJMC 28.32.140 through 28.32.260, and any specific considerations due to project specific site requirements.

Applicable design parameters include:

(a) Longitudinal Channel Slope. Concrete-lined channels have the ability to accommodate supercritical flow conditions and thus can be constructed almost on any naturally occurring slope. The maximum slope is determined by the maximum permissible velocity shown in **Table 28.32.200**.

(b) Roughness Coefficients. See figures presented in **Tables 28.32.040(b)** through **28.32.040(d)** for appropriate Manning roughness coefficient for concrete-lined channels. For subcritical flow for concrete-lined channels, check the Froude number using a Manning roughness coefficient of 0.011.

(c) Low-Flow Channel. The bottom of the concrete-lined channel shall be sloped to confine the low flows to the middle or one side of the channel. Low-flow channels are defined in GJMC 28.32.280(c)(2).

(d) Bottom Width. The bottom width of the concrete-lined channel shall be a minimum of 4.0 feet.

(e) Flow Depth. There are no flow depth requirements for concrete-lined channels.

(f) Side Slopes. Vertical or flatter side slopes may be designed for concrete-lined channels.

(g) Concrete-Lining Section.

(1) Thickness. Concrete-lined channels shall have a minimum thickness of six inches for flow velocities less than 30 feet per second (fps). For flow velocities of 30 fps and greater, the minimum thickness shall be seven inches.

(2) Concrete Joints. The following design standards, found to work in similar conditions, are suggested. Alternatives will be considered on a case-by-case basis.

(i) Channels shall be continuously reinforced without transverse joints. Expansion/contraction joints (without continuous reinforcement) shall only be installed where the new concrete lining is connected to a rigid structure or to an existing concrete lining which is not continuously reinforced. The design of the expansion joint shall be coordinated with local officials.

(ii) Longitudinal joints, where required, shall be constructed on the sidewalls at least 1.0 foot vertically above the channel invert.

(iii) All joints shall be designed to prevent differential movement.

(iv) Construction joints are required for all cold joints and where the lining thickness changes. Reinforcement shall be continuous through the joint and the concrete-lining shall be thickened at the joint.

(3) Concrete Finish. The surface of the concrete lining shall be provided with a wood float finish unless the design requires additional finishing treatment.

Excessive working or wetting of the finish shall be avoided if additional finishing is required.

(4) Concrete Curing. It is suggested that concrete-lined channels be cured by the application of a liquid membrane-forming curing compound (white pigmented) upon completion of the concrete finish. All curing shall be completed in accordance with the standard specifications of the local government agency.

(5) Reinforcement Steel.

(i) Steel reinforcement shall be at a minimum grade 40 deformed bars. Wire mesh shall not be used.

(ii) Ratio of longitudinal steel area to concrete cross-sectional area shall be greater than 0.0905 but not less than a No. 4 rebar placed at 12-inch spacing. The longitudinal steel shall be placed on top of the transverse steel.

(iii) Ratio of transverse steel area to concrete cross-sectional area shall be greater than 0.0025 but not less than a No. 4 rebar placed at 12-inch spacing.

(iv) Reinforcing steel shall be placed near the center of the section with a minimum clear cover of three inches adjacent to the earth.

(v) Additional steel shall be added as needed. If a retaining wall structure is used, the structure shall be designed by a registered structural engineer with structural design calculations submitted for review and approval.

(6) Earthwork. As a minimum, the following areas shall be compacted to at least 90 percent of maximum density as determined by ASTM 1557 (Modified Proctor). Additional requirements may be required by the geotechnical report.

(i) The 12 inches of subgrade immediately beneath concrete lining (both channel bottom and side slopes).

(ii) Top 12 inches of maintenance road.

(iii) Top 12 inches of earth surface within 10 feet of concrete channel lip.

(iv) All fill material.

(7) Bedding. A geotechnical report shall be submitted which addresses the required bedding necessary for the specific concrete section under consideration.

(8) Underdrain and Weepholes. A transverse concrete cutoff shall be installed at the beginning and end of the concrete-lined section of channel and at a maximum spacing of 90 feet. The concrete cutoffs shall extend a minimum of 3.0 feet below the bottom of the concrete slab and across the entire width of the channel lining. Longitudinal cutoffs, a minimum of 3.0 feet in depth, at top lining are required to ensure integrity of the concrete lining.

If the channel is continuously reinforced without transverse joints then a concrete cutoff is required to be incorporated into the expansion/concrete joint.

(h) Special Consideration for Supercritical Flow. Supercritical flow in an open channel in an urbanized area creates hazards which the designer shall take into consideration. Careful attention shall be taken to ensure against excessive waves which may extend down the entire length of the channel from only minor obstructions. Imperfections at joints may rapidly cause a deterioration of the joints, in which case a complete failure of the channel can readily occur. In addition, high velocity flow entering cracks or joints creates an uplift force by the conversion of velocity head to pressure head which can damage the channel lining.

Generally, there should not be a drastic reduction in cross-section shape, and diligent care shall be taken to minimize the change in wetted area of the cross-section at bridges and culverts. Bridges and other structures crossing the channel shall be anchored satisfactorily to withstand the full dynamic load which might be imposed upon the structure in the event of major debris plugging.

The concrete lining shall be protected from hydrostatic uplift forces, which are often created by a high-water table or momentary inflow behind the lining from localized flooding. Generally, an underdrain will be required under and/or adjacent to the lining. The underdrain shall be designed to be free draining. With supercritical flows, minor downstream obstructions do not create any back-water effect. Backwater computation methods are applicable for computing the water-surface profile or the energy gradient in channels having a supercritical flow; however, the computations shall proceed in a downstream direction. The designer shall take care to ensure against the possibility of unanticipated hydraulic jumps forming in the channel.

(Res. 40-08 (§ 811), 3-19-08)

28.32.320 Design criteria – Other channel linings.

Other channel linings include all channel linings that are not discussed in the previous sections. These include composite-lined channels, which are channels in which two or more different lining materials are used (i.e., riprap bottom with concrete side slope lining). They also include gabions, soil cement linings, synthetic fabric and geotextile linings, preformed block linings, reinforced soil linings, and flood walls (vertical walls constructed on both sides of an existing floodplain). The wide range of composite combinations and other lining types does not allow a discussion of all potential linings in this manual. For these linings not discussed in this manual, supporting documentation will be required to support the use of the desired lining. A guideline of some of the items which should be addressed in the supporting documentation is as follows:

(a) Structural integrity of the proposed lining.

(b) Interfacing between different linings.

(c) The maximum velocity under which the lining will remain stable.

(d) Potential erosion and scour problems.

(e) Access for operations and maintenance.

(f) Long-term durability of the product under extreme meteorological and soil conditions.

(g) Ease of repair of damaged section.

(h) Past case history (if available) of the lining system in other arid areas.

(i) Potential groundwater mitigation issues (i.e., weepholes, underdrains, etc.).

These linings will be allowed on a case-by-case basis. Mesa County and/or other jurisdictions may reject the proposed lining system in the interest of operation, maintenance, and protecting the public safety.

(Res. 40-08 (§ 812), 3-19-08)

28.32.330 Design standards for minor artificial drainageways.

A minor drainageway is defined as a channel/drainageway with a contributing tributary area of less than 160 acres. Additional flexibility and less stringent standards may be allowed for minor drainageways. Only the differences in a channel type's design as a minor drainageway versus that of a major drainageway are presented in this section.

(a) Freeboard. For grass, concrete and riprap-lined swales and drainageways with a 100-year flow of equal to or less than 10 cfs, the minimum freeboard requirement is six inches.

(b) Curvature (Horizontal). For grass, wetland bottom, concrete and riprap-lined swales and drainageways, the minimum radius with a 100-year runoff of 20 cfs or less shall be 25 feet.

(c) Trickle Channel. For grass, concrete and riprap-lined swales and drainageways, with 100-year runoff peaks of 20 cfs or less, trickle channel requirements will be evaluated for each case. Trickle channels help preserve swales crossing residential property. Factors to be considered when establishing the need for trickle channels are: drainage slope, flow velocity, soil type, and upstream impervious area.

(Res. 40-08 (§ 813), 3-19-08)

28.32.340 Channel appurtenances.

Presented in this section are the design standards for appurtenances to improved channels. All improved channels shall be designed to include these appurtenances.

(a) Maintenance Access Road. A maintenance access road with a minimum passage width of 12 feet shall be provided along the entire length of all improved channels with 100-year design capacity equal to or greater than 50 cfs. For such channels with less than 50 feet in top width, one maintenance access shall be provided as part of the channel improvements. For channels with greater than 50 feet in top width, the maintenance road shall be located in or within 10 feet horizontal distance from the bottom of the channel or on both sides of the channel top.

For channels with the maintenance access road at or near the channel bottom, ramps to said road shall be provided at a maximum 10 percent slope. Said ramps shall slope down in the down gradient direction of the channel.

(b) Safety Requirements. The following safety requirements are required for concrete-lined channels. Similar safety requirements may be required for all other channels.

(1) A six-foot-high galvanized-coated chain link or comparable fence shall be installed to prevent unauthorized access. The fence shall be located at the edge of the right-of-way or on the top of the channel lining. Gates, with top latch, shall be placed at major access points or 1,320-foot intervals, whichever is less.

(2) Ladder-type steps shall be installed not more than 1,200 feet apart and shall be staggered on alternating sides of the channel to provide a ladder every 600 feet. The bottom rung shall be placed approximately 12 inches vertically above the channel invert.

(c) Culvert Outlet Protection. If the flow velocity at a culvert or storm sewer outlet exceeds the maximum permissible velocity for the local soil or channel lining, channel protection is required. This protection usually consists of an erosion resistant reach, such as riprap and stilling basin, to provide a stable reach at the outlet in which the exit velocity is reduced to a velocity allowable in the downstream channel.

The following basin sizing procedure shall be used for culvert sizes less than or equal to 36 inches in diameter or equivalent open area and outlet velocities less than 15 fps. For larger culverts or outlet velocities greater than 15 fps, the outlet protection design provided for in USDOT, 1983 shall be used.

(1) Basin Configuration. The length of the outlet protection (L_a) is determined using the following empirical relationships that were developed for the U.S. Environmental Protection Agency (USEPA, 1976):

$$L_a = \frac{1.8Q}{D_o^{3/2}} + 7D_o, \text{ for } TW < \frac{D_o}{2} \quad (28.32\text{-}28)$$

and

$$L_a = \frac{3Q}{D_o^{3/2}} + 7D_o, \text{ for } TW \geq \frac{D_o}{2} \quad (28.32\text{-}29)$$

Where:

D_o	=	Maximum inside culvert width (feet);
Q	=	Pipe discharge (cfs);
TW	=	Tailwater depth (feet)

Where there is no well defined channel downstream of the apron, the width, W, of the outlet and of the apron (as shown in **Figure 28.48.150(a)**) shall be as follows:

$$W = 3D_o + 0.4L_a, \text{ for } TW \geq \frac{D_o}{2} \quad (28.32\text{-}30)$$

and

$$W = 3D_o + L_a, \text{ for } TW < \frac{D_o}{2} \quad (28.32\text{-}31)$$

The width of the apron at the culvert outlet shall be at least three times the culvert width.

Where there is a well-defined channel downstream of the apron, the bottom width of the apron shall be at least equal to the bottom width of the channel and the lining shall extend at least 1.0 foot above the tailwater elevation and at least two-thirds of the vertical conduit dimension above the invert.

The apron side slopes shall be 2:1 or flatter, and the bottom grade shall be level.

(2) Rock Size. The median stone diameter, d_{50}, is determined from the following equation:

$$d_{50} = 0.02\frac{(Q)^{4/3}}{TW(D_o)} \quad (28.32\text{-}32)$$

Existing scour holes may be used where flat aprons are impractical. **Figure 28.32.340(a)** shows a general design of a scour hole. The stone diameter is determined using the following equations.

$$d_{50} = \frac{0.0125(Q)^{4/3}}{TW(D_o)}, \text{ for } y = \frac{D_o}{2} \quad (28.32\text{-}33)$$

Also,

$$d_{50} = \frac{0.0082(Q)^{4/3}}{TW(D_o)}, \text{ for } y = D_o \quad (28.32\text{-}34)$$

Where

y = depth of scour hole below culvert invert

The other riprap requirements are as indicated in the previous sections for channel lining.

(d) Low-Flow Grade Control Structures.

(1) Introduction. With the advent of floodplain management programs, developers and local governments frequently decided to preserve the floodplain. Since urbanization causes more frequent and sustained flows, the trickle/low-flow channel becomes more susceptible to erosion even though the overall floodplain may remain stable and able to resist major flood events.

Erosion of the low-flow channel, if left uncontrolled, can cause degradation and destabilization of the entire floodplain. Low-flow check structures are designed to provide control points and establish stable bed slopes within the base flow channel. The check structures can be small versions of the drop structures described in GJMC 28.36.030 through 28.36.060 or in many instances simply control sills across the floodplain. Low-flow check structures are not appropriate in instances such as completely incised floodplains or very steep channels.

In addition, low-flow structures inherently permit a considerable amount of sediment to be transported downstream as urbanization takes place, which negatively impacts stormwater quality. Therefore, complete channel stabilization using drop structures in conjunction with channel bed and bank stabilization at the time of development may be required.

(2) Drop Structure Grade Control Structures. The grouted sloping boulder drop structure and the vertical riprap drop structure designs can be adapted for use as check structures. The analysis steps are the same with the additional consideration of (i) stable bed slope for the unlined trickle or low-flow channel and (ii) potential overflow erosion during submergence of the check structure and where flow converges back from the main channel sides or below the check structure.

The basic design steps for this type of structure include the following:

(i) Determine a stable slope and configuration for the low-flow zone. For unlined channels, discharges from full floodplain flow to the dominant discharge shall first be considered. The dominant discharge is more fully explained in sediment transport texts such as Simons, Li and Associates (1982).

(ii) The configuration of the low-flow zone, and number and placement of the check structures, has to be reviewed. Typically, the floodplain slope is steeper, often on the order of critical conditions. If the checks are widely spaced, the trickle channel depth can be quite

deep downstream of the check, leading to concentration of higher flows into the trickle channel and the check. A good rule of thumb is to not have the trickle channel more than two feet deep at the crest of the check, or more than four feet deep below the check structure (relative to the overbank).

(iii) A hydraulic analysis shall be performed using the discharge that completely fills the check structure at its crest (the primary design flow).

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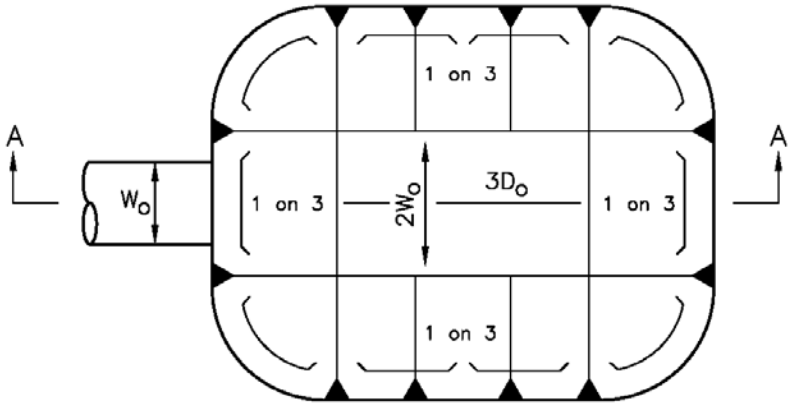
PREFORMED SCOUR HOLE



PLAN VIEW

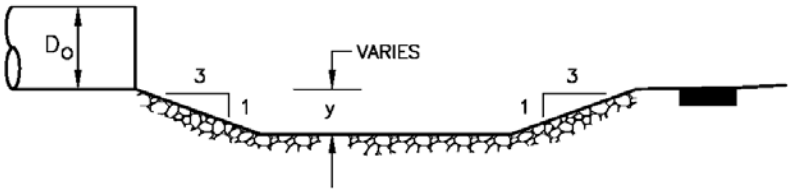


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FIGURE 28.32.340(a)

(iv) The secondary design flow is that flow which causes the worst condition for lateral overflow around the abutments and back into the basin or trickle channel below. The goal is to have the check structure survive such an event with minimal or reasonable damage to the floodplain below. The best approach is to estimate unit discharges, velocities and depths along overflow paths. The unit discharges can be estimated at the crest or critical section for the given total flow. Estimating the overflow path around the check abutment is difficult and requires practical judgment. Slopes can be derived for the anticipated overflow routes and protective measures devised such as grouted rock.

(v) Seepage control is also important, as piping and erosion through or around these structures is a frequent problem. It is advisable to provide a cutoff which extends laterally at least 5.0 to 10 feet into undisturbed bank at minimum and has cutoff depth appropriate to the profile dimensions of the check.

Additional information related to design of drop structures can be found in GJMC 28.36.030 through 28.36.060.

(3) Control Sill Grade Control Structures. Another type of check structure that can be used to stabilize low-flow channels within wide, relatively stable floodplains is the control sill shown in **Figure 28.32.340(b)**. The sill can be constructed by filling an excavated trench with concrete, if soil conditions are acceptable for trenching, or forming a simple wall if a trench will not work.

The sill crosses the low-flow channel and shall extend a significant distance into the adjacent floodplain on both sides. The top of the sill conforms to the top of the ground at all points along its length. Riprap or other erosion control methods can then be added as erosion occurs.

The basic design steps are:

(i) Determine a stable slope as described above.

(ii) Determine spacing of the sills based on the difference in slope between the natural and projected stable slope and the amount of future drop to be allowed (not to exceed three feet).

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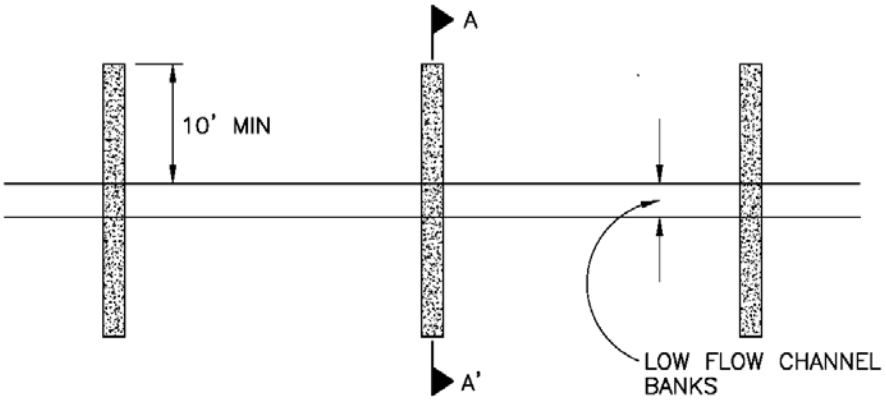
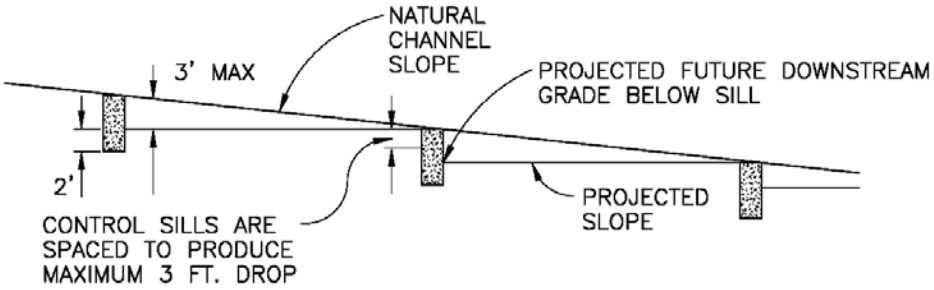
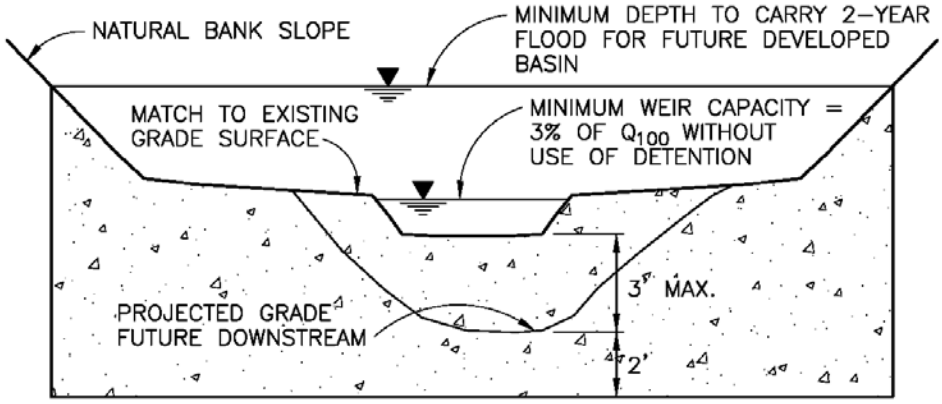
CONTROL SILL GRADE CONTROL STRUCTURE



(a) PLAN



(b) PROFILE



(c) SECTION A–A'

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REFERENCE: UDFCD, 1990

FIGURE 28.32.340(b)

(Res. 40-08 (§ 814), 3-19-08)

28.32.350 Example application.

(a) An open channel is to be constructed for Doe Creek downstream of John Boulevard and north of Rose Subdivision.

Assume the following conditions for this problem.

Q_{100} = 191 cfs

Invert elevation downstream of John Boulevard = 4,918

Invert elevation downstream of Rose Subdivision = 4,917

Channel improvement length = 900 feet

Due to aesthetics and sufficient right-of-way, a grass-lined channel should be constructed.

Side slope = z = 3

Bottom width = b = 10 feet

n = 0.035 for grass-lined channel

Since the 100-year, 24-hour flow is less than 200 cfs, a trickle channel should be constructed in the proposed channel bottom.

(b) Solution.

(1) Step 1. Determine the depth of water during a 100-year flow event.

$$\text{Slope} = \frac{4{,}918 - 4{,}917}{900} = 0.0011 \text{ feet/foot}$$

The Manning equation can be rewritten so that the depth of flow, y, in a trapezoidal channel is on one side of the equation.

$$\frac{(by + zy^2)}{\left(b + 2y\left(1 + z^2\right)^{1/2}\right)^{2/3}}^{5/3} = \left(\frac{Q}{S^{1/2}}\right)\left(\frac{n}{1.49}\right)$$

Solving by trial and error,

Y = 3.7 feet

(2) Step 2. Calculate the water velocity in the proposed channel during a 100-year flow event using the Manning equation.

$$V = \frac{1.49}{n} S^{1/2} R^{2/3}$$

$$= \left(\frac{1.49}{0.035}\right) * (0.0011)^{1/2} * \left(\frac{(10 + 3 * 3.7) * 3.7}{10 + 2 * 3.7 * \left(1 + 3^2\right)^{1/2}}\right)^{2/3}$$

= 2.5 fps

Since the water velocity of the proposed channel (2.5 fps) is less than the maximum permissible water velocity in a grass-lined channel, a grass-lined channel can be used at this location.

(3) Step 3. Design the trickle channel.

Assume dimensions for a concrete trickle channel:

Bottom width = 5 feet

Depth = 1 foot

Side slopes = vertical

The capacity of the trickle channel is:

$$Q = \left(\frac{1.49}{n}\right)\left(S^{1/2}\right)\left(R^{2/3}\right)(A)$$

$$Q = \left(\frac{1.49}{n}\right)\left(S^{1/2}\right)\left(\frac{by}{b+2y}\right)^{2/3}(by)$$

$$Q = \left(\frac{1.49}{0.015}\right) * (.0011)^{1/2} * ((5*1)/(5+(2*1)))^{2/3} * (5*1)$$

Q = 13.16 cfs

(4) Step 4. Verify that trickle channel has sufficient capacity.

The minimum capacity of the trickle channels is:

$$\text{Min. } Q_{Tc} = 0.05 * Q_{100}$$

$$\text{Min. } Q_c = 9.6\text{cfs}$$

Since the capacity of the proposed trickle channel (13.2 cfs) is greater than the required capacity (9.6 cfs), the proposed trickle channel is adequate.

(5) Step 5. Determine the freeboard required for the proposed channel.

$$F_b = 0.5 + \frac{V^2}{2g}$$

$$F_b = 0.5 + \frac{(2.5)^2}{2*32.2} = 0.6 \text{ feet},$$

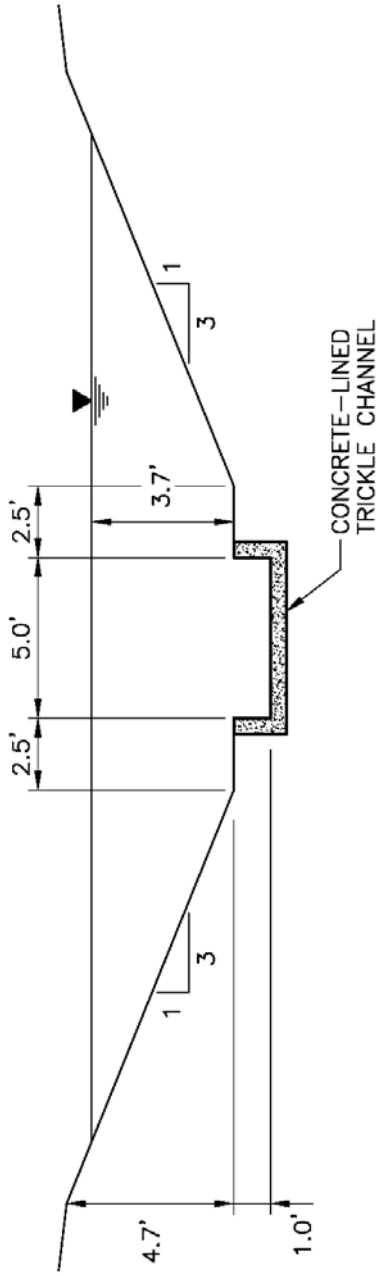
but minimum = 1.0 foot.

Therefore use Fb = 1.0 foot.

(6) Step 6. The cross-section of the proposed channel is shown in **Figure 28.32.350**.

STORMWATER MANAGEMENT MANUAL

EXAMPLE: CROSS SECTION OF DOE CREEK



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REFERENCE:

FIGURE 28.32.350

(Res. 40-08 (§ 815), 3-19-08)

Chapter 28.36

ADDITIONAL HYDRAULIC STRUCTURES

Sections:

28.36.010 Introduction.
28.36.020 Channel drop structures.
28.36.030 Grouted sloping boulder (GSB) drop structure.
28.36.040 Vertical riprap drop structure (vertical hard drop basin).
28.36.050 Straight drop spillway.
28.36.060 Baffled aprons (USBR Type IX, baffle chute drop).
28.36.070 Energy dissipation structures.
28.36.080 Increased roughness basins.
28.36.090 Induced hydraulic jump basins.
28.36.100 Impact basins.
28.36.110 Overbank prevention structures and wasteways.
28.36.120 Side-channel spillways.
28.36.130 Gated turnouts.
28.36.140 Pipe appurtenances.
28.36.150 Pipe collars.
28.36.160 Thrust blocks at pipe bends.
28.36.170 Valves.

28.36.010 Introduction.

This chapter presents criteria regulating the design and construction of certain hydraulic structures commonly encountered in Mesa County at storm drain and culvert outlets as well as in open channels that are intended to convey storm runoff. Many of the structures discussed herein vary widely in physical and hydraulic parameters, and are thus presented with general design criteria only. The designer is referred to the applicable references for further detail on the hydraulic theory and design processes for these structures.

Many of the structures discussed in this chapter are highly visible and easily accessible to the general public. In some cases, these structures may attract onlookers who are unaware of the inherent dangers associated with their operation. Therefore, it is imperative that the design of such structures incorporate posted warnings, pedestrian barriers, fences, and/or other safety apparatuses. It is recommended that the designer consult with Mesa County and/or other local jurisdictions to coordinate the planning and design of the structures in this chapter.

(Res. 40-08 (§ 901), 3-19-08)

28.36.020 Channel drop structures.

The design of open channels for conveyance of stormwater runoff is governed by the maximum permissible velocities for a given channel type. These velocities, presented in Chapter 28.32 GJMC, Open Channels, are primarily related to the erosive potential of nonclear stormwater flow. In some locations, such as those adjacent to schools or parks, it may be advisable to further reduce design velocities to diminish safety risks to children. Drop structures are used at locations where the use of channel lining materials is undesirable or does not sufficiently reduce design velocity in the channel (see Chapter 28.32 GJMC for the design of lined channels). A properly designed drop structure will effectively reduce the design slope in a channel segment and dissipate the energy produced by the drop without adverse erosive effects to the channel bed.

Control sill grade control structures, or low-flow check structures, are used for velocity and grade control in wide, relatively stable floodplains and wetland areas. These structures are addressed in GJMC 28.32.340(d)(3).

The first three structures addressed in this section are typically selected for drops of 5.0 feet or less, but may be used in series (stepped drops). The vertical riprap drop structure (hard drop basin) is limited to 3.0 feet per drop for safety reasons. For larger single drops, the straight drop spillway, the baffled apron, or one of the structures found in GJMC 28.36.070 through 28.36.100 may be employed.

(Res. 40-08 (§ 902), 3-19-08)

28.36.030 Grouted sloping boulder (GSB) drop structure.

The GSB drop structure has recently become one of the most commonly installed drop structures in both new construction and channel retrofit situations. Relatively good hydraulic effectiveness and generally pleasing aesthetics likely contribute to this trend. However, the local availability of rock that meets the size and quality requirements for this structure weighs heavily on the economic viability of GSB drops. Much of the design data presented herein is attributed to the *Urban Drainage Criteria Manual* for the Denver-area UDFCD.

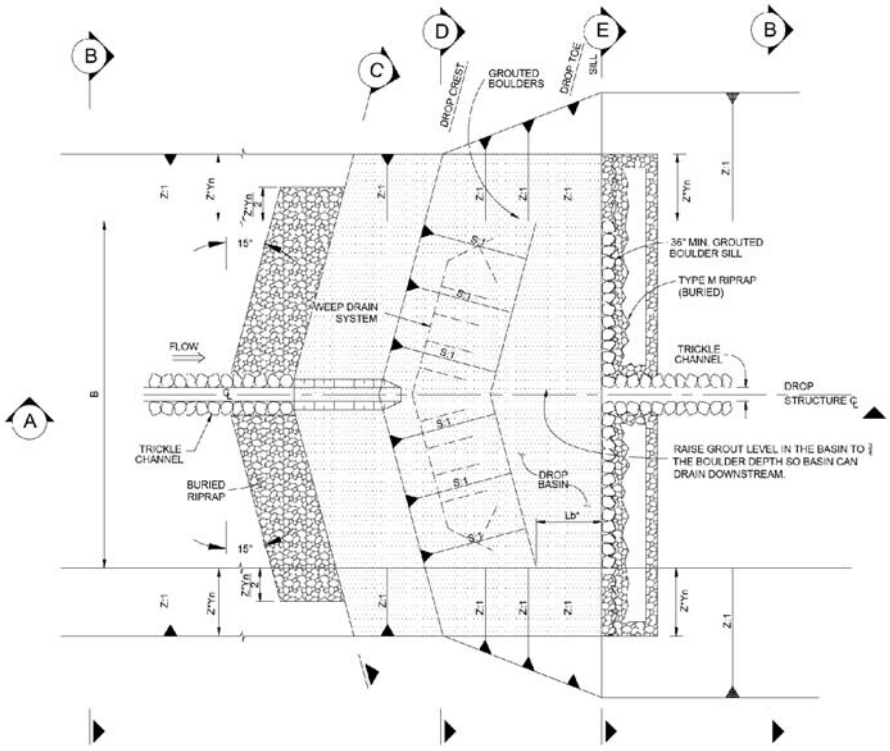
The excess energy created by the invert drop is dissipated in two ways in a GSB structure. The additional channel roughness of the grouted boulders themselves is secondary in energy dissipation to the hydraulic jump formed in the drop basin downstream. However, improper design or construction of the grouted boulders, including faulty rock or grout selection and placement, may result in sweepout of the hydraulic jump due to excessive velocity in the drop basin.

The GSB structure is intended for use only in grass-lined channels with upstream velocities within the limits set forth in Chapter 28.32 GJMC. With some variation in design (as outlined in this chapter), GSB structures may be used with channels containing or not containing a trickle channel or a low-flow channel.

Plans, profiles, sections, and details of typical GSB structures are found in **Figures 28.36.030(a), 28.36.030(b), 28.36.030(c), 28.36.030(d), 28.36.030(e),** and **28.36.030(f)**. Design of these structures involves five components: Rock and grout, upstream channel and approach apron, the drop face, the drop basin, and the exit apron. Seepage concerns are addressed in the design of the approach apron and associated cutoff wall.

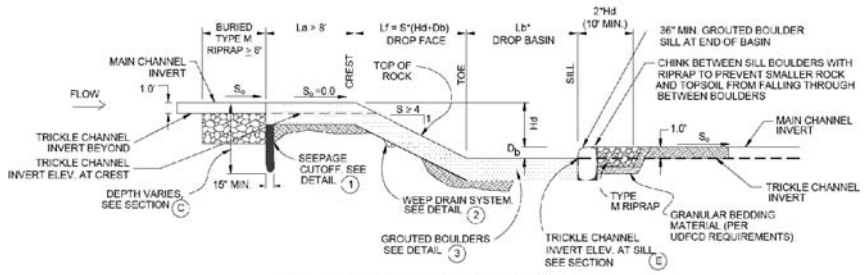
STORMWATER MANAGEMENT MANUAL

GSB DROP W/ TRICKLE CHANNEL



DROP STRUCTURE PLAN
NTS

* Lb = 20' FOR EROSIVE SOILS
Lb = 15' FOR NON-EROSIVE SOILS



DROP STRUCTURE PROFILE A
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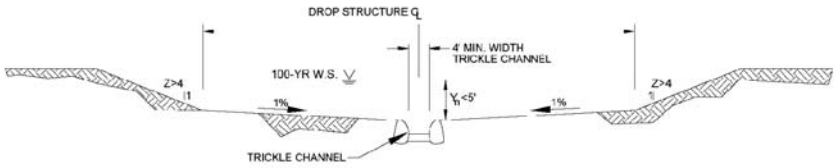
REFERENCE: USDCM VOL. 2 (UDFCD, 2001)

FIGURE 28.36.030(a)

STORMWATER MANAGEMENT MANUAL

GSB DROP W/ TRICKLE CHANNEL



TYPICAL CHANNEL SECTION (UPSTREAM AND DOWNSTREAM OF DROP) B

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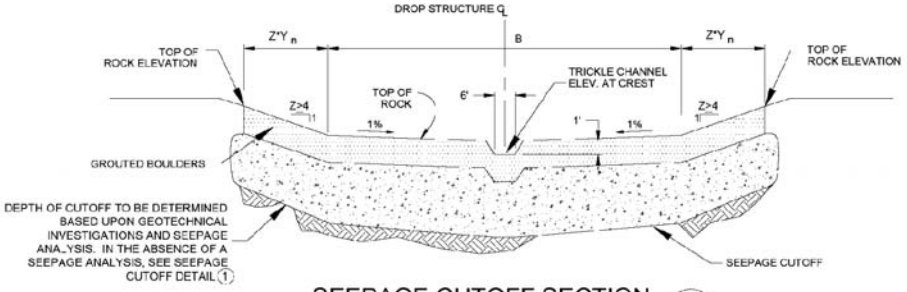

SEEPAGE CUTOFF SECTION C

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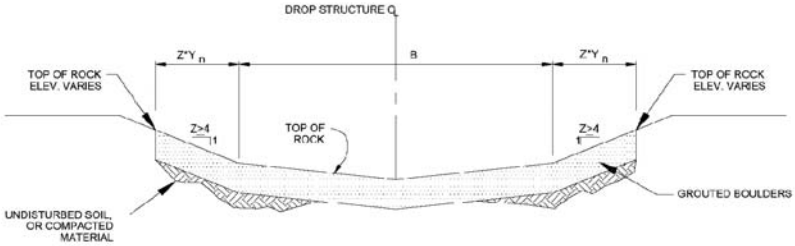

TYPICAL DROP FACE SECTION D

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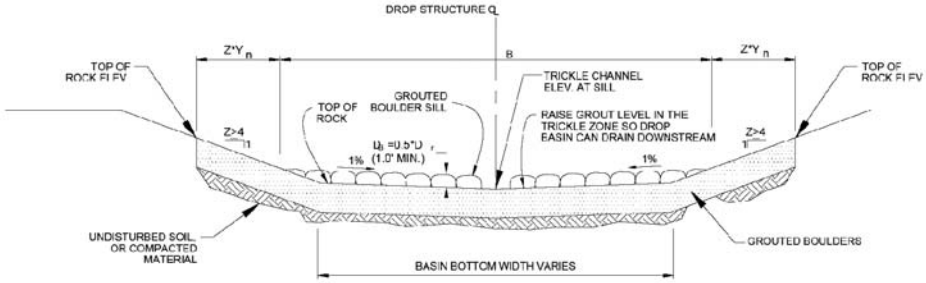

TYPICAL DROP BASIN SECTION AND SILL E

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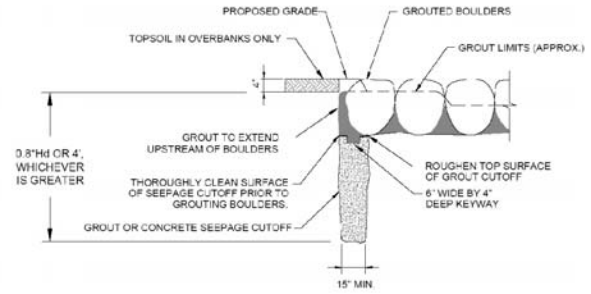
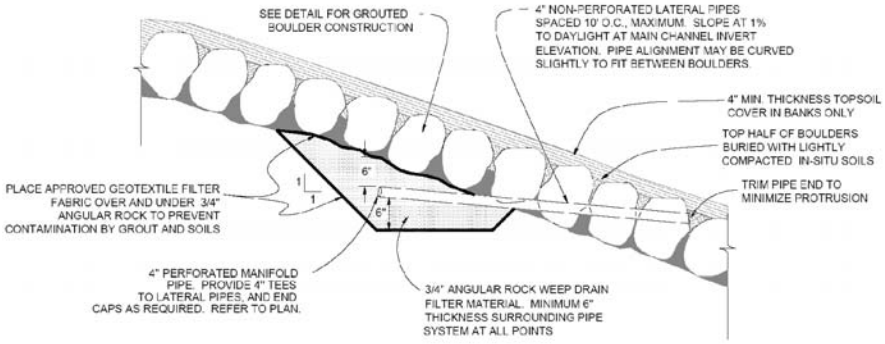
FIGURE 28.36.030(b)

STORMWATER MANAGEMENT MANUAL

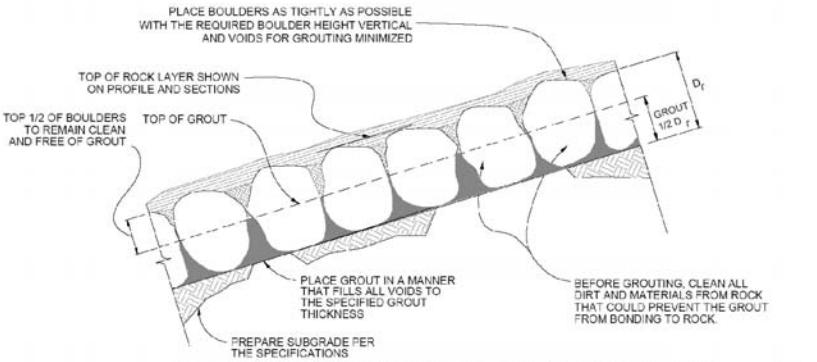
GSB DROP DETAILS



SEEPAGE CUTOFF DETAIL (1)
NTS



WEEP DRAIN SYSTEM DETAIL (2)
NTS USE ONLY IN DROPS HIGHER THAN 5 FEET



GROUTED BOULDER PLACEMENT DETAIL (3)
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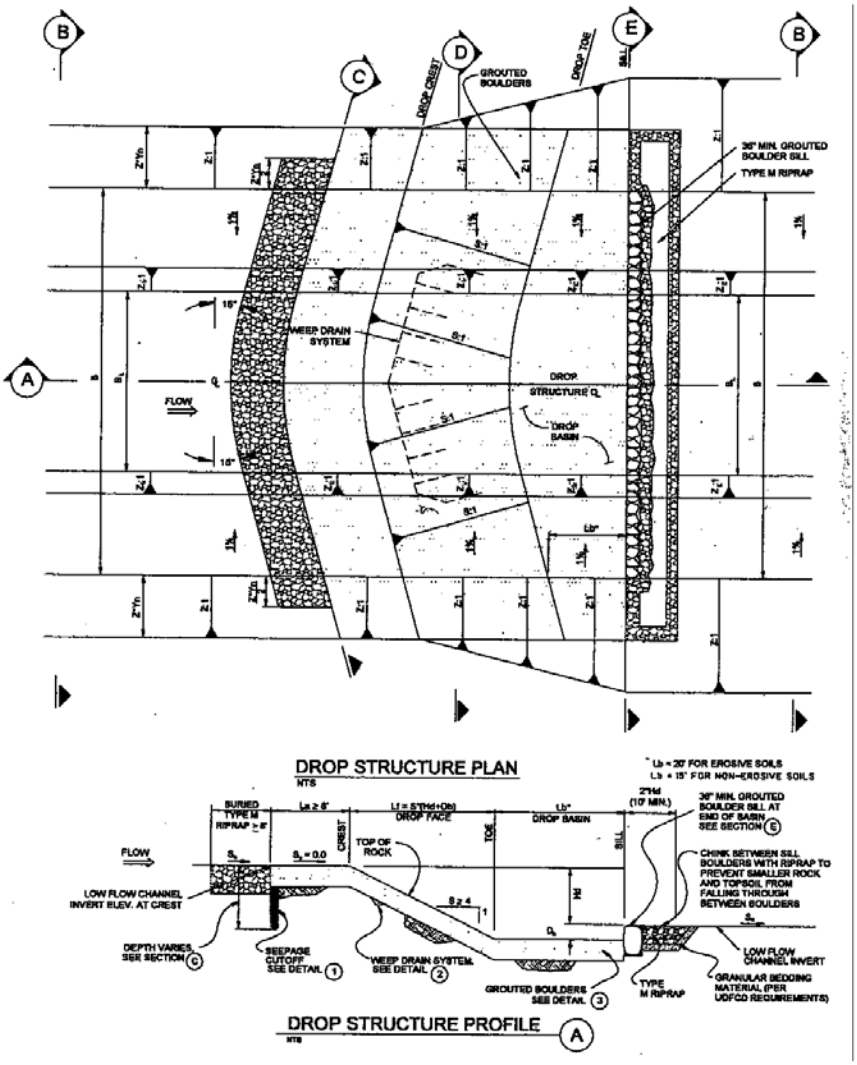
REFERENCE: USDCM VOL. 2 (UDFCD, 2001)

FIGURE 28.36.030(c)

STORMWATER MANAGEMENT MANUAL

GSB DROP W/ LOW-FLOW CHANNEL



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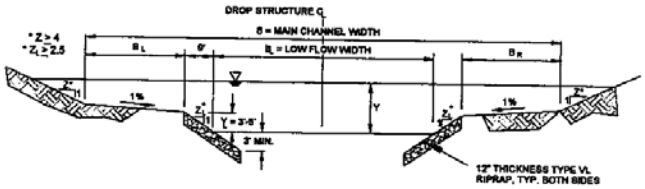
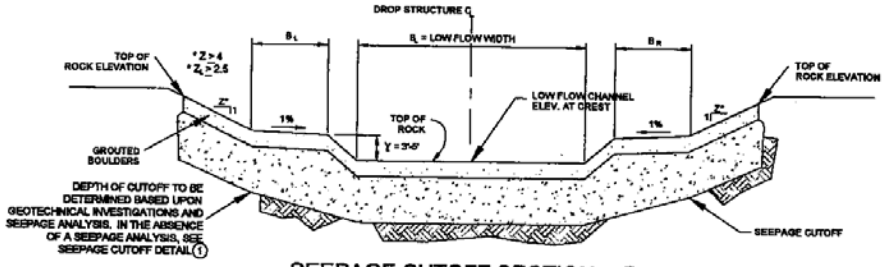
WRC ENGINEERING, INC.	REFERENCE: USDCM VOL. 2 (UDFCD, 2001)	**FIGURE 28.36.030(d)**

STORMWATER MANAGEMENT MANUAL

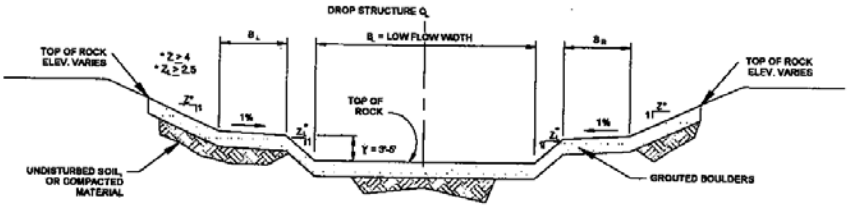
GSB DROP W/ LOW-FLOW CHANNEL



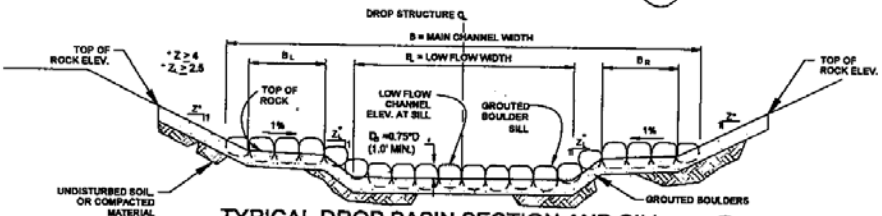
TYPICAL CHANNEL SECTION (UPSTREAM AND DOWNSTREAM OF DROP — B



SEEPAGE CUTOFF SECTION — C



TYPICAL DROP FACE SECTION — D



TYPICAL DROP BASIN SECTION AND SILL — E

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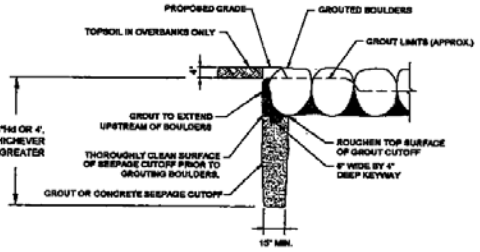
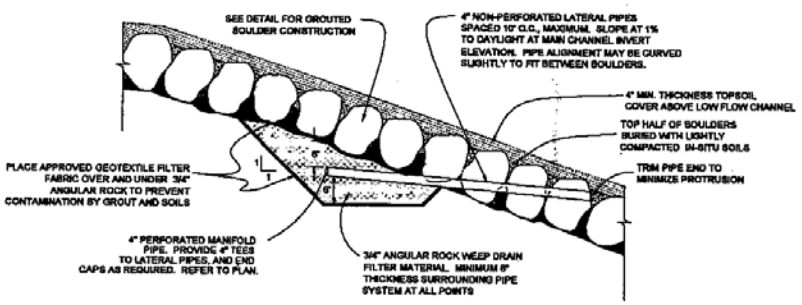
FIGURE 28.36.030(e)

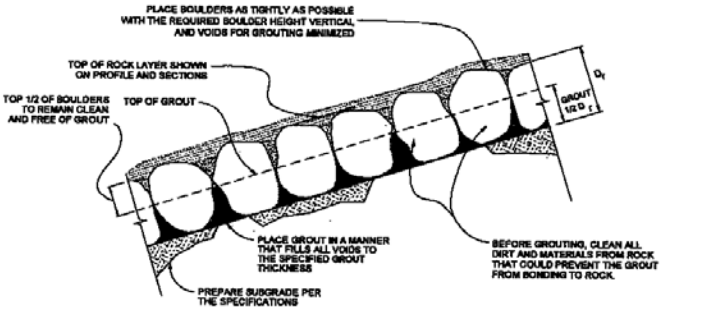
STORMWATER MANAGEMENT MANUAL



SEEPAGE CUTOFF DETAIL (1)
NTS



WEEP DRAIN SYSTEM DETAIL (2)
NTS USE ONLY IN DROPS HIGHER THAN 5 FEET



GROUTED BOULDER PLACEMENT DETAIL (3)
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WRC ENGINEERING, INC.	REFERENCE:	**FIGURE 28.36.030(f)**

(a) Rock and Grout. Grouted boulders must be placed upstream of, and along, the crest of the drop, in the drop face and basin, and along the sill at the end of the basin.

Boulder sizing is based upon the critical velocity, V_{c1}, in the channel upstream from the drop structure. If a trickle channel or low-flow channel is present, the maximum critical velocity of that channel and the main channel is used to find the rock-sizing parameter:

$$R_p = \frac{V_{c1} S^{0.17}}{(G_{s,rock} - 1)^{0.66}} \qquad (28.36\text{-}1)$$

Where:

R_p = Rock-Sizing Parameter
V_{c1} = Maximum Upstream Critical Velocity (fps)
S = Longitudinal Slope (ft./ft.)
$G_{s,rock}$ = Specific Gravity of Rock = 2.55 unless otherwise certified by quarry

This parameter is used in **Table 28.36.030(a)** to find minimum boulder dimension, D_r.

Table 28.36.030(a): Grouted Sloping Boulder (GSB) Drop Structure Rock Sizing

Rock Sizing Parameter, R_p	Minimum Boulder Dimension, D_r
Less than 4.50	18 inches
4.50 to 4.99	24 inches
5.00 to 5.59	30 inches
5.60 to 6.39	36 inches
6.40 to 6.99	42 inches
7.00 to 7.50	48 inches

Adapted from *USDCM* (UDFCD) Table HS-5

Note that standard riprap rock gradation is not utilized in GSB structures. Instead, the boulders are placed in one layer directly on the graded and compacted subgrade (compaction per GJMC 28.32.310(g)(6)), as close together as is possible, and in such a manner so as not to adversely disturb the subgrade. The flattest surface of each boulder shall be oriented upward and shall be as horizontal as possible. The boulders shall be cleaned with water before grouting to improve grout-rock adherence. The boulders shall be placed by such methods that are less likely to cause breakage or significant blemishes and shall be checked for significant cracking before grouting. Damaged boulders shall be replaced before grouting.

Grout is used to fill the voids between the boulders from the subgrade to one-half of the boulder height from the subgrade. In the drop basin only, this is increased to three-quarters of the boulder height from the subgrade to promote draining. Excessive grouting leads to a reduction in hydraulic capacity and energy dissipation, and may endanger the structural stability of the drop. Selection, mixing, placement, and finishing of grout shall comply with the specifications set forth in **Table 28.36.030**.

STORMWATER MANAGEMENT MANUAL

GROUTING CRITERIA

GROUT NOTES

Material Specifications

1. All grout shall have a minimum 28-day compressive strength equal to 3200 psi.
2. One cubic yard of grout shall have a minimum of six (6) sacks of Type II Portland cement.
3. A maximum of 25% Type F Fly Ash may be substituted for the Portland cement.
4. For Type A grout, the aggregate shall be comprised of 70% natural sand (fines) and 30% $\frac{3}{8}$ -inch rock (coarse).
5. For Type B grout, the aggregate shall be comprised of $\frac{3}{4}$ -inch maximum gravel, structural concrete aggregate.
6. Type B grout shall be used in streams with significant perennial flows.
7. The grout slump shall be 4-inches to 6-inches.
8. Air entrainment shall be 5.5%-7.5%.
9. To control shrinkage and cracking, 1.5 pounds of Fibermesh, or equivalent, shall be used per cubic yard of grout.
10. Color additive in required amounts shall be used when so specified by contract.

Placement Specifications

1. All Type A grout shall be delivered by means of a low pressure (less than 10 psi) grout pump using a 2-inch diameter nozzle.
2. All Type B grout shall be delivered by means of a low pressure (less than 10 psi) concrete pump using a 3-inch diameter nozzle
3. Full depth penetration of the grout into the boulder voids shall be achieved by injecting grout starting with the nozzle near the bottom and raising it as grout fills, while vibrating grout into place using a pencil vibrator.
4. After grout placement, exposed boulder faces shall be cleaned with a wet broom.
5. All grout between boulders shall be treated with a broom finish.
6. All finished grout surfaces shall be sprayed with a clear liquid membrane curing compound as specified in ASTM C-309.
7. Special procedures shall be required for grout placement when the air temperatures are less than 40°F or greater than 90°F. Contractor shall obtain prior approval from the design engineer of the procedures to be used for protecting the grout.
8. Clean Boulders by brushing and washing before grouting.

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WRC ENGINEERING, INC.	REFERENCE: USDCM VOL. 2 (UDFCD, 2001)	**TABLE 28.36.030**

(b) Upstream Channel and Approach Apron. Grouted boulders shall be placed on grade with the upstream channel for a minimum of 8.0 feet upstream from the drop crest (this shall be referenced as the "approach apron"). Buried riprap shall be installed from the upstream end of the approach apron to a point at least 8.0 feet upstream along the channel flowline. The riprap shall be D_{50} = 12 inches (UDFCD Type M) and shall be installed per the criteria described in GJMC 28.32.300. The grouted boulder approach apron shall be continuous across the width of the channel (except as described in the following paragraph) and up each bank to the elevation of the normal depth for the design flow at that location. The buried riprap shall be installed across the channel bottom and up each bank to the elevation of one-half the normal depth for the design flow at that location.

For grass-lined channels with a concrete or rock-lined trickle channel (see GJMC 28.32.280(c)(1)), the approach apron and upstream riprap protection are discontinuous across the channel cross-section to allow the trickle channel flowline to continue unimpeded to the drop crest (see **Figure 28.36.030(a)**). While this is necessary to retain the effectiveness of the trickle channel in conveying base or nuisance flows, it tends to create a concentrated jet at the location of the trickle channel during higher flow periods. The additional energy introduced to the basin in these cases may be partially dissipated by the installation of large boulders or baffles in the trickle channel and/or a meandering trickle channel through the drop basin itself. These options are not shown in the GSB details (**Figures 28.36.030(a)**, **28.36.030(b)**, **28.36.030(c)**, **28.36.030(d)**, **28.36.030(e)** and **28.36.030(f)**), but are similar to the trickle channel/drop basin controls used for the vertical riprap drop structure (see **Figure 28.36.030(g)**).

Grouted rock is particularly susceptible to failure from undermining and the subsequent loss of the supporting bank material. (HEC-11) This refers to the high potential for seepage and piping under and around the drop structure. Since the GSB structure is rigid and essentially monolithic, seepage under the grouted boulders and the resultant transport of subgrade particles will eventually lead to structural failure. Therefore, a seepage cutoff section is required as shown in **Figures 28.36.030(a), 28.36.030(b), 28.36.030(c), 28.36.030(d), 28.36.030(e)** and **28.36.030(f)**. As noted in the details, the dimensions of the vertical cutoff shall be determined based on geotechnical investigations and seepage analysis or shall comply with the minimum cutoff criteria set forth in the appropriate figures. The seepage cutoff shall be installed prior to the placement of the grouted boulders at the drop crest, and shall include a keyway for the grout/cutoff interface as shown in the details.

(c) Drop Face. The drop face shall consist of grouted boulder "steps" of vertical dimension no greater than one-half of the minimum boulder dimension, D_r, from **Table 28.36.030(a)**. The overall drop face slope must not exceed 4H:1V; flatter slopes are permissible and encouraged due to improved aesthetics and energy dissipation. Slopes steeper than 4H:1V may reduce structural stability.

The grouted boulders are continuous across the entire bottom width on the drop face – the trickle channel flowline equals the main channel flowline in the drop section. The grouted boulders also continue up each bank to the elevation equivalent to the downstream channel normal depth (sequent subcritical depth) plus freeboard or the channel critical depth plus 1.0 foot, whichever is greater.

A weep drain system shall be installed behind the drop face to relieve hydrostatic pressure in drops exceeding 5.0 vertical feet. See details in **Figures 28.36.030(a)**, **28.36.030(b)**, **28.36.030(c)**, **28.36.030(d)**, **28.36.030(e)** and **28.36.030(f)**.

(d) Drop Basin. The basin area shall be constructed of continuous grouted boulders of the same dimensions as the drop face section (boulder size, crest and basin width, height of bank protection). However, the grout level is increased to three-quarters of the boulder height in the basin, and shall be sloped to drain to the centerline of the channel (or trickle channel if applicable).

The basin is depressed below the downstream channel invert by 2.0 feet for drops of 5.0 feet or less. This helps to stabilize the hydraulic jump. For drops exceeding 5.0 feet, a sequential depth analysis is necessary to determine basin depression depth (a minimum of 2.0 feet applies). Sequential depth analysis is not presented in this title; refer to a hydraulics text such as *Open-Channel Hydraulics* (Chow, 1959) for explanation.

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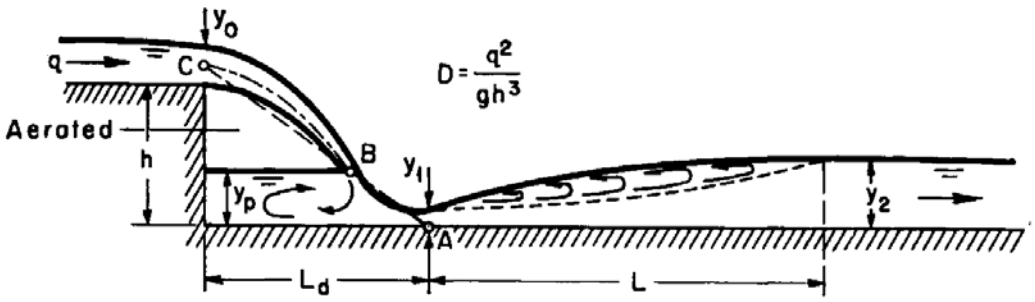
VERTICAL RIPRAP DROP STRUCTURE (HARD DROP BASIN) (DIMENSIONAL DEFINITIONS)



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WRC ENGINEERING, INC.	REFERENCE: OPEN-CHANNEL HYDRAULICS (CHOW, 1959)	FIGURE 28.36.030(g)

Basin length shall be a minimum of 15 feet for nonflexible downstream channel lining (concrete, grouted riprap, geosynthetic linings) and a minimum of 20 feet for downstream channels with flexible linings. A row of 36-inch or larger grouted boulders shall be placed at the downstream end of the basin. The top of this sill shall be equal to the invert of the downstream channel. For channels with a concrete or rock-lined trickle channel, there shall be a break in the end sill of width equal to that of the trickle channel. The trickle channel shall continue downstream through the sill and exit apron with scour protection as specified in Chapter 28.32 GJMC.

(e) Exit Apron and Downstream Channel. The exit apron shall consist of buried riprap of size D_{50} = 12 inches (UDFCD Type M) and shall be installed per the criteria described in GJMC 28.32.300. The riprap shall extend across the channel (except in the trickle channel as applicable) and up the banks to an elevation equal to the top of the adjacent grouted boulders. This riprap protection shall extend downstream from the end sill a minimum distance of twice the drop height or 10 feet, whichever is greater.

(Res. 40-08 (§ 902.1), 3-19-08)

28.36.040 Vertical riprap drop structure (vertical hard drop basin).

This type of drop structure consists of an approach apron (grouted rock), a vertical concrete crest wall, a jump basin with end sill (grouted rock or concrete), and downstream channel scour protection. While an effective method for drop design, these structures shall be avoided if possible in areas of significant public use or in highly visible locations due to safety concerns and low aesthetic appeal. Vertical drop structures shall be avoided in channel reaches which may be utilized for boating or other recreation activities in or adjacent to the water. The maximum allowable drop for a vertical drop structure of this type shall be 3.0 feet.

(a) Rock and Grout. Rock used upstream of the crest wall shall have a minimum dimension of 12 inches in any direction. Rock used downstream of the drop shall have a minimum dimension of 18 inches in any direction. Grouting requirements are identical to those presented in GJMC 28.36.030 for the GSB drop structure.

(b) Approach Apron. A grouted rock apron shall be installed across the entire bottom width (including trickle and low-flow channels) and up each bank to the elevation equal to upstream channel normal depth plus 1.0 foot. The rock shall be buried to a depth such that the top of the grout is equal to the invert of the upstream channel at every point across the channel. This approach apron shall extend upstream from the crest wall a minimum of 10 feet.

(c) Vertical Crest Wall. The concrete crest wall conforms to the upstream inverts for the trickle or low-flow channel and the main channel across the bottom width. The wall shall extend a minimum of 5.0 feet into the undisturbed banks. However, all design dimensions including minimum structural width, wall thickness, footer size and geometry, and reinforcement shall be determined using accepted structural analysis methods and determination of potential creep, heave, buoyancy and uplift due to seepage pressures, and all other considerations associated with the design of a retaining wall.

An impervious backfill material is recommended both upstream and downstream adjacent to the crest wall and footers to act as a horizontal seepage cutoff. In lieu of this material, other appliances may be employed to ensure minimized seepage around/under the crest wall. Piping, the transport of structural supporting material away from its intended location, is a common cause of structure instability and failure.

(d) Basin. The basin is a depressed, hard-surface area which redirects the plunging flow from the crest horizontally. At lower flows, the energy dissipated by this redirection may be sufficient to return the flow to a subcritical state. However, the primary energy dissipation method for this structure is a hydraulic jump formed in the basin. When the upstream channel is composite (utilizing a trickle or low-flow channel), the approach velocity tends to be higher in the smaller sub-channel zone than in the main channel zone. Therefore, for the design flow, the basin length and downstream protec-

tion requirements may differ for the two zones. By placing large boulders (60 percent to 80 percent of critical depth in height) between the location of nappe impingement on the basin floor and a point at least 10 feet from the end sill, the required basin length for the sub-channel zone may be reduced to that of the main channel zone. Otherwise, the following calculations must be applied to both zones independently.

The drop will be treated hydraulically as a straight-drop spillway and analyzed per Chow's (1959) method:

A "drop number," D_N, must first be calculated in order to relate other associated lengths and depths:

$$D_N = \frac{q^2}{gh^3} \quad (28.36\text{-}2)$$

Where:

q = Discharge per Unit Width for the Subject Zone (cfs/ft.)

g = Gravitational Constant = 32.2 $ft.^2/s$

h = Effective Height of Drop (ft.)

Note that the effective drop height must include the basin depression depth. Using the drop number, the following relationships can be solved:

$$\frac{L_d}{h} = 4.30 \cdot D_N^{0.27} \quad (28.36\text{-}3)$$

$$\frac{y_p}{h} = 1.00 \cdot D_N^{0.22} \quad (28.36\text{-}4)$$

$$\frac{y_1}{h} = 0.54 \cdot D_N^{0.425} \quad (28.36\text{-}5)$$

$$\frac{y_2}{h} = 1.66 \cdot D_N^{0.27} \quad (28.36\text{-}6)$$

Where:

L_d = Drop Length (ft.)

y_p = Pool Depth Under Nappe (ft.)

y_1 = Depth Upstream of the Hydraulic Jump (ft.)

y_2 = Subcritical Sequent Depth (ft.)

See **Figure 28.36.030(g)** for illustration of these variables. These values assume that atmospheric pressure is maintained under the nappe, thus the designer is responsible for incorporation of aeration devices as necessary. Drop length, L_d, refers to the horizontal distance from the crest wall to the location of depth y_1, upstream of the hydraulic jump.

The basin design length, for the subject zone, is given by Equation 28.36-7:

$$L_b = L_d + D_j + 0.60 \cdot L_j \qquad (28.36\text{-}7)$$

Where:

L_b = Basin Design Length (ft.)

D_j = Distance from Location of Depth y_1 to Jump (ft.)

L_j = Length of Jump $\cong 6 \cdot y_2$

The distance from the point of nappe impingement on the basin floor to the upstream end of the hydraulic jump is determined by a water surface profile analysis as presented in most hydraulic design texts.

Basin depression depth below the downstream channel invert is determined by comparing the sub-critical sequent depth, y_2, with the tailwater depth in the downstream channel, y_{TW}. If y_2 exceeds y_{TW}, the jump will be swept downstream and possibly out of the basin. This situation is to be avoided since significant erosion may take place if the jump occurs in an unarmored location in the channel. If y_{TW} exceeds y_2, the jump is pushed upstream toward the wall, potentially submerging jump. Hydraulically, this is not problematic, but the structural design of the crest wall may be affected by the additional forces. Basin depression effectively adds to the tailwater depth in the downstream channel, controlling the location of jump formation. Therefore, the minimum basin depression depth, B, is the maximum of the following:

$$B = y_2 - y_{TW}$$
or
$$B = 1.5 \text{ ft} \qquad (28.36\text{-}8)$$

This is the height of the end sill and downstream invert above the downstream end of the depressed basin. The end sill shall be constructed of reinforced concrete or grouted boulders of a minimum 36-inch dimension. This acts as a protected transition back to the channel invert.

(e) Downstream Channel Protection. The channel directly downstream from the end sill shall be protected for a minimum of 10 feet in the direction of flow with buried riprap of size D_{50} = 12 inches (UDFCD Type M) or grouted rock with a minimum dimension of 12 inches.

In cases where the sub-channel zone basin length is longer than the main channel zone (no additional boulders or baffles placed in the basin to dissipate the center jet), the additional protection shall extend a lateral distance equal to the bottom width of the trickle channel from each edge of the trickle channel. This results in an extended protection zone with a width equal to three times the trickle channel bottom width.

(Res. 40-08 (§ 902.2), 3-19-08)

28.36.050 Straight drop spillway.

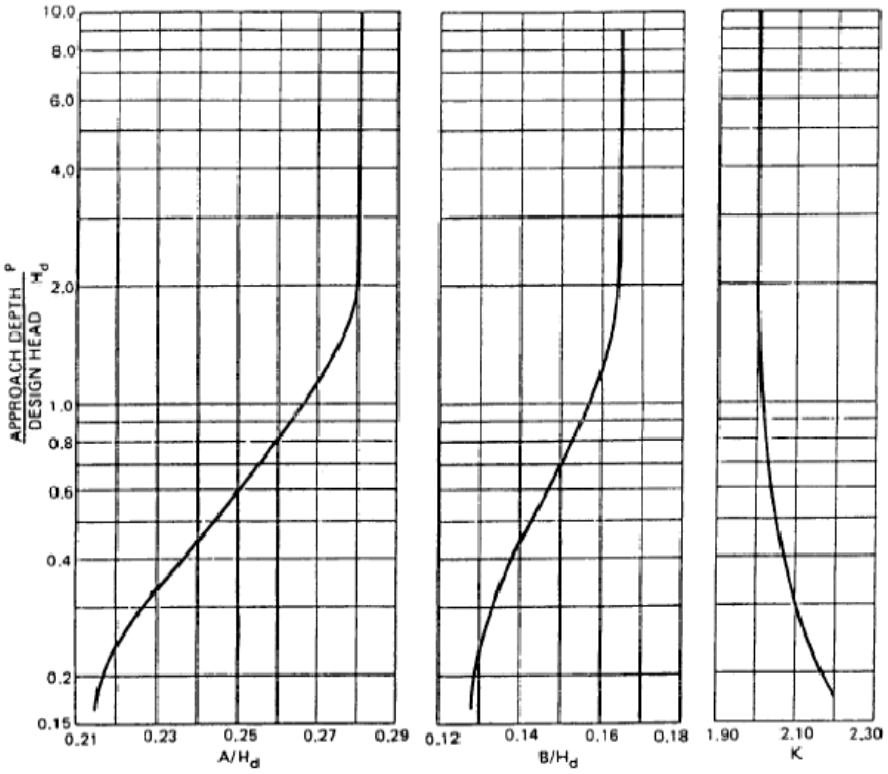
The straight drop spillway is very similar hydraulically to the vertical hard drop basin presented in GJMC 28.36.040. The primary difference exists in the shaping of the spillway downstream from the crest to closely resemble the shape of the lower nappe, i.e., the bottom of the jet formed by the flow suddenly departing the crest. This results in a “classic” spillway shape, as used for major reservoir spillways and channel drops alike. The straight drop spillway itself is not a significant energy dissipation structure, and must be paired with an induced hydraulic jump basin as presented in GJMC 28.36.090.

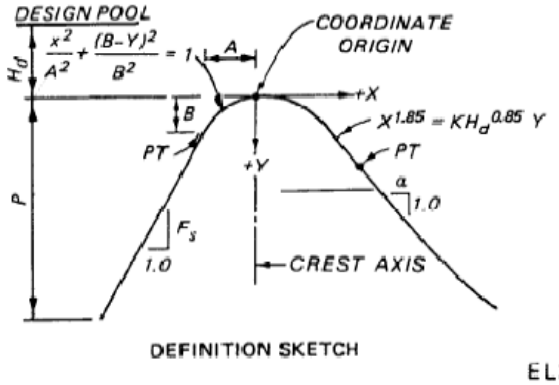
The shape of a straight drop spillway is dependent on the shape of the nappe, which varies with head over the crest and the shape of the approach to the spillway. The reader is referred to *Open-Channel Hydraulics* (Chow, 1959), *Hydraulic Design of Spillways* (USACOE, 1992), or other texts for design of these structures.

Figure 28.36.050 shows a typical straight drop spillway configuration.

STORMWATER MANAGEMENT MANUAL

STRAIGHT - DROP SPILLWAY





DEFINITION SKETCH

ELLIPTICAL CREST SPILLWAY
COORDINATES
COORDINATE COEFFICIENTS
FROM HDC 111-20

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ORIGINAL ISSUE	3/27/08

WRC ENGINEERING INC.	REFERENCE: USACE WES (1987)	FIGURE 28.36.050

(Res. 40-08 (§ 902.3), 3-19-08)

28.36.060 Baffled aprons (USBR Type IX, baffle chute drop).

The fixed costs associated with the construction of a baffled apron structure (hereafter referred to as a baffle chute drop) typically limit their use to larger drops from an economic standpoint, although the actual minimum size is limited to that length required to incorporate the minimum number of baffle rows. These drop structures are most effective at unit discharge rates between 35 and 60 cfs per foot. However, a value in this range can often be attained by altering the width of the chute. Most often, transition walls are employed to direct wider upstream channel flow to a narrower chute, decreasing the cost of the drop structure. When designed and built correctly, these structures are effective and last for many years with minimal maintenance requirements.

While the baffle chute drop can pass most sediment and debris, larger debris may become caught behind the baffles or in the narrowed chute, disabling the structure's ability to dissipate energy. This can lead to an effectively higher invert in the chute and overtopping, and can also allow the nearly unimpeded flow in the chute to exit the structure at erosive velocities. Therefore, debris-control structures are recommended upstream of the drop, and regular inspection and maintenance may be necessary.

The baffle chute drop structure does not rely on the formation of a hydraulic jump as its primary energy dissipation process. Instead, excess energy in the chute flow is dissipated by redirection over and around baffle blocks, which are arranged in offset rows to avoid the passing of high-velocity jets between the blocks. Since a hydraulic jump is not part of the design, there are no tailwater requirements for this structure. However, potential scour due to relatively high velocities at the end of the chute and in the downstream transition section necessitate a protected exit apron and/or scour hole.

Figure 28.36.060 presents an isometric view of a baffle chute drop with typical dimensional requirements. Note that this figure does not indicate structural requirements such as concrete thickness or reinforcement, footer depths and dimensions, or seepage control. These factors shall be assessed and approved by qualified professionals.

(a) Upstream Channel Transition. Typically, the design width of the baffle chute drop is less than the upstream channel width for economic and sizing reasons as well as to attain unit discharge rates in the desired range. The headwalls and/or wingwalls associated with this transition are subject to design constraints set forth in this manual and shall be designed using proper structural analysis techniques. The designer should note that the effective width of a conduit or channel is often considerably smaller than the physical width due to the separation of flow from the abutment/conduit interface.

The approach section downstream from the transition is designed to maintain an approach velocity of less than the critical velocity at the crest. Recommended approach velocities are presented in **Figure 28.36.060**. The concrete flow alignment apron, reaching from the abutment/conduit interface to the chute crest, shall be a minimum of 5.0 feet in length and shall be equal to the chute in width along its entire length. In certain cases, the transition section may not sufficiently reduce the specific energy of the flow to achieve the proper approach (alignment) apron velocity. In these situations, the crest may be raised by up to 12 inches above the approach apron invert.

If a trickle channel is present in the upstream channel, it shall continue through the transition section and apron, and shall maintain a continuous flowline through any raised crest.

Transition and apron wall heights are determined by backwater analysis at peak flow, with a freeboard equal to or greater than that of the upstream channel.

(b) Baffled Chute. The chute floor, walls, and baffles shall be constructed of reinforced concrete and shall be structurally designed to withstand all geotechnical, hydrostatic, and hydrodynamic (impact and frictional) forces imposed by the specific site conditions, including a reasonably conservative factor of safety for all loading. The chute floor shall have a slope no steeper than 2H:1V (Z:1, Z_{MAX} = 2). The chute walls shall be vertical and shall be tied to the floor, upstream wall or abutments, and downstream abutments with properly sized and installed steel reinforcement.

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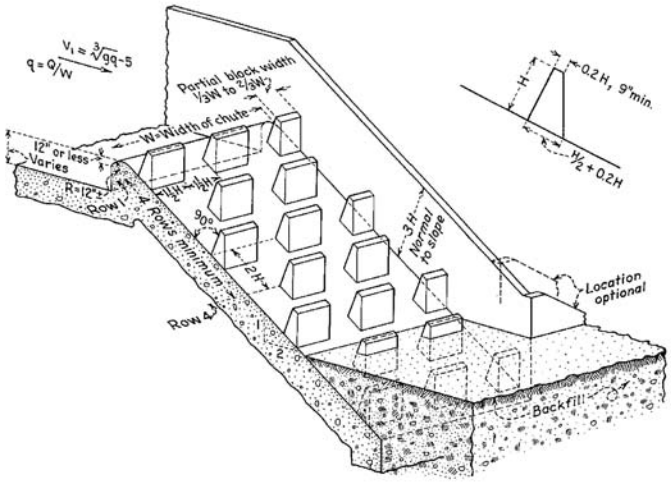
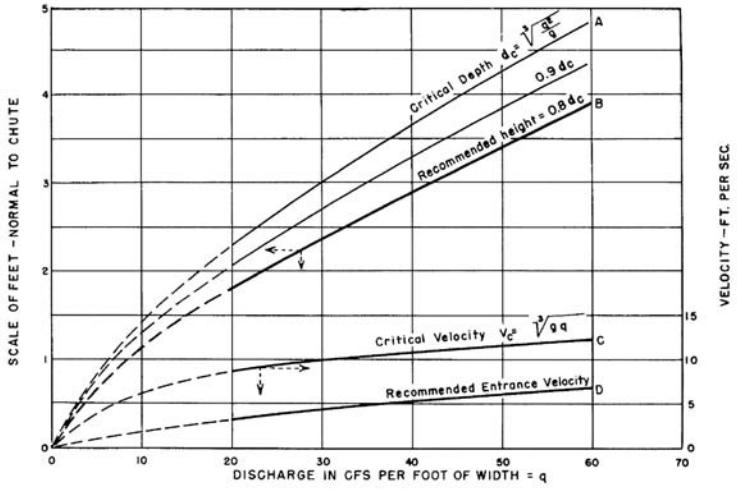
BAFFLED APRON



(A) USBR ISOMETRIC



(B) DESIGN CRITERIA

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REFERENCE: USDCM VOL 2 (UDFCD/USBR, 2001)

FIGURE 28.36.060

The baffle blocks shall be reinforced concrete of the dimensions shown in **Figure 28.36.060**. Baffle blocks shall be adequately reinforced and tied with steel reinforcement to the chute floor. A key-in interface is recommended to stabilize the blocks on the chute floor. The block height normal to the chute floor is defined in Equation 28.36-9:

$$H = 0.8y_c \qquad (28.36\text{-}9)$$

Where:

H = Block Height Normal to Chute Floor

y_c = Critical Depth at Peak Flow

There shall be at least four rows of baffle blocks. Baffle block rows shall be spaced at $Z \cdot H$ along the direction of flow, and shall be staggered such that jets of water not directly impinging on a baffle block within a two-row distance are minimized. The blocks and the spaces between the blocks shall be equal to 1.5H except where the width is limited by the chute wall. All baffle rows shall be symmetrical along the centerline of the chute. When a trickle channel exists, the top row of baffles shall be aligned such that the maximum percentage of the trickle channel flow width is not impingent upon any baffles in the first row.

Chute walls shall be at least 3H in height normal to the chute floor. Other dimensional requirements may be found in **Figure 28.36.030**.

Where a hard-surface exit apron is not employed, at least 1.5 rows of baffles shall be buried in riprap. This allows for the exposure of additional baffle blocks as loose rock is displaced to form a scour hole or to adapt to a lower downstream channel invert.

Downstream transition walls (headwalls and/or wingwalls) shall be of a height equal to the design normal depth in the downstream channel plus 1.0 foot of freeboard. They shall extend from the chute walls at an angle of 45 to 90 degrees for a distance necessary to contain any eddies that may form in this area.

(c) Basin/Exit Apron. There exist two primary design options for the basin downstream from the baffle chute. The first, a hard-surface basin, is used if the invert of the downstream channel is expected to remain approximately constant over the life of the drop structure. This basin is constructed of either reinforced concrete tied to the downstream end of the chute floor or grouted rock, the latter of which further dissipates energy in the flow and protects the downstream channel from excessive degradation.

Even more energy dissipation is often achieved with the installation of a preformed or nonpreformed scour hole at the chute exit. The former is a riprap-lined depressed basin that approximately imitates the dimensions of the scour hole that would form if loose rock was placed as backfill. The riprap and basin sizing requirements are found in GJMC 28.32.340(c) and **Figure 28.32.340(a)**. The designer may substitute the downstream design flow normal depth for D_o in the relevant equations and figures. W_o is equal to the width of the chute for the purpose of this design.

A nonpreformed scour hole is constructed by backfilling up to the existing downstream channel invert with loose rock. The loose rock shall be at least 2.0 feet deep and shall extend a minimum of 4H feet horizontally parallel to the chute. The rock backfill area shall be of such a width to reach the ends of the downstream abutment walls. Rock size is based on the riprap selection criteria set forth in Chapter 28.32 GJMC. Placement of the rock must not damage the buried baffle blocks. With sufficient operation time, the force of the flow from the baffle chute will displace the loose rock in such a way so as to form a stable scour hole.

The scour hole options, especially the latter, tend to adapt somewhat automatically to changing conditions in the downstream channel, including a gradually lowered invert elevation. However, it is

still recommended that a protective channel lining be installed in the downstream channel for an appropriate distance to allow flow to return to a nearly steady state.

(Res. 40-08 (§ 902.4), 3-19-08)

28.36.070 Energy dissipation structures.

(a) The structures described in this section are similar in many ways to the channel drop structures of GJMC 28.36.020 through 28.36.060. However, while the drop structures' primary purpose is to allow a channel to quickly change elevation without excessively increasing the specific energy of the flow in the downstream channel, these structures are designed to dissipate excess energy already present in the upstream channel. These energy dissipation structures are often employed at transitions from nonflexible channels or conduits to channels with flexible linings or other velocity restrictions. This includes culvert and storm drain outlets to open channels. They are also occasionally used at locations where the energy produced by a channel drop exceeds the limitations of the channel drop structures. As mentioned in GJMC 28.36.050, straight-drop spillways must be paired with one of the structures in this section to dissipate the energy associated with the high-velocity flows.

(b) The structures in this section are divided into three categories:

(1) Increased roughness basins.

(2) Induced hydraulic jump basins.

(3) Impact basins.

(Res. 40-08 (§ 903), 3-19-08)

28.36.080 Increased roughness basins.

Increased roughness basins are designated for use in locations where the upstream Froude number does not exceed 3.0. Further restrictions apply to each type, including maximum velocities and maximum cross-sectional flow areas. These basins include the riprap basin (preformed scour hole) and the array of drop structures introduced in GJMC 28.36.020 through 28.36.060.

The FHWA's *Hydraulic Design of Energy Dissipators for Culverts and Channels* (HEC-14) also presents methods for the design of increased resistance devices for pipes, box culverts, and channels. These devices are intended to create a tumbling flow pattern along steep reaches of conduits and channels, thereby maintaining an allowable average velocity. However, due to the economic advantages of other options and to the relatively flat terrain in developed portions of Mesa County, these structures are not included in this title.

(a) Riprap Basin. The riprap basin/preformed scour hole is effective for the dissipation of excess energy from upstream conduits and channels complying with the following:

(1) Maximum allowable upstream flow area must be equal to or less than the equivalent full-flow area of a 36-inch pipe.

(2) Maximum upstream flow velocity must be equal to or less than 15 feet per second at any flow depth.

The design procedure for this structure is presented in GJMC 28.32.340(c) and **Figure 28.32.340(a)**.

(b) Drop Structure as an Energy Dissipator. While the first two drop structures listed in GJMC 28.36.020 through 28.36.060 are intended to dissipate only energy produced by the drop itself, they can in certain cases be used as dissipators of upstream energy. The most significant restriction is that flow in the upstream channel must be in a subcritical state before reaching the structure. The

combination of a small channel drop and local energy dissipation can effectively reduce the velocity in the downstream channel.

(Res. 40-08 (§ 903.1), 3-19-08)

28.36.090 Induced hydraulic jump basins.

Induced hydraulic jump basins are commonly used for large and small projects alike. They are highly effective at utilizing the hydraulic jump phenomenon to dissipate excess energy and return the flow to a subcritical depth. While the space required for these structures is relatively large, they are typically less expensive than impact-type basins on a unit-discharge basis. Five distinct induced hydraulic jump basin designs are presented herein. The designer shall incorporate adequate seepage controls as part of the design of all structures. Riprap protection shall be provided for an appropriate distance downstream of all structures in this section where the receiving channel has a flexible lining.

(a) CSU Rigid Boundary Basin. The Colorado State University Rigid Boundary Basin (CSU RBB) utilizes offset rows of baffles (roughness elements) to force supercritical flow from a conduit into a hydraulic jump. The only basin in this category to be designed as entirely on-grade, the CSU RBB is useful for locations with restrictive vertical alignment criteria. However, the upstream Froude number is restricted to a value of 3.0. **Figures 28.36.090(a)** and **28.36.090(b)** present sketches and data for the design of this structure.

The design procedure for the CSU RBB is presented in HEC-14, Chapter VII-A.

(b) USBR Type II Basin. This basin utilizes chute blocks and a dentated sill to induce a hydraulic jump in the basin. An isometric sketch of this basin is presented in **Figure 28.36.090(c)**. Unlike the CSU rigid boundary basin, the USBR Type II basin does not allow for subcritical upstream flow by forcing the flow through critical depth prior to the jump basin. Therefore, this basin requires an upstream Froude number between 4.0 and 14.0. The required tailwater depth for this basin varies with the Froude number per **Figure 28.36.090(d)**, in which the solid "design curves" incorporate the required 10 percent factor of safety. This basin is intended for rectangular sections only, thus transitions may be required upstream of the structure. The design procedure herein is intended for unit discharge rates of up to 500 cfs per foot width. The incoming chute to the basin can be of any slope, but slopes greater than 2:1 shall incorporate a radius curve to allow for a smooth transition to the basin floor. Sequent depths for a free hydraulic jump, USBR Type II basin, and USBR Type III basin are shown in **Figure 28.36.090(e)**.

The design procedure for the USBR Type II Basin is presented in HEC-14, Chapter VII-D.

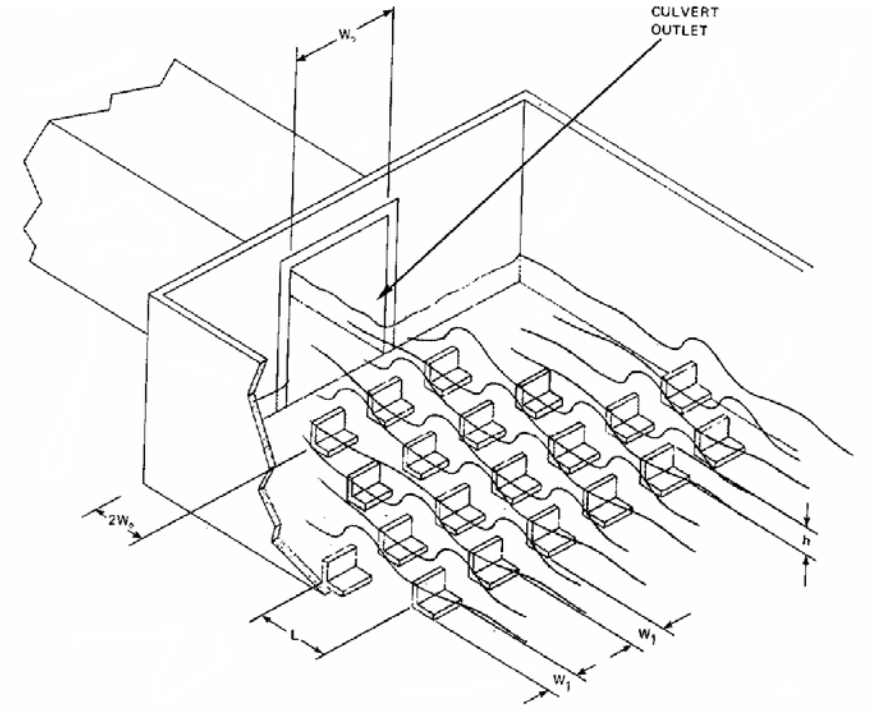
(c) USBR Type III Basin. This basin utilizes chute blocks, baffle piers, and a solid end sill (no dentates) to induce a hydraulic jump in the basin. An isometric sketch of this basin is presented in **Figure 28.36.090(f)**. This basin requires an upstream Froude number between 4.5 and 17.0. This can in part be controlled by the height and slope of the upstream chute, but the designer shall be aware that lower basin elevations can cause the jump to move upstream and submerge the chute, negating its ability to increase the influent Froude number. The required tailwater depth for this basin is at least full conjugate depth as indicated in **Figure 28.36.090(d)**. This basin is intended for rectangular sections only, thus transitions may be required upstream of the structure.

The USBR Type III basin is limited to a unit discharge rate of 200 cfs per foot width, but can handle velocities up to 50 or 60 feet per second. The design is intended to effectively initiate and shorten the hydraulic jump, thereby reducing the space requirements for the structure. However, the baffle piers, which are essential for controlling the jump, must be carefully designed to comply with the procedure outlined below. The incoming chute to the basin can be of any slope, but slopes greater than 2:1 shall incorporate a radius curve to allow for a smooth transition to the basin floor.

The design procedure for the USBR Type III Basin is presented in HEC-14, Chapter VII-E.

STORMWATER MANAGEMENT MANUAL

CSU RIGID BOUNDARY BASIN (ISOMETRIC)



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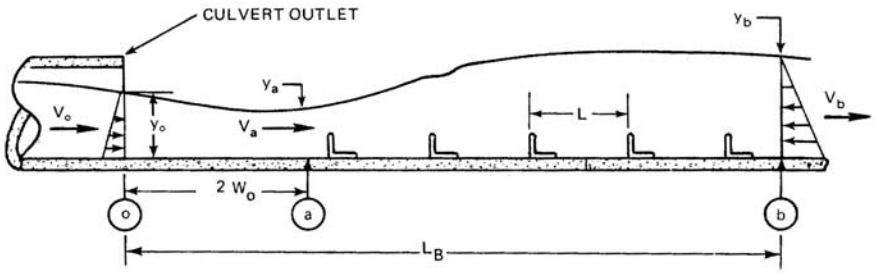
REFERENCE: HYDRAULIC DESIGN OF ENERGY DISSIPATORS FOR CULVERTS AND CHANNELS (HEC-14) (1983)

FIGURE 28.36.090(a)

STORMWATER MANAGEMENT MANUAL

CSU RIGID BOUNDARY BASIN (PROFILE)



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REFERENCE: HYDRAULIC DESIGN OF ENERGY DISSIPATORS FOR CULVERTS AND CHANNELS (HEC-14) (1983)

FIGURE 28.36.090(b)

STORMWATER MANAGEMENT MANUAL

USBR TYPE II BASIN

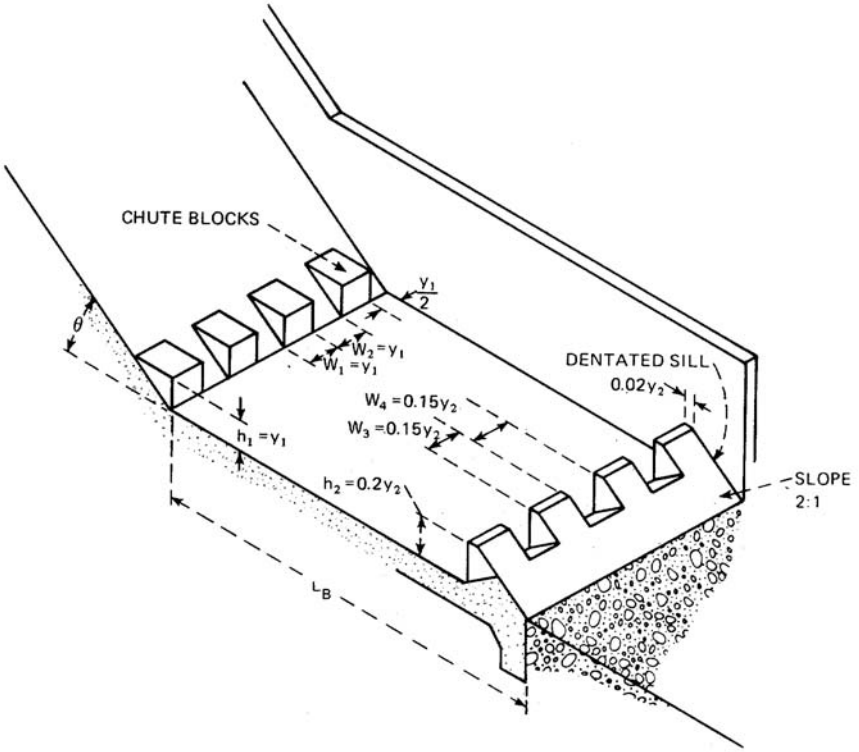

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FIGURE 28.36.090(c)

STORMWATER MANAGEMENT MANUAL

REQUIRED TAILWATER DEPTHS (USBR TYPES II, III & IV)

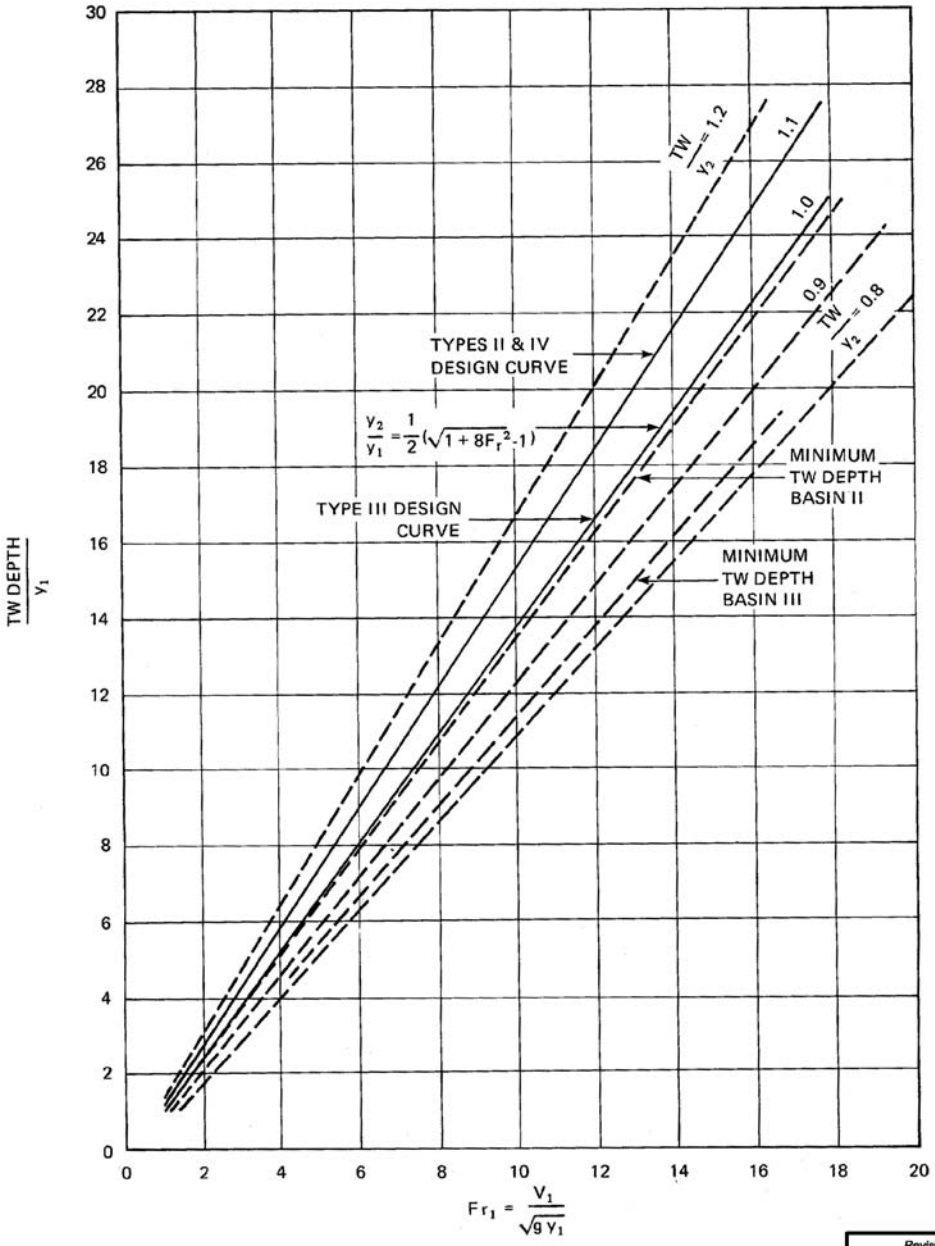

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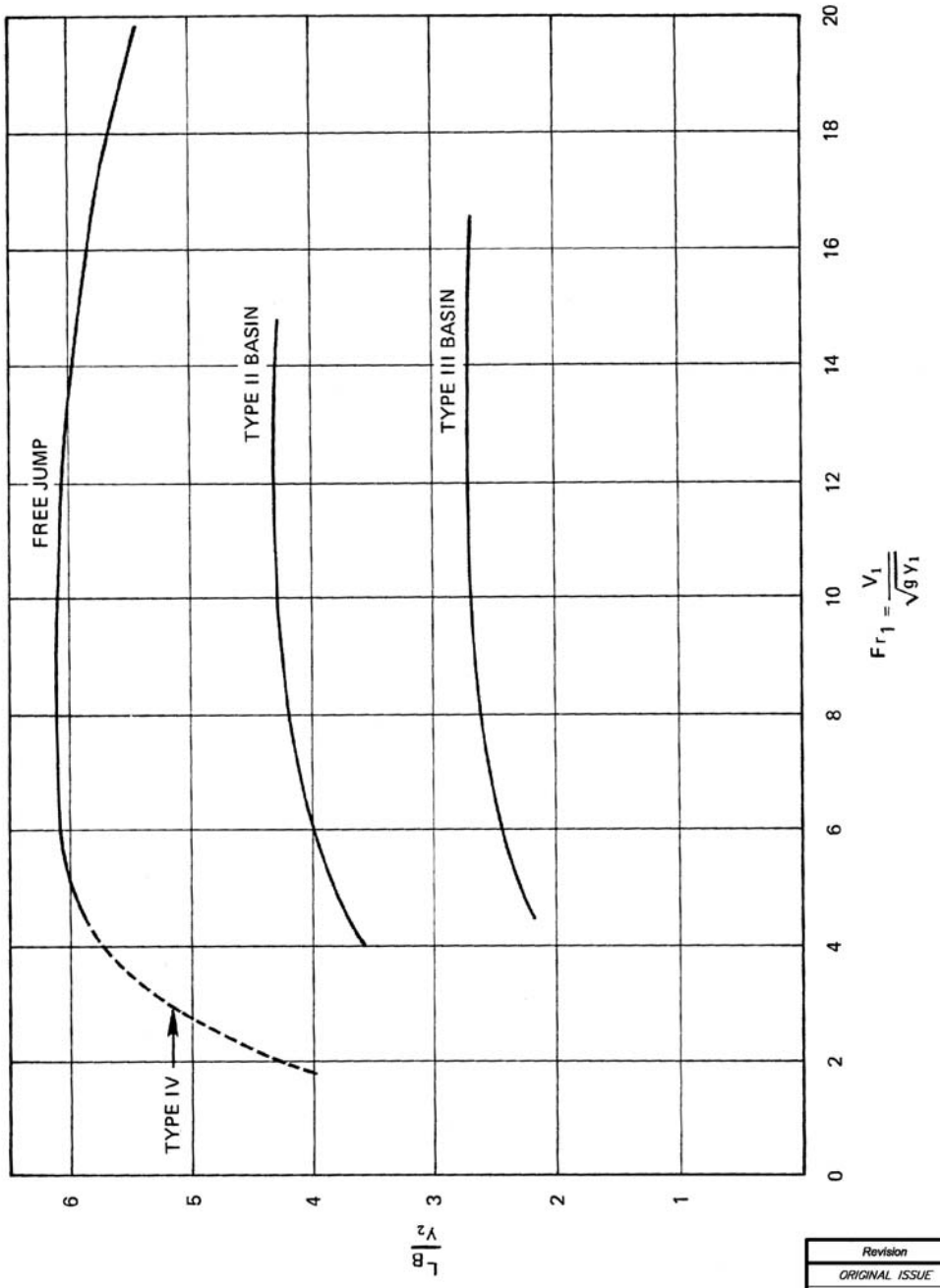
FIGURE 28.36.090(d)

STORMWATER MANAGEMENT MANUAL

HYDRAULIC JUMP LENGTH



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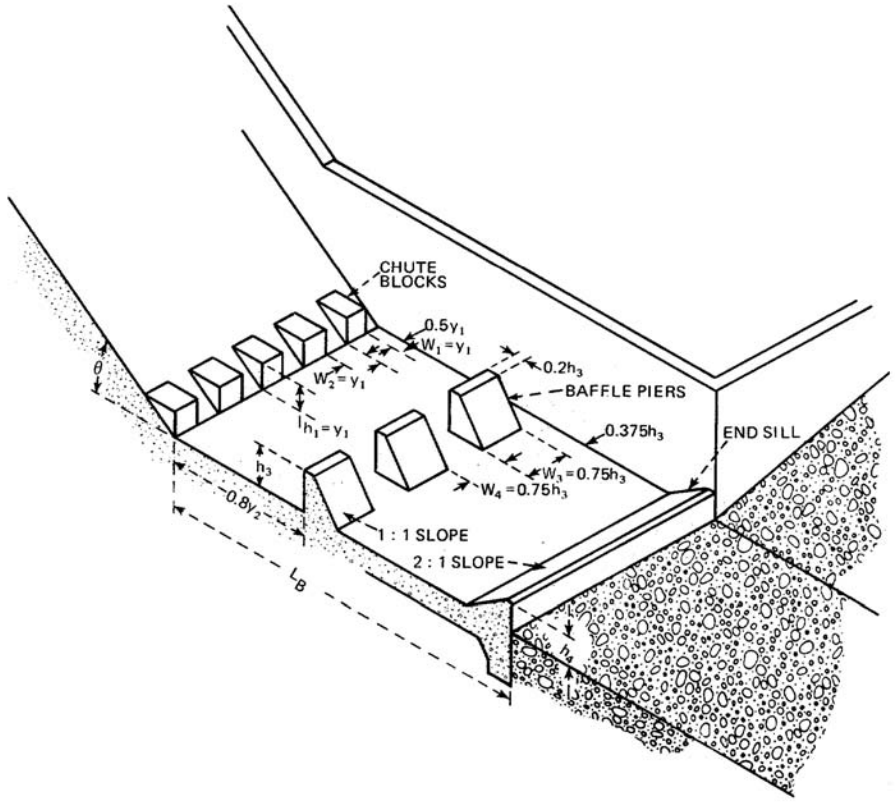
REFERENCE: HYDRAULIC DESIGN OF ENERGY DISSIPATORS FOR CULVERTS AND CHANNELS (HEC-14) (1983)

FIGURE 28.36.090(e)

STORMWATER MANAGEMENT MANUAL

USBR TYPE III BASIN



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REFERENCE: HYDRAULIC DESIGN OF ENERGY DISSIPATORS FOR CULVERTS AND CHANNELS (HEC-14) (1983)

FIGURE 28.36.090(f)

(d) USBR Type IV Basin. At locations where the upstream flow is supercritical but still in the relatively low range of Froude numbers, the USBR Type IV basin can be employed. Designated for Froude numbers between 2.5 and 4.5, the jump is defined by Chow (1959) as an "oscillating jump." This type of hydraulic jump can produce potentially destructive downstream wave action, so the recommended tailwater depth for this structure is higher than that for the Type III basin.

Like the Type II basin, this structure utilizes chute blocks and an end sill. However, the end sill in this case is solid, not dentated. This basin is intended for rectangular sections only, thus transitions may be required upstream of the structure. An isometric sketch with general dimensions is presented in **Figure 28.36.090(g)**.

The design procedure for the USBR Type IV basin is presented in HEC-14, Chapter VII-F.

(e) SAF Stilling Basin. The Saint Anthony Falls (SAF) stilling basin is similar to the USBR Type III Basin in that it utilizes chute blocks, baffle piers (floor blocks), and an end sill to induce and maintain a steady hydraulic jump in the basin. Also similar to the Type III, it produces a jump that is significantly shorter than a natural hydraulic jump (approximately 80 percent of the length), thereby reducing the required length of the basin and downstream protection.

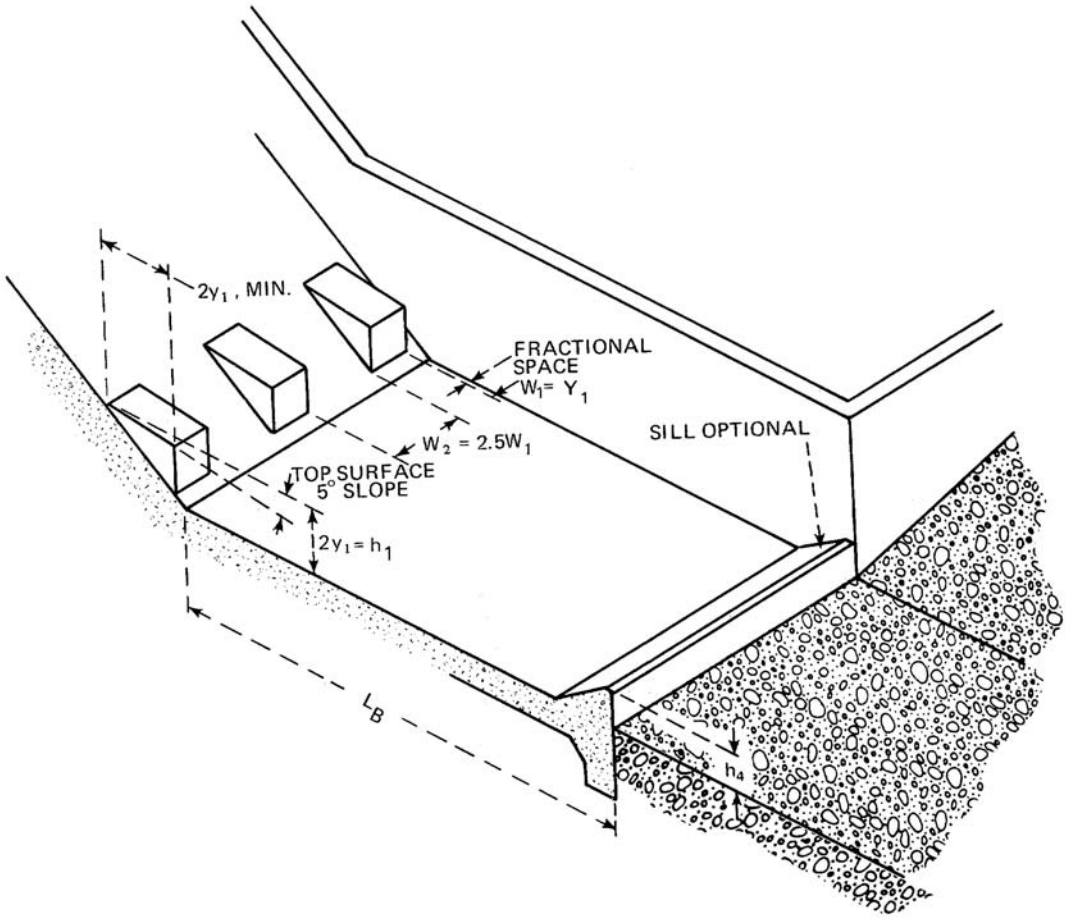
Plan and profile views of the SAF basin are provided in **Figure 28.36.090(h)**. Note that the basin itself may be laterally flared to better fit the downstream channel. This flare is labeled as z (longitudinal):1 (lateral), wherein the variable z is limited to values equal to or greater than 2.0. However, all side walls, headwalls, and wingwalls shall be vertical.

The SAF Basin may be used at the base of straight-drop spillways, at culvert and storm drain outlets, and in canals. It is required that flow entering the basin be supercritical, but this can usually be achieved by proper upstream chute design. The allowable range of Froude numbers for this structure is 1.7 to 17.0.

The design procedure for the SAF stilling basin is presented in HEC-14, Chapter VII-G.

STORMWATER MANAGEMENT MANUAL

USBR TYPE IV BASIN



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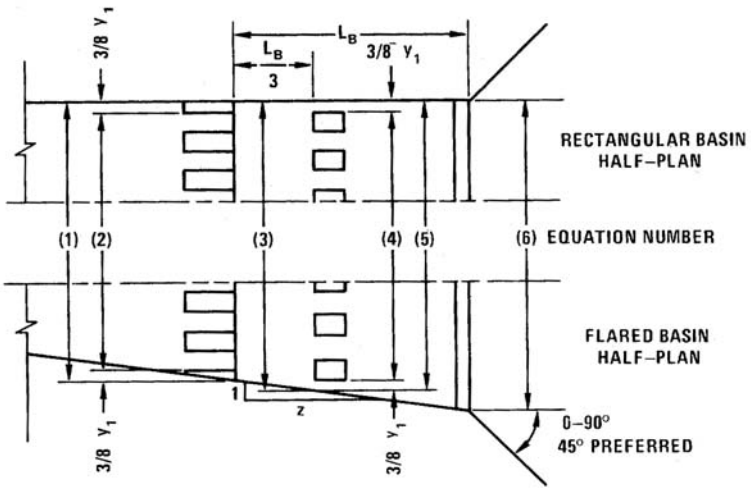
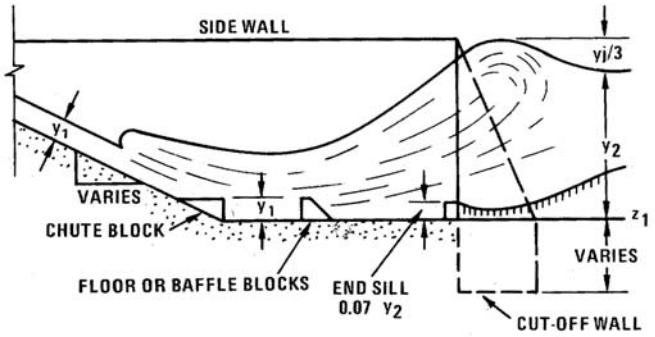
REFERENCE: HYDRAULIC DESIGN OF ENERGY DISSIPATORS FOR CULVERTS AND CHANNELS (HEC-14) (1983)

FIGURE 28.36.090(g)

STORMWATER MANAGEMENT MANUAL

SAF STILLING BASIN





(1) W_B = BASIN WIDTH UPSTREAM
(2) n BLOCKS AT 3/4 y_1 ±
(3) 0.40 W_{B2} ≤ AGGREGATE BLOCK WIDTH ≤ 0.55 W_{B2}
(4) n BLOCKS AT 3/4 y_1 $\frac{W_{B2}}{W_B}$ ±
(5) $W_{B2} = W_B + 2L_B/3z$
(6) $W_{B3} = W_B + 2L_B/z$

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REFERENCE: HYDRAULIC DESIGN OF ENERGY DISSIPATORS FOR CULVERTS AND CHANNELS (HEC-14) (1983)

FIGURE 28.36.090(h)

(Res. 40-08 (§ 903.2), 3-19-08)

28.36.100 Impact basins.

Impact basins dissipate energy by causing the high-velocity flow to encounter an obstruction, redirecting the flow in directions other than the influent path. This action effectively negates a large percentage of the velocity head that would otherwise potentially cause damage to the downstream channel. While these structures tend to be costly on a unit-discharge basis, they require far less space than many other dissipation options. Three types of impact basins are presented in this section.

The designer of the energy dissipators discussed herein is responsible for ensuring adequate structural design, including the analysis of all forces incident on the structure, calculation of creep and overturning potential, and design and installation of seepage controls. Necessary seepage controls may include cutoff walls, liners, weep drains, and/or other devices. The designer is referenced to applicable texts concerning subgrade compaction, concrete mixing, steel reinforcement, calculation of external forces, and retaining wall design.

(a) Contra Costa Energy Dissipator. This structure is intended for use with small to medium culverts with medium to high velocity flows. It is also designed to operate with minimal tailwater, although some tailwater improves the dissipator's performance. Tailwater depth is limited to one-half of the culvert height. The Contra Costa dissipator is best for locations where the design flow depth at the culvert outlet is less than the culvert height. Therefore, culvert effluent depth is limited to one-half of the culvert height. The Froude number of the culvert outlet flow is limited to a maximum of 3.0.

The Contra Costa energy dissipator is a concrete structure designed to be placed in a trapezoidal channel with side slopes of 1:1 and a bottom width between one and three times the culvert height ($D \leq W \leq 3D$). If a natural channel exists at the structure location, the structure width shall conform to that channel, with a maximum width of 3D. The structure consists of two continuous baffles of different heights across the basin floor as well as a vertical end sill. All parts of the structure shall be reinforced concrete and shall be tied to the downstream end of the culvert with steel reinforcement bars if possible. Profile and section views with dimensional definitions are provided in **Figure 28.36.100(a)**.

The design procedure for the Contra Costa energy dissipator is presented in HEC-14, Chapter VIII-A.

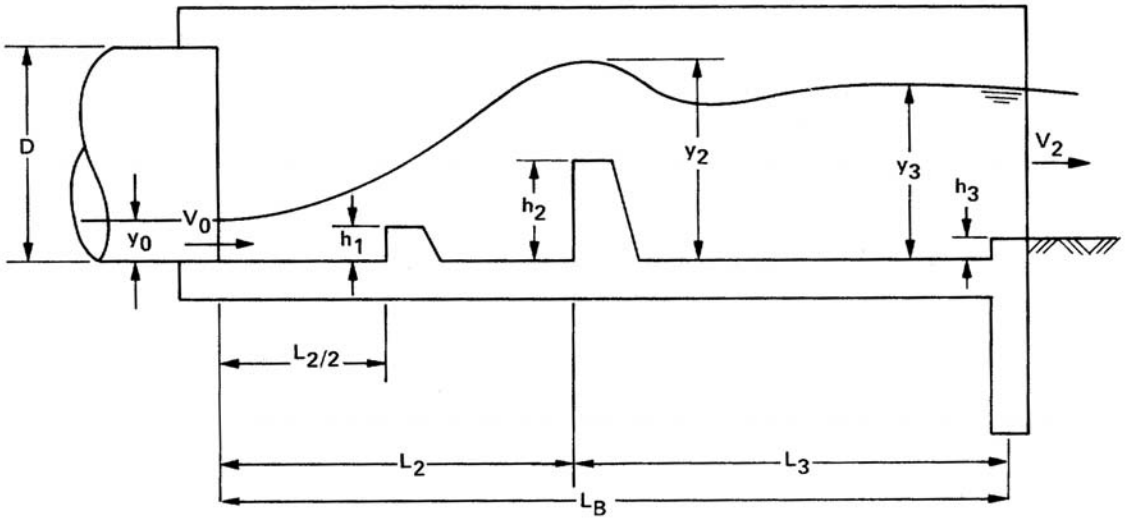
(b) Hook-Type Energy Dissipator. The hook-type dissipator, also called aero-type, is used at culvert outlets with Froude numbers in the range of 1.8 to 3.0. Each dissipator utilizes three hook structures in the basin that redirect a portion of the high-velocity flow up and back into the basin flow. This action creates a large amount of turbulence, thereby dissipating some of the excess energy in the flow. At Froude numbers exceeding about 3.0, the dissipation effects are greatly diminished.

This energy dissipation structure is designed to use either of two basin configurations. The first type contains vertical wingwalls at the culvert exit which are warped smoothly to side slopes of 1.5:1 at the end sill (see **Figure 28.36.100(b)**). The second configuration is a trapezoidal channel with a constant cross-section throughout the basin (see **Figure 28.36.100(d)**). Hook details for the two configurations are found in **Figures 28.36.100(c)** and **28.36.100(e)**, respectively.

The design procedure for the Hook-Type Energy Dissipator is presented in HEC-14, Chapter VIII-B.

STORMWATER MANAGEMENT MANUAL

CONTRA COSTA ENERGY DISSIPATOR



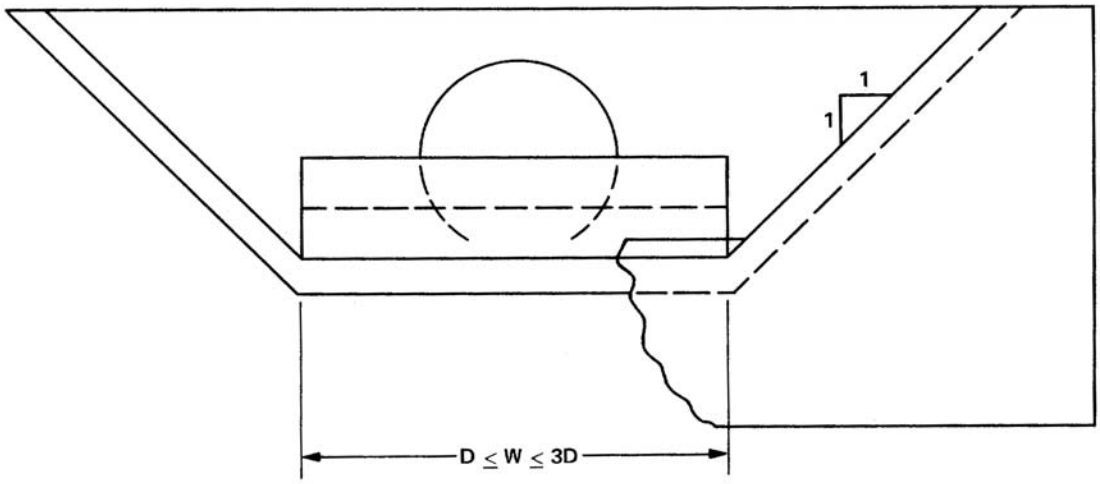


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FIGURE 28.36.100(a)

STORMWATER MANAGEMENT MANUAL

HOOK-TYPE ENERGY DISSIPATOR (WARPED WINGWALL BASIN)

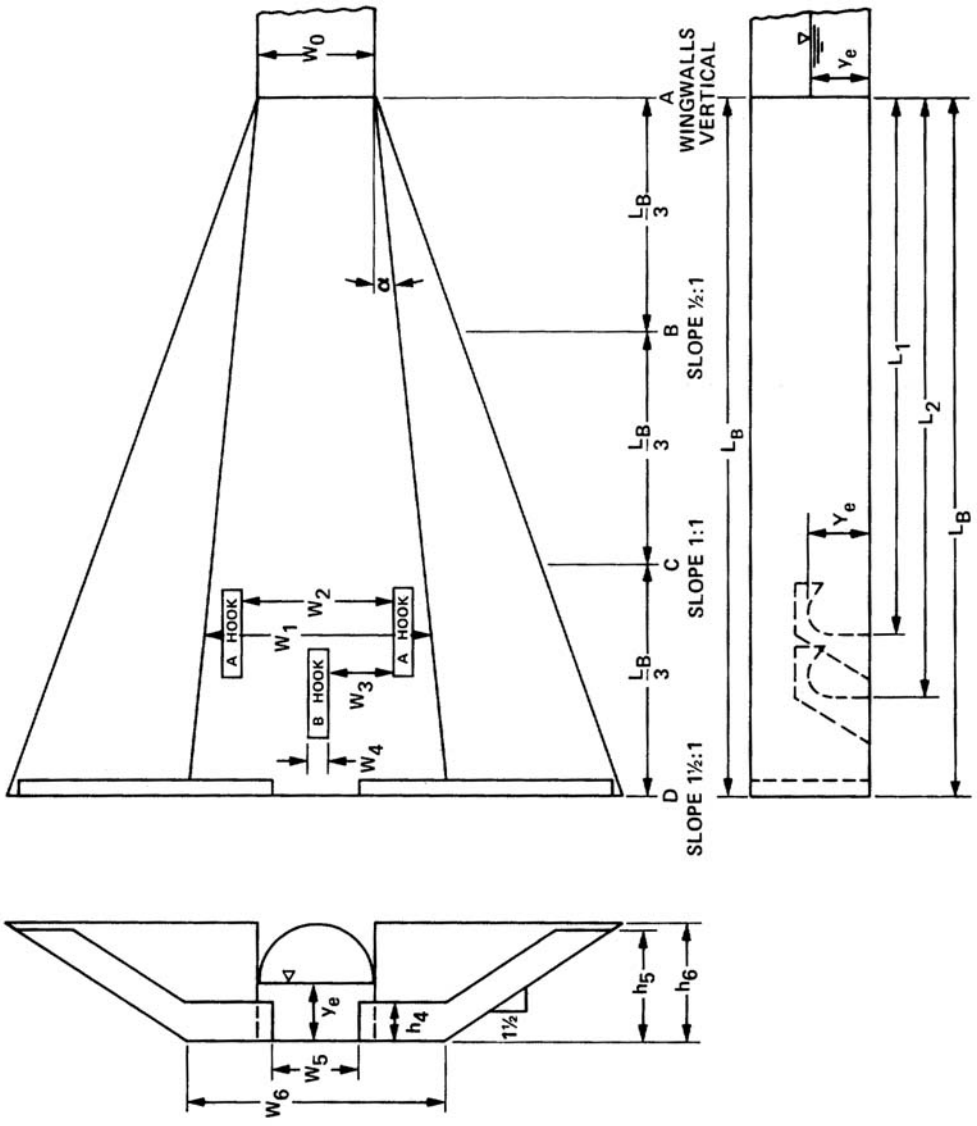

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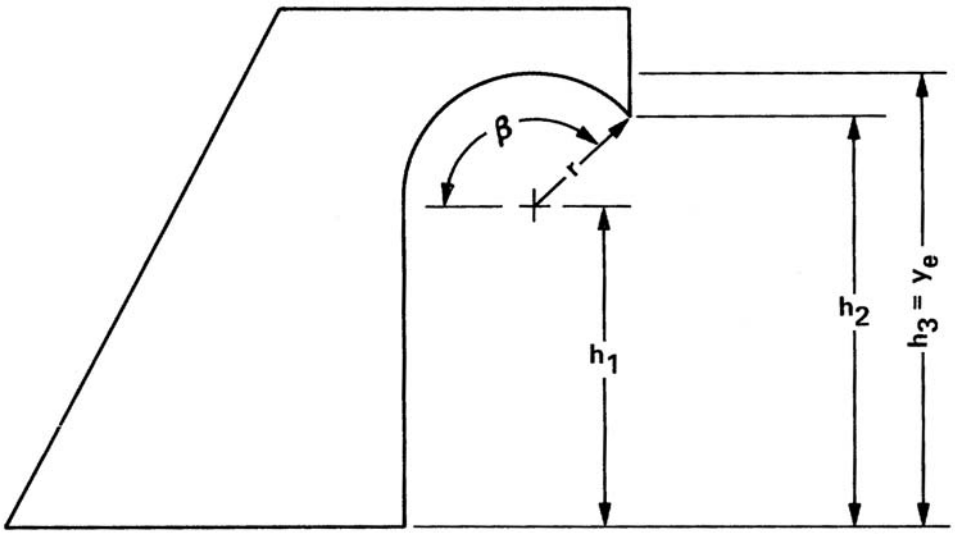
FIGURE 28.36.100(b)

STORMWATER MANAGEMENT MANUAL

HOOK-TYPE ENERGY DISSIPATOR (HOOK DETAIL - WARPED WINGWALL BASIN)



$h_3 = y_e$

$h_2 = 1.28\, h_1$

$h_1 = y_e / 1.4$

$\beta = 135^{o}$

$r = 0.4\, h_1$

HOOK FOR WARPED WINGWALL BASIN

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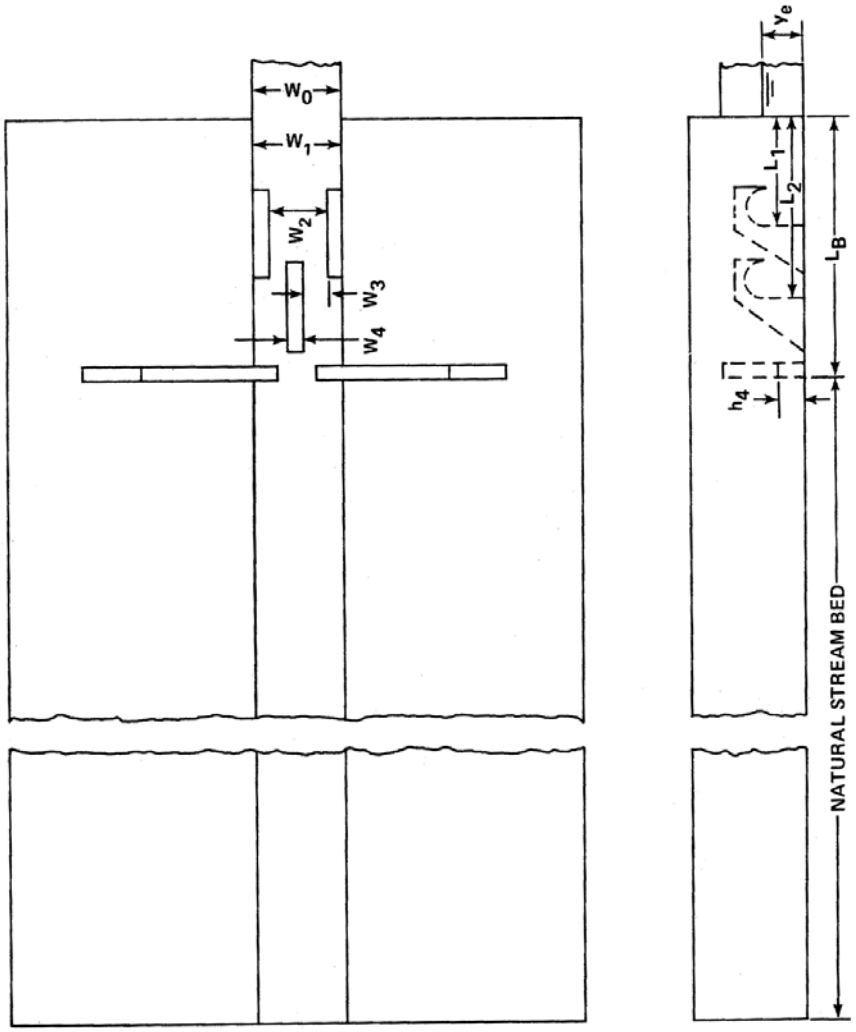
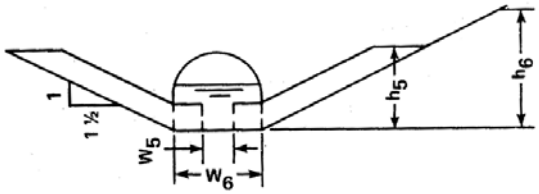
REFERENCE: HYDRAULIC DESIGN OF ENERGY DISSIPATORS FOR CULVERTS AND CHANNELS (HEC-14) (1983)

FIGURE 28.36.100(c)

STORMWATER MANAGEMENT MANUAL

HOOK-TYPE ENERGY DISSIPATOR (STRAIGHT TRAPEZOIDAL BASIN)





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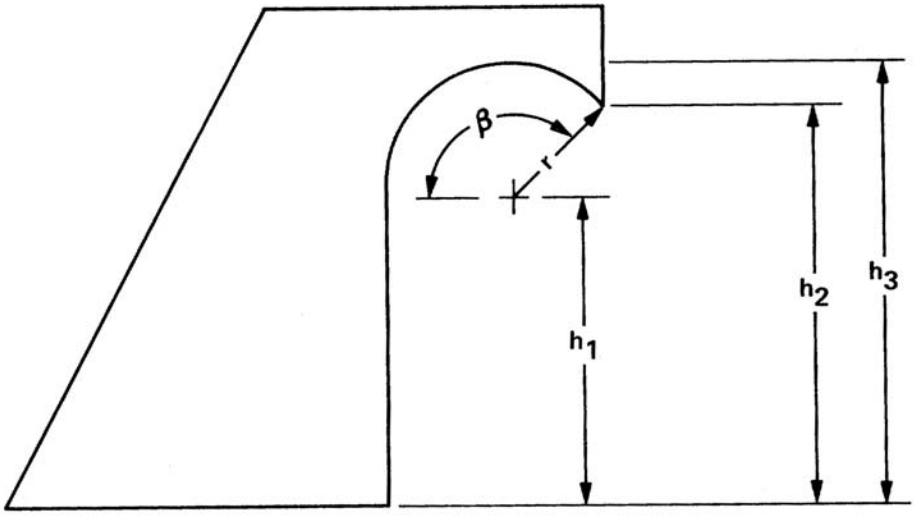
REFERENCE: HYDRAULIC DESIGN OF ENERGY DISSIPATORS FOR CULVERTS AND CHANNELS (HEC-14) (1983)

FIGURE 28.36.100(d)

STORMWATER MANAGEMENT MANUAL

HOOK-TYPE ENERGY DISSIPATOR (HOOK DETAIL - STRAIGHT TRAPEZOIDAL BASIN)



$h_2 = y_e$

$h_1 = 0.78\, y_e$

$h_3 = 1.4\, h_1$

$r = 0.4\, h_1$

$\beta = 135^o$

HOOK FOR STRAIGHT TRAPEZOIDAL BASIN

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REFERENCE: HYDRAULIC DESIGN OF ENERGY DISSIPATORS FOR CULVERTS AND CHANNELS (HEC-14) (1983)

FIGURE 28.36.100(e)

(c) Impact-Type Energy Dissipator (USBR Type VI). Also called the baffle-wall energy dissipator or baffled outlet, this structure is compact and highly effective for the control of high-energy flows exiting a conduit or rectangular channel section. Consisting of a vertical-walled basin with a single large vertical hanging baffle, energy is dissipated by impact with the baffle and secondarily by eddies formed in the basin. At the design flow, this structure dissipates energy more effectively than a hydraulic jump (See **Figure 28.36.100(g)**), and has no minimum tailwater depth. However, its debris-handling capability and maximum tailwater depth limit (discussed later) limit the locations at which the structure can be used. Further limitations include a maximum discharge of 400 cfs per structure and a maximum upstream velocity of 50 feet per second. This latter value is intended to minimize damage to the baffle due to cavitation. Where these limits are exceeded, two or more structures may be built adjacent to one another to accommodate the excess flow.

For upstream conduits with a slope greater than 15 percent and for all open channels, it is recommended that there be a horizontal section from the outlet brink to a point at least four conduit widths upstream. Rectangular upstream channels shall have sidewalls of a height equal to or greater than the walls of the dissipator basin and shall always have a zero longitudinal slope for a minimum of three channel widths upstream from the entrance to the basin.

Figure 28.36.100(f) presents the configuration and necessary dimensions for the design of the USBR Type VI structure. Note that the optional notches near the edges of the basin are included to create concentrated jets for self-cleaning purposes.

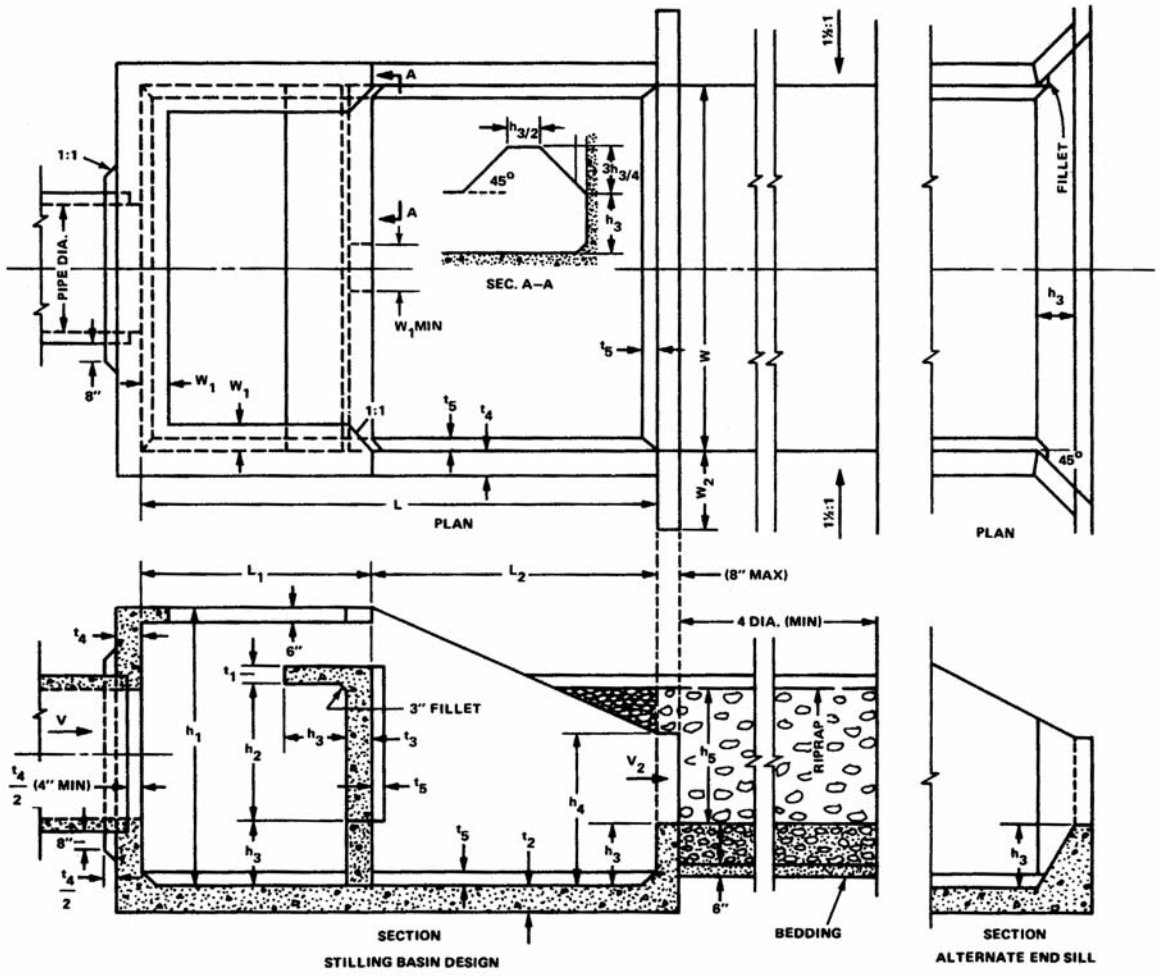
One of the most important design features of this structure is its ability to pass the entire design discharge over the top of the baffle. This is important to prevent upstream flooding in the case of complete clogging of the area under the baffle. However, this flow configuration is not nearly as effective and shall not be relied upon as an alternative energy dissipation method. Therefore, the debris and ice buildup potential at a given location shall be analyzed prior to selection of this structure as the energy dissipator for that outlet.

While some tailwater (up to $h_3+h_2/2$) improves the performance of the dissipator, depths over this height shall be avoided. Significant degradation of performance occurs with tailwater depths greater than h_3+h_2, thus the USBR Type VI structure shall not be installed in these conditions.

The design procedure for the impact-type energy dissipator is presented in HEC-14, Chapter VIII-C.

STORMWATER MANAGEMENT MANUAL

IMPACT -TYPE ENERGY DISSIPATOR (USBR TYPE VI)



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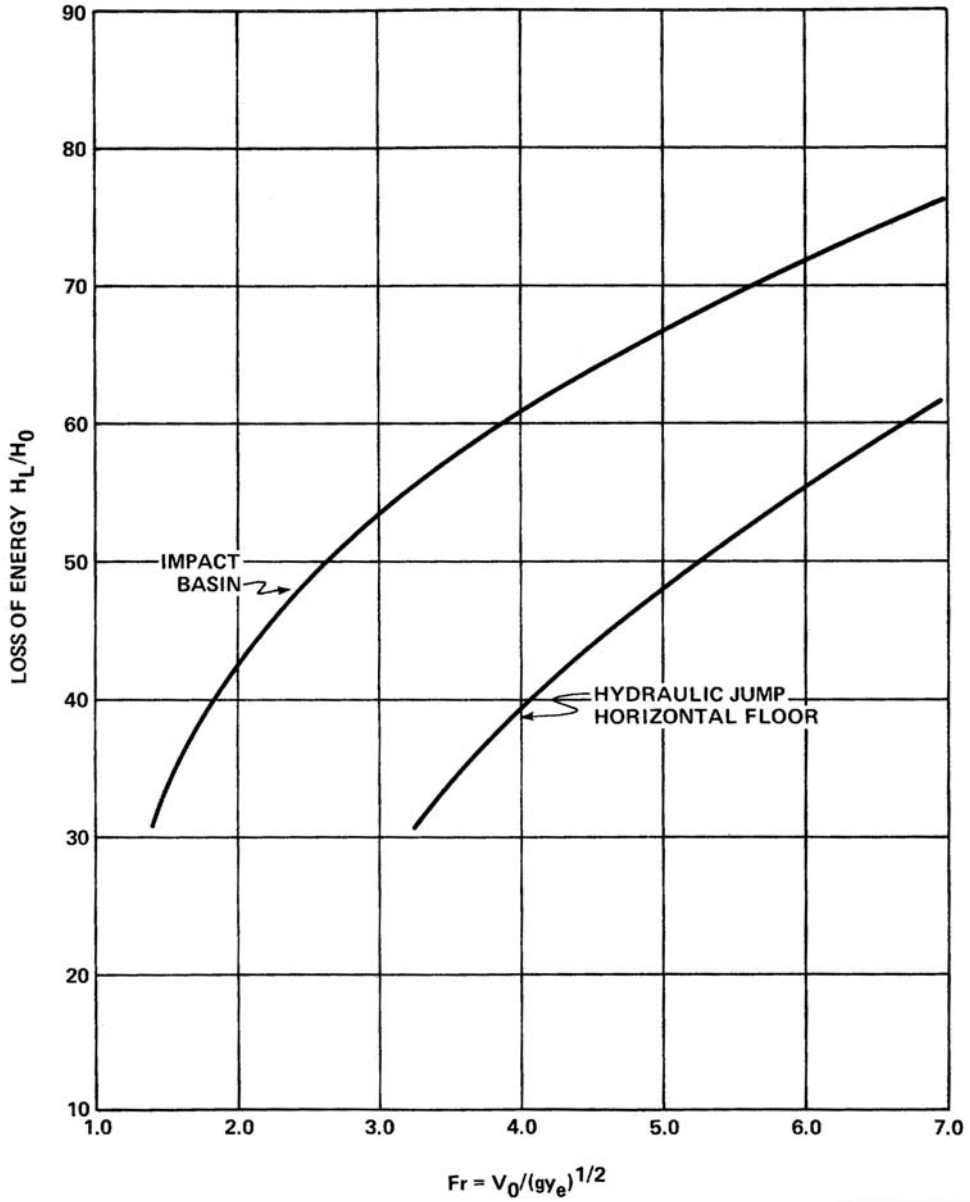
REFERENCE: HYDRAULIC DESIGN OF ENERGY DISSIPATORS FOR CULVERTS AND CHANNELS (HEC-14) (1983)

FIGURE 28.36.100(f)

STORMWATER MANAGEMENT MANUAL

IMPACT -TYPE ENERGY DISSIPATOR (ENERGY LOSS)



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REFERENCE: HYDRAULIC DESIGN OF ENERGY DISSIPATORS FOR CULVERTS AND CHANNELS (HEC-14) (1983)

FIGURE 28.36.100(g)

(Res. 40-08 (§ 903.3), 3-19-08)

28.36.110 Overbank prevention structures and wasteways.

Every channel has a maximum allowable flow depth which, when exceeded, may cause damage to the banks and eventually failure of the channel. Occasionally, overflow from a storm drainage system enters an irrigation canal (this shall be avoided unless specific consent is granted by the owner/operator of the canal). In these situations, it is typically necessary to remove the overflow from the canal at some downstream location. The structures in this section are intended to remove excess water from a channel to maintain a specified water surface elevation or to allow the water in a channel section to be drained. The latter may be necessary to inspect, maintain, or repair the channel, or in the event of an embankment failure, to redirect some of the escaping flow to an acceptable location.

Wasteway is the term commonly applied to the channel to which the main channel excess flow is diverted. A wasteway shall have the capacity to convey the maximum flow that can be diverted through all diversion structures located upstream, and shall deliver the excess flow to an acceptable disposal point.

Two types of diversion structures which can act as overbank prevention structures are presented herein: the side-channel spillway and the gated turnout.

(Res. 40-08 (§ 904), 3-19-08)

28.36.120 Side-channel spillways.

A side-channel spillway is the most effective structure for automatic removal of excess flow in a channel since its capacity increases with depth over its crest. The spillway crest is usually parallel to the channel alignment except at terminal wasteways (at the end of a canal). Typically, the spillway crest is set approximately 0.2 feet above the normal design depth for the channel to allow for normal wave action. The length of the spillway is then controlled by the required overflow discharge capacity and the maximum allowable water surface elevation in the channel. A standard rule of thumb is to ensure no more than 50 percent encroachment on the freeboard of the channel banks in the vicinity of the spillway. A detailed procedure for the design of a side-channel spillway turnout and wasteway is not presented in this manual due to the infrequent application of such a structure in stormwater runoff designs. However, Equation 28.36-10 is the basic design equation for the side-channel spillway (suppressed rectangular weir):

$$Q = 3.33 L_c H^{3/2} \qquad (28.36\text{-}10)$$

Where:

Q	=	Design Flow over the Spillway (cfs)
L_c	=	Crest Length (ft.)
H	=	Height of Channel Water Surface over Crest (ft.)

(Res. 40-08 (§ 904.1), 3-19-08)

28.36.130 Gated turnouts.

To allow for manual release of water from a channel for the purpose of water level control, maintenance access, et cetera, gated turnouts are often installed at wasteways. It is common practice to include at least one gated turnout at any side-channel spillway location for flushing and additional water level control. Again, specific design procedures are not presented, but the general orifice equation is given:

$$Q = CA\sqrt{2gh} \qquad (28.36\text{-}11)$$

Where:

Q = Design Flow through Gate (cfs)

C = Orifice Coefficient ≅ 0.6

h = Height of Water Surface Over Gate Centerline (ft.)

A = Area of Orifice ($ft.^2$)

g = Gravitational Constant (32.2 $ft./s^2$)

(Res. 40-08 (§ 904.2), 3-19-08)

28.36.140 Pipe appurtenances.

GJMC 28.36.150 through 28.36.170 present appurtenances for use in conjunction with pipe systems, specifically those designed for the transport of stormwater.

(Res. 40-08 (§ 905), 3-19-08)

28.36.150 Pipe collars.

Pipe collars are transverse fins that extend from the pipe into the surrounding earth and function as barriers to percolating water and burrowing rodents (USBR 1974). Due to the relative smoothness and impermeability of pipe, percolated water tends to collect and move along the soil adjacent to a pipe's outer wall. This action, typically called piping, tends to transport soil particles away from the pipe, potentially causing the pipe to experience structural problems. Failure of the backfill and ultimately the pipe itself can lead to hydraulic failure of the pipe system as well as the failure of surface structures such as roadways and buildings.

While percolation is expected around many storm drains and culverts, especially near pipe inlets, those with higher (5H:1V or greater) percolation gradients are often candidates for pipe collars. The percolation gradient is the slope of a line from an inlet water surface to a point of relief for the percolated water. The difference in water surface elevations between the upstream end of the percolation path and the point of relief is ΔH_{perc}. Lane's weighted creep method is used to determine a percolation factor (weighted-creep ratio), which is compared to the allowable ratio for the soil type at a given site. First, determine the weighted-creep length:

$$L_{wc} = y_{steep} + (x_{mild}/3) + 2(L_{sc}) \quad (28.36\text{-}12)$$

Where:

L_{wc} = Weighted creep length (ft.)

y_{steep} = Vertical path distance along the structure (steeper than 45°) (ft.)

x_{mild} = Horizontal path distance along the structure (flatter than 45°) (ft.

L_{sc} = Percolation path distance that shortcuts the soil (ft.)

Then determine the percolation factor, R_{wc} to 1:

$$R_{wc} = \frac{L_{wc}}{\Delta H_{perc}} \quad (28.36\text{-}13)$$

Table 28.36.150 presents minimum recommended weighted-creep ratios for a range of soil types:

Table 28.36.150: Lane's Minimum Recommended Weighted-Creep Ratios

Material	Minimum Ratio
Very fine sand or silt	8.5:1
Fine sand	7.0:1
Medium sand	6.0:1
Course sand	5.0:1
Fine gravel	4.0:1
Medium gravel	3.5:1
Course gravel w/cobbles	3.0:1
Boulders w/some cobbles and gravel	2.5:1
Soft clay	3.0:1
Medium clay	2.0:1
Hard clay	1.8:1
Very hard clay/Hardpan	1.6:1

Adapted from USBR 1974, Untitled Table, Page 364

Where the weighted-creep ratio calculated in Equation 28.36-13 does not exceed the applicable recommended ratio from **Table 28.36.150**, or does not exceed 2.5:1, pipe collars shall be installed.

Figure 28.36.150 presents basic dimensions for pipe collar fittings on reinforced concrete pipe (RCP) and corrugated metal pipe (CMP).

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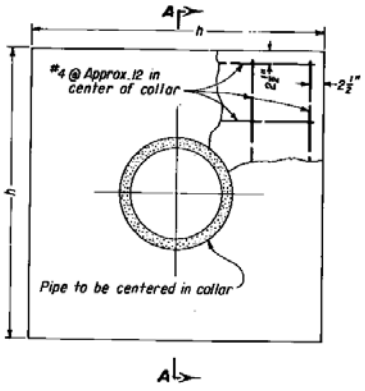
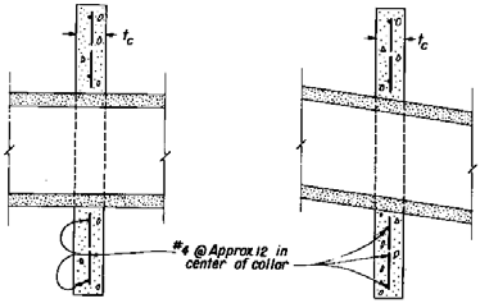
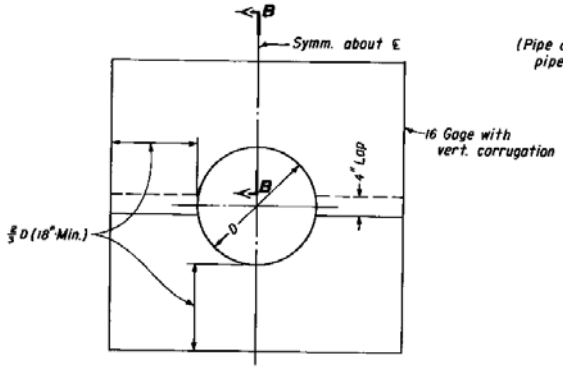
PIPE COLLAR DETAILS



ELEVATION
(Pipe collar for precast concrete pipe, asbestos-cement pipe and reinforced plastic mortar pipe)



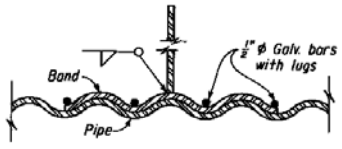
SECTION A-A



ELEVATION
(Pipe collar for corrugated metal pipe)

DIMENSIONS AND ESTIMATED QUANTITIES
(Pipe collar for precast concrete pipe, asbestos-cement pipe and reinforced plastic mortar pipe)

PIPE DIA.	h	t_c	CONC. CU.YD.	REINF. LBS.
18"	5'-0"	6"	0.4	33
21"	5'-3"	6"	0.4	35
24"	5'-6"	6"	0.5	44
27"	6'-3"	6"	0.7	50
30"	7'-0"	6"	0.8	62
36"	8'-6"	6"	1.2	96
42"	9'-3"	8"	1.8	100
48"	10'-0"	8"	2.2	120
54"	11'-6"	8"	2.7	170
60"	12'-0"	8"	2.9	180



SECTION B-B

Revision	Date
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REFERENCE:
DESIGN OF SMALL CANAL STRUCTURES (USBR, 1974)

FIGURE 28.36.150

(Res. 40-08 (§ 905.1), 3-19-08)

28.36.160 Thrust blocks at pipe bends.

Every horizontal or vertical pipe bend in a storm drain, culvert, inverted siphon or other pipe structure shall be analyzed for stability. As the momentum of flow changes around a bend, forces are exerted on the bend that must be countered by the pipe walls, soil pressure, pipe joints, and friction. When the dynamic thrust exceeds the allowable force on any of these resistance devices, a thrust block is installed at the bend. A thrust block typically consists of a rough block of concrete poured around the outside of a pipe bend in direct contact with the outer wall of the pipe.

The thrust force on a pipe bend is calculated by vector components (x, y, and z) to simplify the process. In the equations below, "x" represents the horizontal direction of flow upstream of the bend, "y" represents the horizontal direction of flow normal to "x," and "z" represents the vertical direction along which gravity acts. Equations 28.36-14 through 28.36-16 are adapted from Roberson et al., 1998, using conservation of momentum to find reaction forces. Pipe cross-sectional area and internal pressure are assumed to be constant through the bend, with pressure assumed to equal the surcharge depth above the pipe crown, if applicable.

$$F_{R_x} = \frac{\rho}{g} Q\left(V_{2_x} - V_{1_x}\right) + pA(\cos\theta - 1) \qquad (28.36\text{-}14)$$

$$F_{R_y} = \frac{\rho}{g} Q\left(V_{2_y} - 0\right) - pA \cdot \sin\theta \qquad (28.36\text{-}15)$$

$$F_{R_z} = \frac{\rho}{g} Q\left(V_{2_z} - 0\right) - W_{bend} - W_{water} \qquad (28.36\text{-}16)$$

Where:

F_R	=	Reaction force required to hold bend in place, lbf
ρ	=	Density of water $\cong$ 62.4 lbs/ft^3
Q	=	Flow rate in pipe, cfs
V_{1x}	=	Average pipe velocity upstream of the bend, fps
V_{2x}	=	$V_{1x} \cos\theta$, $V_{2y} = V_{1x} \sin\theta$, $V_{2z} = V_{1x} \sin\theta$
p	=	Internal pipe pressure, psf
g	=	Gravitational constant, 32.17 ft./s^2
A	=	Cross-sectional flow area of pipe, sf
θ	=	Total bend angle (vertical or horizontal)
W_{bend}	=	Weight of the pipe in the bend, lbs.
W_{water}	=	Weight of the water in the bend, lbs.

Subscripts 1 and 2 indicate conditions just upstream and just downstream of the bend.

In addition to soil bearing pressure, force on a bend is resisted by friction between the pipe and the soil. A sliding coefficient of 0.35 is recommended for purposes of calculating the friction force (USBR 1974).

Where calculations indicate that sliding or displacement of a horizontal bend may occur, a thrust block is installed to increase the effective bearing area on the soil such that the load is adequately dispersed. Vertical bends may require an anchor block to provide additional weight to resist the resultant vertical

force. Calculation of resisting forces for a vertical bend may include full pipe weight and anchor block weight, but shall not include the weight of earth cover on the bend. This allows for safe operation of the pipe even with reduction or removal of cover material (USBR 1974).

(Res. 40-08 (§ 905.2), 3-19-08)

28.36.170 Valves.

References for this section include USBR, 1974 and Linsley and Franzini, 1964.

(a) Drain (Blow-Off) Valves. A blow-off valve is intended to allow for the draining of a structure that typically will otherwise not fully drain. Most commonly used in long inverted siphons, blow-off valves may be gravity-fed, pumped, or a combination of both, depending on the invert of the discharge pipe. The design and installation of blow-off valves and related pipes shall incorporate pressure-rated joints and provisions for operation and maintenance access.

(b) Pressure Relief Valves. Pressure relief valves are used to exhaust excess air pressure from a pipeline to protect the pipe from bursting and to remove large volumes of entrapped air that may significantly impact the hydraulic capacity of the pipe. The valves are set to open at a predetermined pressure so as to allow for a sealed pipeline under normal operating pressures.

These valves are commonly utilized in smaller pressure pipelines such as water supply lines to limit the effects of hydraulic transients (water hammers), but are occasionally used in stormwater systems. Inverted siphons (GJMC 28.52.030) often require a venting system to prevent blowback of air entrained in the water, although an open air vent (no valve) is usually an acceptable solution given an exhaust point that is well above the hydraulic grade line.

An air venting system of some type is required at all locations where the crown of a pipe is higher than the crown elevations upstream and downstream from that point.

(c) Air Inlet Valves. Air inlet valves operate in a similar fashion to pressure relief valves, but instead allow air into a pipeline to avoid internal pressure to drop too far below atmospheric pressure. As water drains from a sealed pipeline, a partial vacuum is created that can collapse or severely damage the pipe. Air inlet valves operate either by a float (water level) control or by opening at a set pressure difference like a pressure relief valve.

High points in a pipeline shall always be designed with an air venting system to avoid extreme positive or negative internal pressures as compared to atmospheric pressure.

(Res. 40-08 (§ 905.3), 3-19-08)

Chapter 28.40

STORM DRAIN SYSTEMS

Sections:

28.40.010 Introduction.
28.40.020 Storm drain design criteria.
28.40.030 Storm drain design criteria – Allowable capacity.
28.40.040 Storm drain design criteria – Allowable velocity.
28.40.050 Storm drain design criteria – Pipe roughness.
28.40.060 Storm drain design criteria – System layout.
28.40.070 Storm drain hydraulics.
28.40.080 Gravity-flow analysis.
28.40.090 Pressure-flow analysis.
28.40.100 Computer hydraulic modeling.
28.40.110 Construction standards.
28.40.120 Storm drain pipe.
28.40.130 Manholes.
28.40.140 Inlets.
28.40.150 Outlets.
28.40.160 Storm drain system design.
28.40.170 Initial storm drain design.
28.40.180 Preliminary/final storm drain design.
28.40.190 Example design application.

28.40.010 Introduction.

(a) Storm drains are used to convey runoff in locations where streets or other drainage facilities exceed their designated capacity or are otherwise unable to drain. The most common method for the introduction of water into a storm drain is the street inlet, discussed in Chapter 28.44 GJMC. However, water may also enter the system via grated area inlets, culvert-type inlets (typically for the conveyance of drainage-channel flow into the drain), pump stations, or other entry points. The design of a storm drain system is dependant on topography, street rights-of-way and drainage easements, the need to convey flows from multiple locations, existing and proposed structures and utilities, outfall locations, local hydrology, and regional and local design criteria.

(b) Typically, storm drains are sized to convey the peak runoff from the minor storm in excess of the contributing street flow capacity. This means the upper end of a storm drain branch will usually be located at the first inlet encountered by runoff in a given sub-watershed. As discussed in Chapter 28.44 GJMC, the first inlet will either be located at the point where street flow from the design storm exceeds street capacity for that storm (on-grade inlet) or where there is a vertical sag in the street (sump inlet). In some cases, however, street inlets discharge their intercepted flow to drainage facilities other than a storm drain (e.g., a drainage channel). Storm drains shall be sized to carry the maximum difference between street capacity and peak runoff for any given design storm. This could be the difference between the major storm peak runoff and the allowable street capacity for the major storm, or it could be the difference between the minor storm runoff and allowable street capacity for the minor storm. This is discussed further in GJMC 28.40.160 through 28.40.190.

(c) Occasionally, inlets and storm drains must be sized to convey the entire major storm event flow. Two examples of this situation follow:

(1) Locations where street flow is not in the desired direction and there is no other feasible drainage solution (such as closed basins – natural ponding areas).

(2) Locations where the standard allowable major storm street capacities do not apply, such as negative slopes outside the curb but within the right-of-way.

(d) Peak runoff values are found using the methods set forth in Chapters 28.24 and 28.28 GJMC.

(Res. 40-08 (§ 1001), 3-19-08)

28.40.020 Storm drain design criteria.

GJMC 28.40.020 through 28.40.060 present certain parameters relating to the design and construction of storm drain systems in Mesa County.

(Res. 40-08 (§ 1002), 3-19-08)

28.40.030 Storm drain design criteria – Allowable capacity.

As described in GJMC 28.40.010 and 28.40.160 through 28.40.190, a storm drain is designed to convey up to the entire design storm for all sub-watersheds tributary to it. The design of pressure-flow, or surcharged, storm pipes is allowed under certain restrictions as specified in this chapter. These include the calculation of energy grade lines (EGLs) and hydraulic grade lines (HGLs) indicating all hydraulic losses due to friction, junctions, and other structures and phenomena. The EGL for the storm drain design flow must at no time or location exceed the manhole rim or inlet throat elevation. More restrictive local criteria may apply; it is the responsibility of the designer to select the most restrictive of all applicable design criteria. Note that calculation of EGL and HGL is mandatory on all projects for the drainage plan submittal.

For the purpose of completing a conceptual storm drain system design, calculation of an EGL and HGL is not required. In these cases, the initial design methods presented in GJMC 28.40.170 (using open-channel hydraulics as presented in GJMC 28.40.080) are considered sufficient. The specific requirements for a conceptual drainage report are detailed in GJMC 28.12.030 through 28.12.050.

(Res. 40-08 (§ 1002.1), 3-19-08)

28.40.040 Storm drain design criteria – Allowable velocity.

Minimum velocities are required in storm drains to reduce sedimentation and promote positive drainage through the pipe at all depths. A minimum design-flow velocity of 2.5 feet per second is required for standard (positive-slope) storm drains. **Table 28.40.040** provides required slope values needed to maintain this minimum velocity for different pipe sizes and roughness factors.

While concrete pipe itself “can carry clear water of extremely high velocities without eroding” (ACPA, 1996), there exist numerous other factors that indicate the need for a maximum velocity in storm drains. Among these are the use of other pipe materials and shapes, expected flow conditions, and the “type and quality of construction of joints, manholes, and junctions” (Washoe County, 1996). Therefore, storm drains shall have a maximum design-flow velocity of 15 feet per second. Note that maximum outfall velocities are more restrictive to protect those areas from extensive erosion. See Chapter 28.32 GJMC, Open Channels; Chapter 28.36 GJMC, Additional Hydraulic Structures; and Chapter 28.48 GJMC, Culverts and Bridges, for details.

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SLOPES REQUIRED FOR V=2.5 FPS AT FULL AND HALF-FULL FLOW

Pipe Diameter (Inches)	Required Slopes to Maintain Minimum Velocity (V = 2.5 fps) at Full and Half-Full Flow					
	n = 0.012	n = 0.013	n = 0.014	n = 0.015	n = 0.022	n = 0.025
8	0.283%	0.332%	0.385%	0.442%	0.951%	1.228%
10	0.210%	0.247%	0.286%	0.328%	0.706%	0.912%
12	0.165%	0.193%	0.224%	0.257%	0.554%	0.715%
15	0.122%	0.144%	0.167%	0.191%	0.411%	0.531%
18	0.096%	0.113%	0.131%	0.150%	0.322%	0.416%
21	0.078%	0.092%	0.106%	0.122%	0.263%	0.339%
24	0.065%	0.077%	0.089%	0.102%	0.220%	0.284%
27	0.056%	0.066%	0.076%	0.087%	0.188%	0.243%
30	0.049%	0.057%	0.066%	0.076%	0.163%	0.211%
33	0.043%	0.050%	0.058%	0.067%	0.144%	0.186%
36	0.038%	0.045%	0.052%	0.059%	0.128%	0.165%
42	0.031%	0.036%	0.042%	0.048%	0.104%	0.135%
48	0.026%	0.030%	0.035%	0.041%	0.087%	0.113%
54	0.022%	0.026%	0.030%	0.035%	0.075%	0.096%
60	0.019%	0.023%	0.026%	0.030%	0.065%	0.084%
66	0.017%	0.020%	0.023%	0.027%	0.057%	0.074%
72	0.015%	0.018%	0.021%	0.024%	0.051%	0.066%
78	0.014%	0.016%	0.018%	0.021%	0.046%	0.059%
84	0.012%	0.014%	0.017%	0.019%	0.041%	0.053%
90	0.011%	0.013%	0.015%	0.018%	0.038%	0.049%
96	0.010%	0.012%	0.014%	0.016%	0.035%	0.045%
102	0.009%	0.011%	0.013%	0.015%	0.032%	0.041%
108	0.009%	0.010%	0.012%	0.014%	0.030%	0.038%
114	0.008%	0.010%	0.011%	0.013%	0.028%	0.036%
120	0.008%	0.009%	0.010%	0.012%	0.026%	0.033%
126	0.007%	0.008%	0.010%	0.011%	0.024%	0.031%
132	0.007%	0.008%	0.009%	0.011%	0.023%	0.029%
138	0.006%	0.007%	0.009%	0.010%	0.021%	0.028%
144	0.006%	0.007%	0.008%	0.009%	0.020%	0.026%

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REFERENCE: ADAPTED FROM ACPA

TABLE 28.40.040

(Res. 40-08 (§ 1002.2), 3-19-08)

28.40.050 Storm drain design criteria – Pipe roughness.

Roughness effects tend to vary with changes in flow depth and installation inconsistencies. To simplify design and ensure consistency, this manual specifies roughness values and does not permit the use of pipe manufacturers' values. **Table 28.40.050** provides a range of Manning's *n* values for many pipe materials and configurations as developed by Chow in 1959 and Normann in 1985 (adapted from tables found in HDS-4 and HEC-22). For purposes of storm drain design, hydraulic roughness shall be specified by the largest Manning's *n* value in the provided range.

The designer may choose to use a higher Manning's *n* value if conditions warrant.

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MANNING'S ROUGHNESS COEFFICIENTS FOR STORM DRAIN CONDUITS

Type of Conduit	Interior Wall Description	Manning's n
Concrete Pipes	Smooth	0.011-0.013
Concrete Boxes		
Wood forms	Smooth	0.012-0.014
Steel forms	Smooth	0.012-0.013
Spiral-Rib Metal Pipes	Smooth	0.012-0.013
Corrugated Metal Pipes and Boxes		
Annular Corrugations	68mm x 13mm (2-2/3" x 1/2") corrugations	0.022-0.027
Helical Corrugations	68mm x 13mm (2-2/3" x 1/2") corrugations	0.011-0.023
	150mm x 25mm (6" x 1") corrugations	0.022-0.025
	125mm x 25mm (5" x 1") corrugations	0.025-0.026
	75mm x 25mm (3" x 1") corrugations	0.027-0.028
Structural Plate Corrugations	230mm x 64mm (9" x 2-1/2") corrugations	0.033-0.037
	150mm x 50mm (6" x 2") corrugations	0.033-0.035
Corrugated Polyethylene (HDPE)	Smooth	0.009-0.015
	Corrugated	0.018-0.025
Polyvinyl Chloride (PVC)	Smooth	0.009-0.012
Cast-Iron Pipe, uncoated		0.013
Steel Pipe		0.009-0.013
Vitrified Clay Pipe		0.012-0.014
Vitrified Clay Liner Plates		0.015
Cemented Rubble Masonry Walls		
Concrete Floor and Top		0.017-0.022
Natural Floor		0.019-0.025
Brick		0.014-0.017
Laminated Treated Wood		0.015-0.017

Note: The Manning's n values indicated in this table were obtained in the laboratory and are supported by the provided references. Actual field values for older existing pipelines may vary depending on the effects of abrasion, corrosion, deflection, and joint conditions. (HDS-4) The designer should take into account these potential issues when selecting roughness values.

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REFERENCE: ADAPTED FROM HDS-4 & HEC-22

TABLE 28.40.050

(Res. 40-08 (§ 1002.3), 3-19-08)

28.40.060 Storm drain design criteria – System layout.

The layout of a storm drain system is dependent on topography, hydrology, surface hydraulics, easements and rights-of-way, existing structures and utilities, outfall locations, and other factors. General criteria for the design of a storm drain layout follow.

(a) Vertical Alignment.

(1) Minimum and maximum cover are determined by the size, material, and class of pipe, as well as the characteristics of the cover material and the expected surface loading. The designer shall consult the appropriate data sources, to include:

(i) Colorado Department of Transportation *Standard Specifications for Road and Bridge Construction*, Section 700 (Materials Details).

(ii) *Concrete Pipe Design Manual* (ACPA).

(iii) *Handbook of Steel Drainage and Highway Construction Products* (AISI).

(iv) Pipe manufacturer specifications.

(v) Other applicable references.

Storm drains crossing under railroads and highways must comply with any cover requirements specified for culverts (Chapter 28.48 GJMC).

(2) Pipes installed under any driving or parking area shall be designed for H-20 minimum live load. (City of Grand Junction *Standard Specifications for Construction of Underground Utilities – Waterlines, Sanitary Drain, Storm Drains, Underdrains and Irrigation Systems*).

(3) Storm drain mains (any storm drain to which laterals connect) shall have a minimum cover of 36 inches over the top of the pipe. This minimum includes any pavement thickness, but does not replace the minimum cover and compaction requirements designated by local standards and the application of valid structural loading computations.

(b) Horizontal Alignment.

(1) Storm drain bends, whether completed using the pulled-joint method, bend pipe, or radius (curved) pipe, shall be avoided where possible. Bends are not allowed for storm drain pipe of less than 48-inch diameter. **Table 28.40.060(a)** shows the maximum allowed deflection for pulled-joint construction.

Table 28.40.060(a): Maximum Allowed Deflection for Pulled-Joint Construction

Pipe Diameter or Span (inches)	Allowed Deflection (Pull) Per Joint
48 – 54	5/8
60 – 78	3/4
84 – 102	7/8
108 – 144	1

(2) Per the *City of Grand Junction General Utility Details*, storm drain manholes shall be located at the centerline of a traffic lane. Storm drain mains are to be located on the south or west side of a roadway, and must have a minimum horizontal clearance of 6.0 feet from the roadway centerline to the storm drain centerline. In cases where the sanitary drain main is not located at the street centerline, the designer shall consult with the appropriate local jurisdiction to determine the required horizontal and vertical clearances.

Maximum allowable spacing between manholes is presented in subsection (d) of this section and **Table 28.40.060(b)**.

(c) Utility Clearances. The designer shall consult with the most recent versions of the following documents to ensure compliance with the most restrictive (largest) utility clearance values applicable to the subject location:

(1) City of Grand Junction *Standard Specifications for Construction of Underground Utilities – Waterlines, Sanitary Drains, Storm Drains, Underdrains and Irrigation Systems*.

(2) City of Grand Junction *Standard Details for Construction of Streets, Storm Drains, and Utilities*.

(3) City of Grand Junction *Transportation Engineering Design Standards* (TEDS) Manual, GJMC Title 29.

(4) Any utility clearance requirements set forth by a local jurisdiction or special district.

Pipe encasement may be required in some locations where minimum utility clearances are unable to be met. Standards for the design and installation of casing pipe and concrete encasement can be found in the *General Utility Details* of the City of Grand Junction *Standard Details for Construction of Streets, Storm Drains, and Utilities.*

(d) Manholes. Manholes are necessary to provide maintenance and inspection access to the storm drain. When designed correctly, they also provide more hydraulically efficient pipe junctions and other transitions. All manhole lids must bear the words “storm water” for identification purpose.

(1) For storm drain pipes of less than 48-inch diameter, a manhole must be located at all changes in main-line pipe size or grade, junctions where a lateral joins the main-line alignment at a higher elevation (vertical drops), main-line vertical drops (drop manhole), and main-line direction changes or bends. Manholes located at storm drain bends shall be located at either tangent intersection or within the bend itself.

(2) Pipes of 48 inches or larger diameter do not necessarily require manholes at all locations specified above. However, manholes in addition to those required by standard maximum spacing may be stipulated by local jurisdiction.

(3) **Table 28.40.060(b)** indicates maximum spacing for manholes. Noncircular pipes shall be converted to equivalent diameters based on pipe area.

Table 28.40.060(b): Maximum Manhole/Accessible Junction Spacing

Equivalent Pipe Diameter	Maximum Allowable Manhole Spacing
Less than 48 inches	400 feet
48 inches or larger	600 feet

(Res. 40-08 (§ 1002.4), 3-19-08)

28.40.070 Storm drain hydraulics.

GJMC 28.40.080 through 28.40.100 present the hydraulic methods used to calculate storm drain capacities and thereby to design a storm drain system. The actual design process is presented in GJMC 28.40.160 through 28.40.190. The majority of the methods in this section are adapted from those presented in *HEC-22 (Urban Drainage Design Manual)* and *HDS-4 (Introduction to Highway Hydraulics)*.

(Res. 40-08 (§ 1003), 3-19-08)

28.40.080 Gravity-flow analysis.

Initial storm drain design is completed by selecting pipe sizes based on "just full" capacity. This means that the drain capacity is calculated using open-channel (nonpressurized) flow computations. Starting at the uppermost reach of the storm drain (at the first inlet), the designer applies Manning's equation (Equation 28.40-1) for each segment of drain. A segment is a reach of pipe with a junction, transition, grade change, horizontal bend, or pipe size change at each end.

$$Q_f = \frac{1.49}{n} A_f R_f^{2/3} S_o^{1/2} \quad (28.40\text{-}1)$$

Where:

Q_f = Full Flow Discharge (cfs)

n = Manning's Roughness Coefficient (see GJMC 28.40.050)

A_f = Full Flow Area = $\frac{\pi D^2}{4}$ for circular pipes

R_f = Full Flow Hydraulic Radius = D/4 for circular pipes (ft.)

S_o = Pipe Slope ($S_o = S_f$ for full flow) (ft./ft.)

D = Pipe Diameter (feet)

Equation 28.40-2 is a form of Manning's that can be used to directly solve for the minimum required pipe diameter for circular pipes. The designer shall always round up to the nearest available pipe size, keeping in mind that minor losses in the pipe may decrease available capacity. Initial pipe size, D_i (ft.), is based on the peak design flow for that pipe segment, Q_P (cfs).

$$D_i = \left[\frac{2.16 n Q_P}{S_o^{1/2}} \right]^{3/8} \quad (28.40\text{-}2)$$

For noncircular pipes, Equation 28.40-2 provides the equivalent diameter based on flow area.

To better account for energy losses that will occur in the system, the designer may choose to calculate preliminary head losses through inlet and manhole junctions. Application of these approximate losses will allow for better estimation of required pipe sizes during the initial design process, expediting the preliminary and final design phases. *HEC-22* presents the following equation and table for the calculation of approximate junction head loss:

$$H_{ah} = K_{ah} \left(\frac{V_o^2}{2g} \right) \quad (28.40\text{-}3)$$

Where:

H_{ah} = Preliminary Junction Head Loss Estimate (ft.)

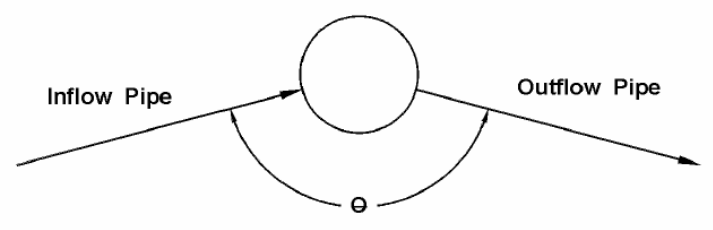
K_{ah} = Head Loss Coefficient from **Table 28.40.080**

V_o = Flow Velocity = Q_P/A_f (fps)

g = Gravitational Constant = 32.2 ft.^{2}/sec.

Table 28.40.080: Preliminary Head Loss Coefficients (for Conceptual/Initial Design ONLY)

Structure Configuration	Coefficient, K_{ah}
Inlet – Straight Run	0.50
Inlet – Angled Through (θ)	
90°	1.50
60°	1.25
45°	1.10
22.5°	0.70
Manhole – Straight Run	0.15
Manhole – Angled Through (θ)	
90°	1.00
60°	0.85
45°	0.75
22.5°	0.45

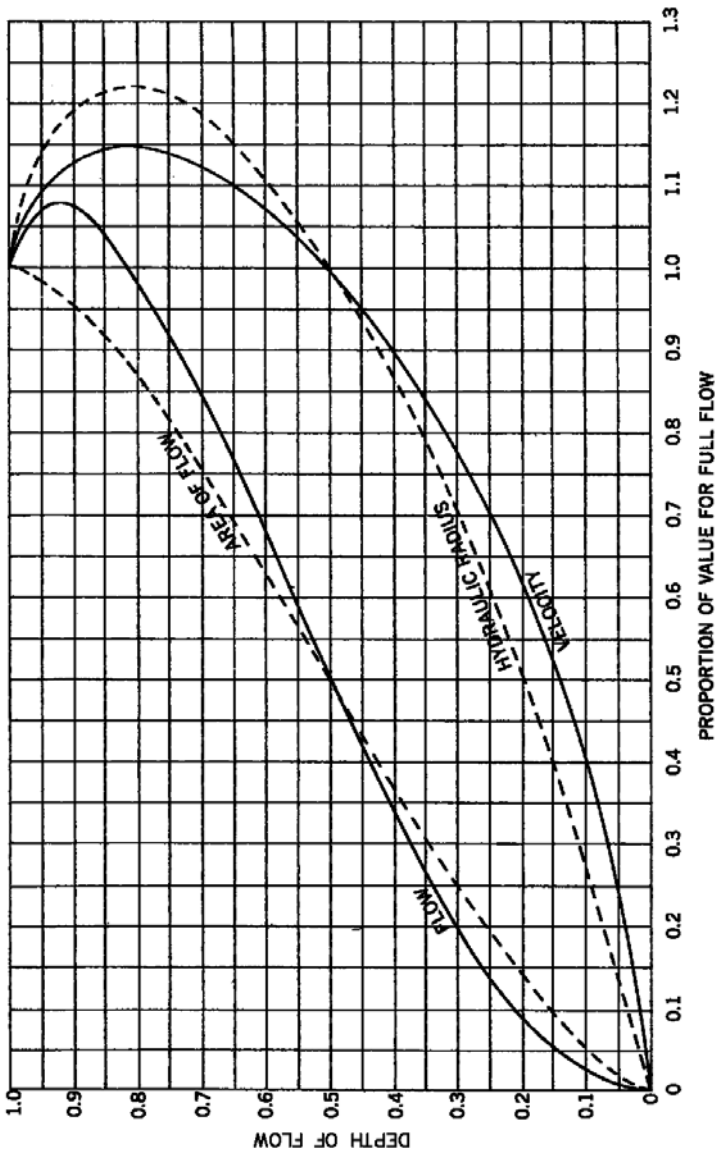


From HEC-22, Table 7-5a and Figure 7-4.

Figures 28.40.080(a) through **28.40.080(d)** present relative velocities and flows for circular, elliptical (horizontal and vertical), and arch pipe under gravity-flow conditions. Similar charts for box sections can be found in the Concrete Pipe Design Manual and other design aids.

STORMWATER MANAGEMENT MANUAL

RELATIVE VELOCITY AND FLOW IN CIRCULAR PIPE FOR ANY DEPTH OF FLOW



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REFERENCE: ACPA FIGURE 20

FIGURE 28.40.080(a)

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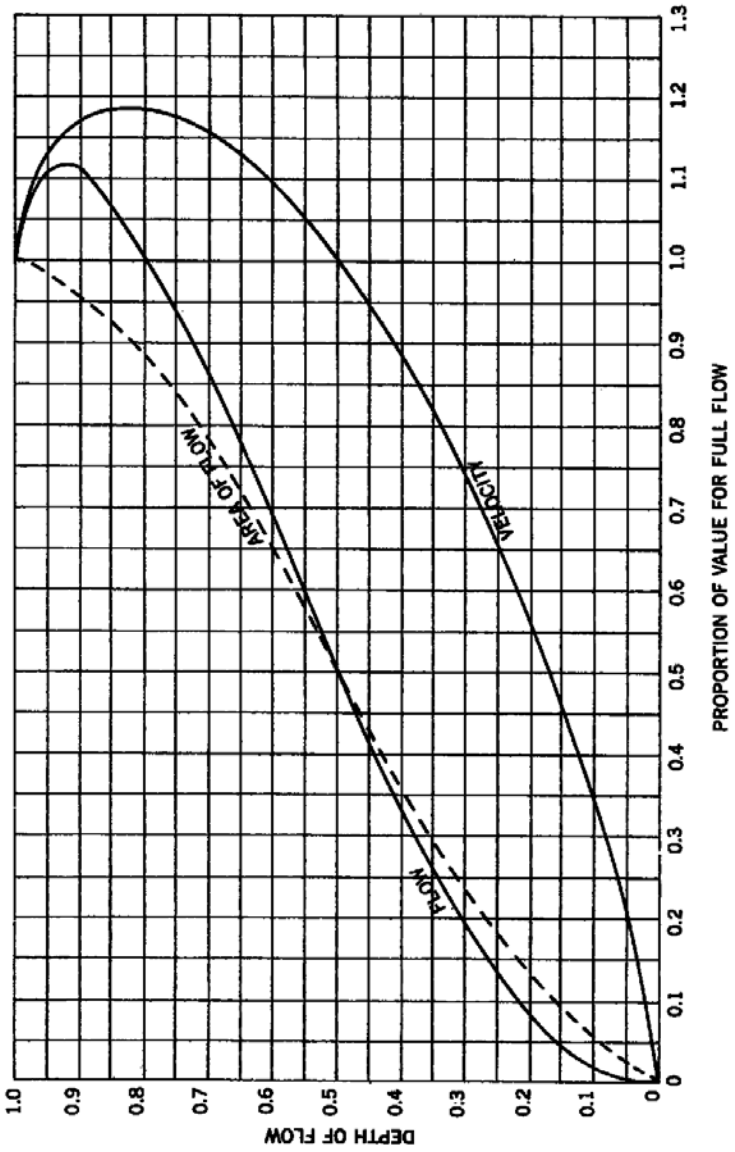
RELATIVE VELOCITY AND FLOW IN HORIZONTAL ELLIPTICAL PIPE FOR ANY DEPTH OF FLOW



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REFERENCE: ACPA FIGURE 21

FIGURE 28.40.080(b)

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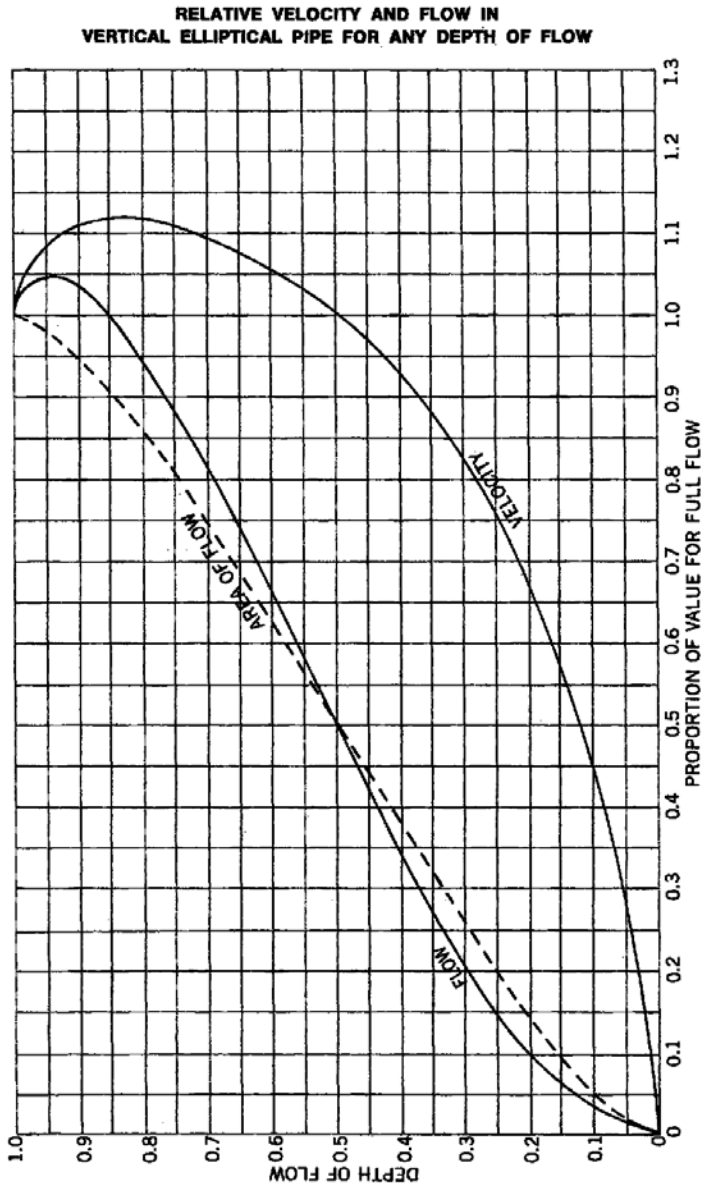

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REFERENCE: ACPA FIGURE 22

FIGURE 28.40.080(c)

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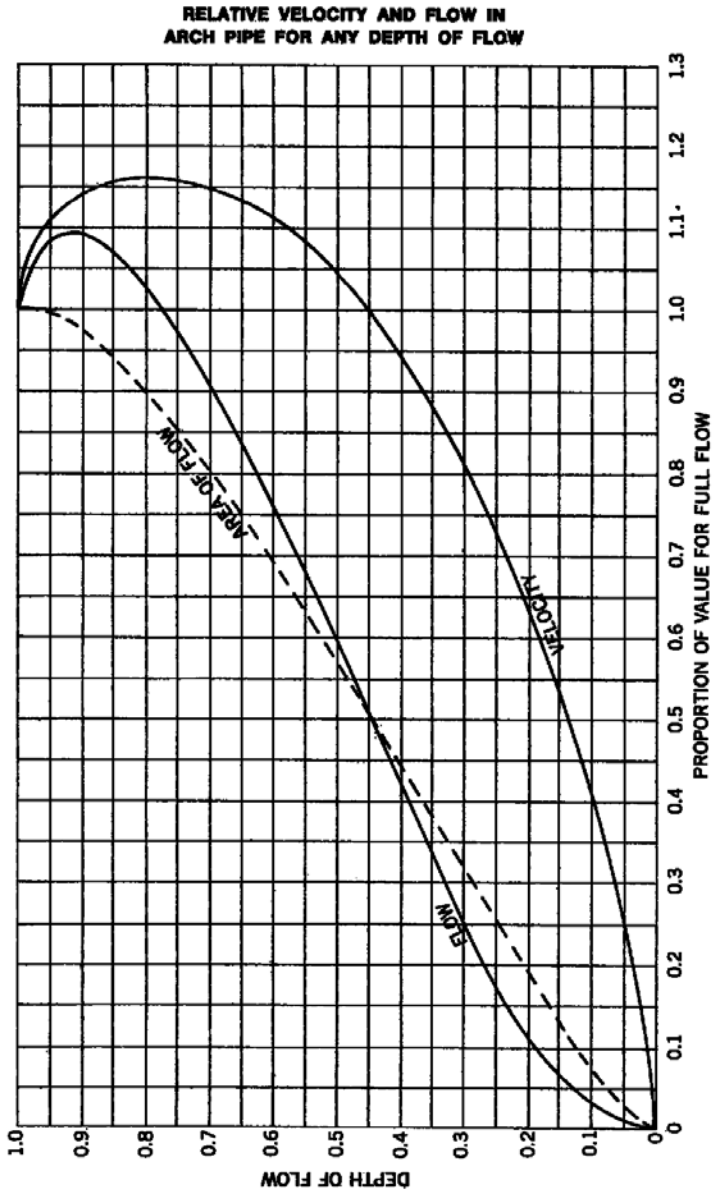

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WRC ENGINEERING, INC.

REFERENCE: ACPA FIGURE 23

FIGURE 28.40.080(d)

(Res. 40-08 (§ 1003.1), 3-19-08)

28.40.090 Pressure-flow analysis.

Following the initial "just-full" storm drain design, the system is analyzed using energy-momentum theory to account for specific energy losses. This method allows for the calculation of hydraulic and energy grade lines (HGL and EGL) for a given storm drain line by starting with the water surface elevation of the outfall and working upstream, accounting for all losses due to pipe friction, manholes, transitions, bends, junctions, and pipe entrances and exits. In cases where pressure flows exist, certain limitations exist on the maximum elevation of the EGL in relation to the ground surface (finished grade). Compliance with minimum and maximum flow velocities is based on peak design flow in the final selected pipe size for each segment. See GJMC 28.40.020 through 28.40.060 for specific design criteria.

Energy-momentum theory is based upon the concept that energy, typically expressed in hydraulics as "head" in a linear dimension such as feet, is conserved along a given conduit segment. For a segment where A is the upstream end and B is downstream, the steady-flow energy equation can be expressed as:

$$z_A + \frac{p_A}{\gamma} + \frac{V_A^2}{2g} + h_p = z_B + \frac{p_B}{\gamma} + \frac{V_B^2}{2g} + \sum h_L \qquad (28.40\text{-}4)$$

Where:

z	=	Invert Elevation above any Horizontal Datum (ft.)
p	=	Fluid Pressure lbf/ft.^{2}
γ	=	Specific Weight of Water $\cong$ 62.4 lbf/ft.^{3}
V	=	Flow Velocity (fps)
h_P	=	Head Added by a Pump (if applicable) (ft.)
Σh_L	=	Sum of Head Losses in Segment A – B as calculated per the methods prescribed in this section

Each term in Equation 28.40-4, and thus the sum of the formula, has a linear dimension (e.g., feet). Each term represents the hydraulic head contributed to the total energy head by that term. For instance, the third term, $V^2/2g$, is the velocity head. The EGL elevation at a given point is equal to:

$$EGL = z + \frac{p}{\gamma} + \frac{V^2}{2g} \qquad (28.40\text{-}5)$$

and the HGL elevation is simply the EGL minus the velocity head:

$$HGL = EGL - \frac{V^2}{2g} \text{ and conversely, } EGL = HGL + \frac{V^2}{2g} \qquad (28.40\text{-}6)$$

In cases where outfall water surface is equal to or higher than the outlet flow elevation, the EGL and HGL are assumed to be equal, i.e., velocity is zero at the downstream point where calculations start. However, if the outfall water surface is lower than the outlet pipe flow elevation, the latter value is used as the outlet HGL. Note that the outfall water surface elevation used must be determined coincident with the time of peak flow from the storm drain.

The HGL at the next structure (e.g., manhole) is determined by the equations presented in **Table 28.40.090(a)**. The equations are separated by HGL at the pipe inlet downstream of the manhole and the pipe outlet at the inlet to the manhole. For nonsurcharged flow (less than 80 percent pipe depth), the free

water surface at the pipe inlet (downstream end of the manhole) is added to head loss across the manhole to find the pipe outlet HGL (upstream end of the manhole).

Table 28.40.090(a): Equations for Determining HGL

Surcharge Conditions	Outlet Submergence	HGL in Manhole/Junction	At	Equation Number
$d_n/D > 0.80$	N/A	$= HGL_{Pipe\ Outlet} + h_f + h_{minor}$	Pipe Inlet (D/S from MH)	28.40-7
$d_n/D > 0.80$	N/A	$= HGL_{Pipe\ Inlet} + h_{mh}$	Pipe Outlet (U/S from MH)	28.40-8
$d_n/D \leq 0.80$	Unsubmerged	$= WSE_{Pipe\ Inlet}$	Pipe Inlet (D/S from MH)	28.40-9
$d_n/D \leq 0.80$	Unsubmerged	$= WSE_{Pipe\ Inlet} + h_{mh}$	Pipe Outlet (U/S from MH)	28.40-10
$d_n/D \leq 0.80$	Submerged	= Larger of Equations 28.40-7 and 28.40-9 OR = Larger of Equations 28.40-8 and 28.40-10		

Where:

d_n	=	Normal Flow Depth in Pipe (feet)
$HGL_{Pipe\ Outlet}$	=	Larger of Tailwater Elevation, Flow Depth Elevation at Pipe Outlet, and HGL at Next Downstream Pipe Inlet
$WSE_{Pipe\ Inlet}$	=	Free Water Surface Elevation at Pipe Inlet
h_f, h_{mh}, h_{minor}	=	Head Losses as Described in This Section

Occasionally, design flow through a pipe may be not only gravity-flow (nonsurcharged) but also supercritical. Pipe losses (h_f and h_{minor}) in a supercritical pipe section are not carried upstream. (HEC-22)

In locations where two adjoining pipe segments flow in supercritical conditions, manhole losses are also ignored for that line. The designer shall be careful to include these losses where only one of the pipes on the line under investigation contains supercritical flow.

Inlet pipes to a manhole must occasionally have an invert significantly above that of the outlet pipe. In locations where the outlet pipe water surface elevation (or HGL if pressure flow) is below the invert of an inlet pipe, that inlet pipe is treated as an outfall pipe. In this case, the outfall water surface elevation is always lower than the pipe outlet water level, so the latter elevation is used for the initial HGL of the new upstream reach. The outflow pipe from the manhole in such a situation acts as a culvert under either inlet or outlet control. See Chapter 28.48 GJMC and/or FHWA *Hydraulic Design of Highway Culverts (HDS-5)* for information regarding the computation of an HGL at the manhole and calculation of head loss due to a culvert inlet.

The following subsections prescribe methods for determining the energy losses induced by pipe friction, manholes, and other structures (minor pipe losses) that may be encountered by storm drain flows.

(a) Pipe Friction Losses. Pipe friction is a significant source of energy dissipation in storm drains, whether in gravity-flow or pressure-flow conditions. For the former, friction slope (S_f) can be assumed to be equal to the slope of the pipe invert (S_o). For pipes with a surcharge flow condition

($d_n/D > 0/80$), Equations 28.40-11 and 28.40-12 define friction slope (units for variables are the same as in Equation 28.40-1 when using English units).

$$S_f = \frac{n^2 V_{avg}^2}{K_Q R^{4/3}} \quad (28.40\text{-}11)$$

Where:

K_Q = 2.21 (English Units)
K_Q = 1.0 (S.I. Units)

$$S_f = \left[\frac{Q_{avg} n}{K_Q D^{8/3}}\right]^2 \quad (28.40\text{-}12)$$

Where:

K_Q = 0.46 (English Units)
K_Q = 0.312 (S.I. Units)

Equation 28.40-11 is a form of the Chezy-Manning formula, and is based on average velocity in the pipe segment. Since flow rate and cross-sectional area typically remain constant through one segment of pipe, average velocity can be assumed to equal flow rate divided by flow area. Where flow rate and/or pipe size changes within one segment (such as at a pipe transition without a manhole or a no-access junction), this velocity is the average of those calculated at the ends of the pipe segment (Linsley, 1992). Equation 28.40-12 is based on the average flow rate in the pipe segment.

Once the friction slope is known, pipe friction head loss is calculated by multiplying the friction slope by the pipe segment length:

$$h_f = S_f L \quad (28.40\text{-}13)$$

(b) Manhole Junction Losses. This subsection details the energy-loss method used by the HYDRAIN program (FHWA) as presented in HDS-4 for calculation of approximate head loss through a manhole. This method applies to any junction of two or more pipes accessible by a manhole. The approximate head loss coefficient values presented in **Table 28.40.080** are replaced by the values computed herein.

For each manhole, the designer must first calculate the initial head loss coefficient (K_o) and all applicable coefficient correction factors (C_x). The adjusted head loss coefficient (K) and head loss in the manhole (h_{mh}) are then computed.

$$h_{mh} = K\left(\frac{V_o^2}{2g}\right) \quad (28.40\text{-}14)$$

$$K_o = 0.1\frac{b}{D_o}(1-\sin\theta) + 1.4\left(\frac{b}{D_o}\right)^{0.15}\sin\theta \quad (28.40\text{-}15)$$

$$K_o = 0.1\frac{b}{D_o}(1-\sin\theta)+1.4\left(\frac{b}{D_o}\right)^{0.15}\sin\theta \qquad (28.40\text{-}16)$$

Where:

θ	=	Angle Between Inflow and Outflow Pipes (≤ 180°)
b	=	Manhole of Junction Diameter (at water level)
D_o	=	Outlet Pipe Diameter

The coefficient correction factors are calculated using the equations presented below and are applied to the initial head loss coefficient per Equation 28.40-15. Note that some correction factors do not apply to all manhole configurations. These nonapplicable factors are set to unity.

(1) C_D – Correction Factor for Pipe Diameter. This applies to pressure flow when the ratio of water depth in the manhole above the outlet pipe invert to outlet pipe diameter is greater than 3.2. $d_{mho}/D_o > 3.2$.

$$C_D = \left(\frac{D_o}{D_i}\right)^3 \qquad (28.40\text{-}17)$$

Where:

D_o	=	Outlet Pipe Diameter
D_i	=	Inlet Pipe Diameter

(2) C_d – Correction Factor for Flow Depth. This applies to gravity flow and low-pressure flow when the ratio of water depth in the manhole above the outlet pipe invert to outlet pipe diameter is less than 3.2. $d_{mho}/D_o < 3.2$.

$$C_d = 0.5\left(\frac{d_{mho}}{D_o}\right)^{0.6} \qquad (28.40\text{-}18)$$

Where:

D_{mho}	=	Water Depth in Manhole Above Outlet Pipe Invert
D_o	=	Outlet Pipe Diameter

For purposes of this calculation, water depth in the manhole is approximated as the vertical distance from the outlet pipe invert to the HGL at the upstream end of the outlet pipe.

(3) C_Q – Correction Factor for Relative Flow. This applies to manholes with three or more pipes entering the structure at similar elevations (one of these pipes will be the outlet pipe). This correction factor does not apply to the effects of inflow pipes with flowlines far enough above the outlet pipe to qualify as plunging flow (see Equation 28.40-20 and explanation, this section).

$$C_Q = (1-2\sin\theta)\left(1-\frac{Q_i}{Q_o}\right)^{0.75}+1 \qquad (28.40\text{-}19)$$

Where:

θ	=	Angle Between the Inflow Pipe of Interest and the Outflow Pipe
Q_i	=	Flow in the Inflow Pipe of Interest
Q_o	=	Flow in the Outflow Pipe

The "pipe of interest" is the inlet pipe to the manhole on the line being investigated. This factor accounts for streamline interference by flow from other pipes entering the manhole. See **Figure 28.40.090(a)** for an illustration of the relative flow effect.

(4) C_p – Correction Factor for Plunging Flow. This applies to manholes with an inflow pipe of interest that is affected by plunging flow from another inflow pipe with a higher flowline. The factor does not apply to the line with the pipe that is discharging the plunging flow, and only applies when the height of the plunging-flow pipe flowline above the outlet pipe center exceeds the manhole water depth above the outlet pipe invert: $h > d_{mho}$

$$C_p = 1 + 0.2\left(\frac{h}{D_o}\right)\left(\frac{h - d_{mho}}{D_o}\right) \quad (28.40\text{-}20)$$

Where:

h	=	Vertical Distance of Plunging Flow (height of plunging flow pipe flowline above center of outlet pipe)
d_{mho}	=	Water Depth in Manhole Above Outlet Pipe Invert
D_o	=	Outlet Pipe Diameter

A common application of this correction factor occurs at locations where inlets convey intercepted flow directly (vertically) to the storm drain main line (drop inlets) or where laterals enter a manhole well above the main line invert.

(5) C_B – Correction Factor for Benching. This applies to all flow conditions. See **Figure 28.40.090(b)** and **Table 28.40.090(b)** for proper correction factor selection.

Table 28.40.090(b): Benching Correction Factors

Bench Type (see Figure 28.40.090(b))	Outlet Pipe Conditions	
	Fully Submerged, Pressure Flow*	Unsubmerged, Free Surface Flow**
Flat or Depressed	1.00	1.00
Benched: 1/2 Pipe Diameter	0.95	0.15
Benched: 1 Pipe Diameter	0.75	0.07
Improved Bench	0.40	0.02

Adapted from *Mesa County SWMM* 1996, Figure "H-4"

*Applies for $d_{mho}/D_o \geq 3.2$

**Applies for $d_{mho}/D_o \leq 1.0$

As can be seen in **Table 28.40.090(b)**, benching in manholes significantly reduces head loss due to outlet inefficiency, especially in unsubmerged conditions. Note that in this case, the

submerged pressure-flow factors do not apply until flow depth in the manhole has exceeded 3.2 times the outlet pipe diameter. Therefore, for depths between free surface (gravity) flow and full pressure-flow conditions ($1.0 > d_{mho}/D_o < 3.2$), the designer shall use a linear interpolation to compute the benching correction factor.

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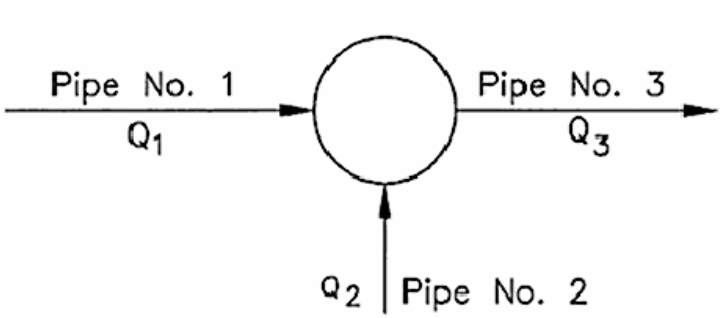
RELATIVE FLOW EFFECT



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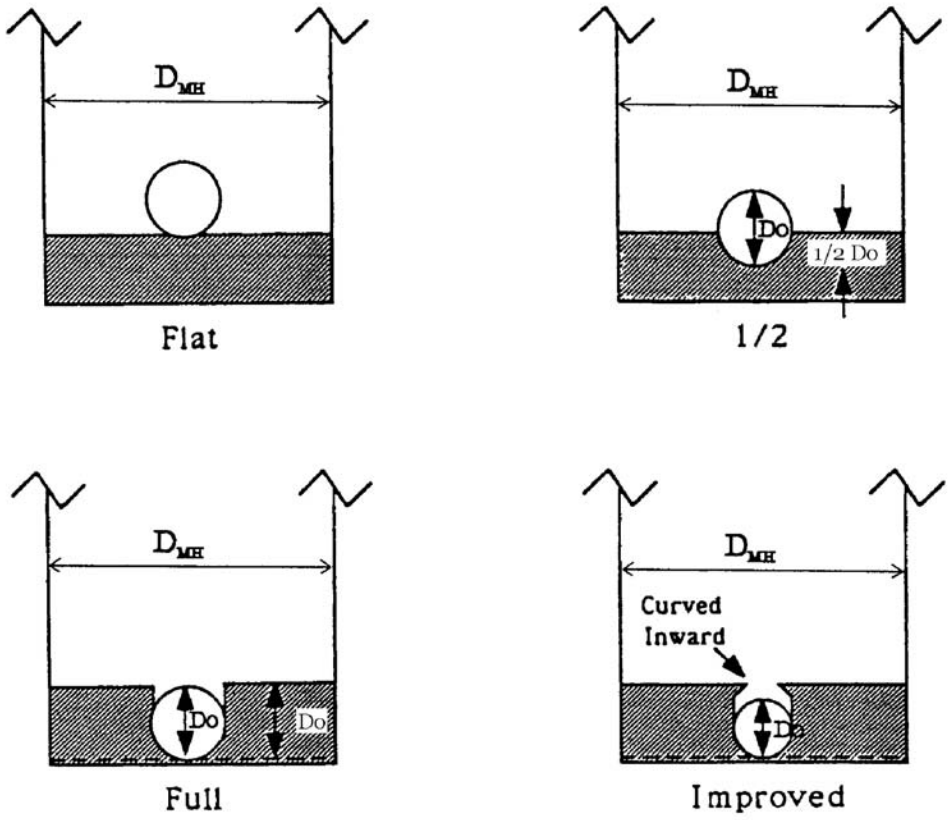
WRK ENGINEERING INC	REFERENCE: HEC-22 FIGURE 7-5	FIGURE 28.40.090(a)

STORMWATER MANAGEMENT MANUAL

TYPES OF MANHOLE BENCHING



D_{MH} = Diameter of Manhole, ft.
d = Depth of flow in manhole, taken at entrance of outflow pipe, ft.
Do = Diameter of outflow pipe, ft.

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REFERENCE: MESA SWMM 1994 FIGURE H-4

FIGURE 28.40.090(b)

(c) Minor Pipe Losses. This subsection describes the methods used in Mesa County for the calculation of head losses caused by pipe transitions (expansions or contractions), bends (curved drains), no-access junctions, on-grade inlets, and exits (outlets). The minor losses are added together for a given pipe segment per Equation 28.40-21:

$$h_{minor} = \sum h_{L,minor} = h_e + h_c + h_b + h_j + h_i + h_o \quad (28.40\text{-}21)$$

(1) h_e and h_c – Transition Losses. Transition losses occur when pipe size is changed at a location other than a manhole. Expansions may be necessary due to changes in flow rate or slope. Contractions are locations where pipe size is decreased, and are allowed only through a variance. Methods for head loss calculation through a pipe contraction are included in this title.

The calculation of head loss through a transition differs for nonpressure flow and pressure flow.

(i) Nonpressure Flow Transitions.

$$h_e = K_e\left(\frac{V_1^2}{2g} - \frac{V_2^2}{2g}\right) \quad (28.40\text{-}22)$$

$$h_c = K_c\left(\frac{V_2^2}{2g} - \frac{V_1^2}{2g}\right) \quad (28.40\text{-}23)$$

Where:

K_e = Expansion Coefficient (see **Table 28.40.090(a)(1)**)
K_c = Contraction Coefficient (see **Table 28.40.090(a)(2)**)
K_c = $0.5 \cdot K_e$ for Gradual Contractions
V_1 = Velocity Upstream of the Transition
V_2 = Velocity Downstream of the Transition

(ii) Pressure-Flow Transitions.

$$h_e = K_{ep}\left(\frac{V_1^2}{2g}\right) \quad (28.40\text{-}24)$$

$$h_c = K_{cp}\left(\frac{V_2^2}{2g}\right) \quad (28.40\text{-}25)$$

Where:

K_{ep} = Expansion Coefficient (see **Table 28.40.090(b)(1), (2)**)
K_{cp} = Contraction Coefficient (see **Table 28.40.090(b)(3)**)
V_1 = Velocity Upstream of the Transition
V_2 = Velocity Downstream of the Transition

See **Figure 28.40.090(c)** for illustration of the "Angle of Cone" variable used in **Tables 28.40.090(a)** and **28.40.090(b)**.

STORMWATER MANAGEMENT MANUAL

TRANSITION COEFFICIENTS FOR GRAVITY-FLOW CONDITIONS

TABLE 26.40.090(a)(1) – VALUES OF K_e FOR GRAVITY FLOW IN PIPE EXPANSIONS (FHWA 1996)

D_2/D_1	Angle of Cone						
	10°	20°	45°	60°	90°	120°	180°
1.5	0.17	0.40	1.06	1.21	1.14	1.07	1.00
3	0.17	0.40	0.86	1.02	1.06	1.04	1.00

TABLE 26.40.090(a)(2) – VALUES OF K_c FOR GRAVITY FLOW IN SUDDEN PIPE EXPANSIONS (LINSLEY AND FRANZINI 1964)

D_2/D_1	K_c
0.2	0.5
0.4	0.4
0.6	0.3
0.8	0.1
1	0

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TABLE 28.40.090(a)

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TRANSITION COEFFICIENTS FOR PRESSURE-FLOW CONDITIONS

TABLE 26.40.090(b)(1) – VALUES OF K_e FOR PRESSURE FLOW IN GRADUAL PIPE EXPANSIONS

D_2/D_1	Angle of Cone										
	2°	6°	10°	15°	20°	25°	30°	35°	40°	50°	60°
1.1	0.01	0.01	0.03	0.05	0.10	0.13	0.16	0.18	0.19	0.21	0.23
1.2	0.02	0.02	0.04	0.09	0.16	0.21	0.25	0.29	0.31	0.35	0.37
1.4	0.02	0.03	0.06	0.12	0.23	0.30	0.36	0.41	0.44	0.50	0.53
1.6	0.03	0.04	0.07	0.14	0.26	0.35	0.42	0.47	0.51	0.57	0.61
1.8	0.03	0.04	0.07	0.15	0.28	0.37	0.44	0.50	0.54	0.61	0.65
2.0	0.03	0.04	0.07	0.16	0.29	0.38	0.46	0.52	0.56	0.63	0.68
2.5	0.03	0.04	0.08	0.16	0.30	0.39	0.48	0.54	0.58	0.65	0.70
3.0	0.03	0.04	0.08	0.16	0.31	0.40	0.48	0.55	0.59	0.66	0.71
inf	0.03	0.05	0.08	0.16	0.31	0.40	0.49	0.46	0.60	0.67	0.72

TABLE 26.40.090(b)(2) – VALUES OF K_e FOR PRESSURE FLOW IN SUDDEN PIPE EXPANSIONS

D_2/D_1	Velocity, V_1, in feet Per Second												
	2.0	3.0	4.0	5.0	6.0	7.0	8.0	10.0	12.0	15.0	20.0	30.0	40.0
1.2	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.09	0.09	0.09	0.09	0.09	0.08
1.4	0.26	0.26	0.25	0.24	0.24	0.24	0.24	0.23	0.23	0.22	0.22	0.21	0.20
1.6	0.40	0.39	0.38	0.37	0.37	0.36	0.36	0.35	0.35	0.34	0.33	0.32	0.32
1.8	0.51	0.49	0.48	0.47	0.47	0.46	0.46	0.45	0.44	0.43	0.42	0.41	0.40
2.0	0.60	0.58	0.56	0.55	0.55	0.54	0.53	0.52	0.52	0.51	0.50	0.48	0.47
2.5	0.74	0.72	0.70	0.69	0.68	0.67	0.66	0.65	0.64	0.63	0.62	0.60	0.58
3.0	0.83	0.80	0.78	0.77	0.76	0.75	0.74	0.73	0.72	0.70	0.69	0.67	0.65
4.0	0.92	0.89	0.87	0.85	0.84	0.83	0.82	0.80	0.79	0.78	0.76	0.74	0.72
5.0	0.96	0.93	0.91	0.89	0.88	0.87	0.86	0.84	0.83	0.82	0.80	0.77	0.75
10.0	1.00	0.99	0.96	0.95	0.93	0.92	0.91	0.89	0.88	0.86	0.84	0.82	0.80
∞	1.00	1.00	0.98	0.96	0.95	0.94	0.93	0.91	0.90	0.88	0.86	0.83	0.81

D_2/D_1	Velocity, V_1, in Meters Per Second												
	0.6	0.9	1.2	1.5	1.8	2.1	2.4	3.0	3.7	4.6	6.1	9.1	12.2
1.2	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.09	0.09	0.09	0.09	0.09	0.08
1.4	0.26	0.26	0.25	0.24	0.24	0.24	0.24	0.23	0.23	0.22	0.22	0.21	0.20
1.6	0.40	0.39	0.38	0.37	0.37	0.36	0.36	0.35	0.35	0.34	0.33	0.32	0.32
1.8	0.51	0.49	0.48	0.47	0.47	0.46	0.46	0.45	0.44	0.43	0.42	0.41	0.40
2.0	0.60	0.58	0.56	0.55	0.55	0.54	0.53	0.52	0.52	0.51	0.50	0.48	0.47
2.5	0.74	0.72	0.70	0.69	0.68	0.67	0.66	0.65	0.64	0.63	0.62	0.60	0.58
3.0	0.83	0.80	0.78	0.77	0.76	0.75	0.74	0.73	0.72	0.70	0.69	0.67	0.65
4.0	0.92	0.89	0.87	0.85	0.84	0.83	0.82	0.80	0.79	0.78	0.76	0.74	0.72
5.0	0.96	0.93	0.91	0.89	0.88	0.87	0.86	0.84	0.83	0.82	0.80	0.77	0.75
10.0	1.00	0.99	0.96	0.95	0.93	0.92	0.91	0.89	0.88	0.86	0.84	0.82	0.80
∞	1.00	1.00	0.98	0.96	0.95	0.94	0.93	0.91	0.90	0.88	0.86	0.83	0.81

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TABLE 28.40.090(b) (PAGE 1 of 2)

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TABLE 26.40.090(b)(3) – VALUES OF K_e FOR PRESSURE FLOW IN GRADUAL PIPE CONTRACTIONS

D_2/D_1	Velocity, V_1, in feet Per Second												
	2.0	3.0	4.0	5.0	6.0	7.0	8.0	10.0	12.0	15.0	20.0	30.0	40.0
1.1	0.03	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.05	0.05	0.06
1.2	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.08	0.08	0.08	0.09	0.10	0.11
1.4	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.18	0.18	0.18	0.18	0.19	0.20
1.6	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.25	0.25	0.24
1.8	0.34	0.34	0.34	0.34	0.34	0.34	0.33	0.33	0.32	0.32	0.32	0.29	0.27
2.0	0.38	0.38	0.37	0.37	0.37	0.37	0.36	0.36	0.35	0.34	0.33	0.31	0.29
2.2	0.40	0.40	0.40	0.39	0.39	0.39	0.39	0.38	0.37	0.37	0.35	0.33	0.30
2.5	0.42	0.42	0.42	0.41	0.41	0.41	0.40	0.40	0.39	0.38	0.37	0.34	0.31
3.0	0.44	0.44	0.44	0.43	0.43	0.43	0.42	0.42	0.41	0.40	0.39	0.36	0.33
4.0	0.47	0.46	0.46	0.46	0.45	0.45	0.45	0.44	0.43	0.42	0.41	0.37	0.34
5.0	0.48	0.48	0.47	0.47	0.47	0.46	0.46	0.45	0.45	0.44	0.42	0.38	0.35
10.0	0.49	0.48	0.48	0.48	0.48	0.47	0.47	0.46	0.46	0.45	0.43	0.40	0.36
∞	0.49	0.49	0.48	0.48	0.48	0.47	0.47	0.47	0.46	0.45	0.44	0.41	0.38

D_2/D_1	Velocity, V_1, in Meters Per Second												
	0.6	0.9	1.2	1.5	1.8	2.1	2.4	3.0	3.7	4.6	6.1	9.1	12.2
1.1	0.03	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.05	0.05	0.06
1.2	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.08	0.08	0.08	0.09	0.10	0.11
1.4	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.18	0.18	0.18	0.18	0.19	0.20
1.6	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.25	0.25	0.24
1.8	0.34	0.34	0.34	0.34	0.34	0.34	0.33	0.33	0.32	0.32	0.32	0.29	0.27
2.0	0.38	0.38	0.37	0.37	0.37	0.37	0.36	0.36	0.35	0.34	0.33	0.31	0.29
2.2	0.40	0.40	0.40	0.39	0.39	0.39	0.39	0.38	0.37	0.37	0.35	0.33	0.30
2.5	0.42	0.42	0.42	0.41	0.41	0.41	0.40	0.40	0.39	0.38	0.37	0.34	0.31
3.0	0.44	0.44	0.44	0.43	0.43	0.43	0.42	0.42	0.41	0.40	0.39	0.36	0.33
4.0	0.47	0.46	0.46	0.46	0.45	0.45	0.45	0.44	0.43	0.42	0.41	0.37	0.34
5.0	0.48	0.48	0.47	0.47	0.47	0.46	0.46	0.45	0.45	0.44	0.42	0.38	0.35
10.0	0.49	0.48	0.48	0.48	0.48	0.47	0.47	0.46	0.46	0.45	0.43	0.40	0.36
∞	0.49	0.49	0.48	0.48	0.48	0.47	0.47	0.47	0.46	0.45	0.44	0.41	0.38

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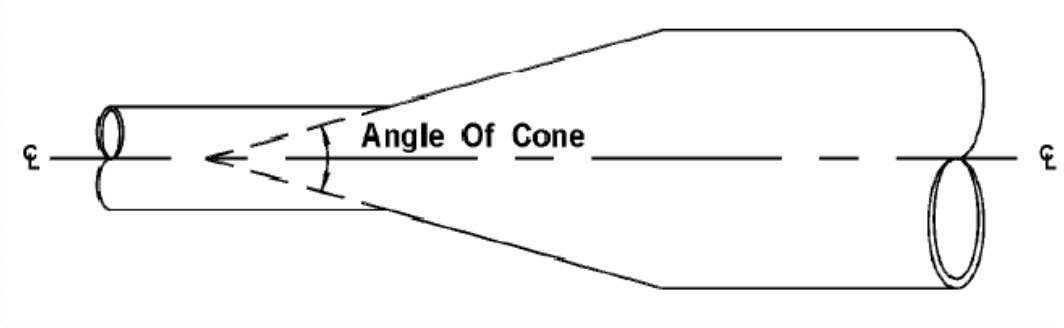
ANGLE OF CONE FOR PIPE TRANSITIONS



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WRK ENGINEERING INC	REFERENCE: FROM HEC-22 FIGURE 7-3	FIGURE 28.40.090(c)

(2) h_b – Bend Losses (Curved Drains). The minor loss that accompanies a storm drain bend can be approximated by:

$$h_b = 0.0033 \cdot (\Delta)\left(\frac{V^2}{2g}\right) \quad (28.40\text{-}26)$$

Where:

Δ = Angle of Curvature (degrees)

This equation does not apply to bends located at manholes. Head losses due to manhole bends and deflections are addressed in subsection (b) of this section.

(3) h_j – No-Access Junctions. This term applies to head loss associated with locations where a lateral pipe connects to a larger trunk pipe without the use of a manhole structure. While these junctions are not recommended for trunk pipes of less than 48 inches in diameter, it is sometimes physically or economically inefficient to place a manhole at every junction location. At locations where more than one lateral joins the main line (trunk), a manhole is required. The head loss at no-access junctions is related to the relative flows and velocities of all three pipes, the angle between the lateral and trunk pipes, and the cross-sectional area of the trunk pipe.

$$h_j = \frac{(Q_o V_o) - (Q_i V_i) - (Q_L V_L \cos\theta)}{0.5 \cdot g \cdot (A_o + A_i)} + h_{vi} - h_{vo} \quad (28.40\text{-}27)$$

Where:

Q_o, Q_i, Q_L = Outlet, Inlet and Lateral Flow Rates
V_o, V_i, V_L = Outlet, Inlet and Lateral Velocities
h_{vo}, h_{vi} = Outlet and Inlet Velocity Heads = $V^2/2g$
A_o, A_i = Outlet and Inlet Cross-Sectional Areas
θ = Angle of Lateral with Respect to Outflow Pipe

(4) h_i – On-Grade Inlets (Culvert-Type Inlets). In some locations, water may enter a storm drain system from a drainage channel, overflowing pond, or other conveyance with a flowline approximately equal to that of the storm drain inlet. These storm drain entrances are hydraulically equivalent to culvert inlets, thus the coefficient K_i in Equation 28.40-28 is equal to the culvert entrance loss coefficient K_e provided in Chapter 28.48 GJMC, **Table 28.48.110**. (Note that K_e represents the expansion loss coefficient in this chapter.)

$$h_i = K_i\left(\frac{V^2}{2g}\right) \quad (28.40\text{-}28)$$

Where:

K_i = On-Grade Inlet Coefficient (see **Table 28.48.110**)

(5) h_o – Outlets (Pipe Exits). This term applies to pipe outlets other than those which exit to a manhole. Outlet losses are always associated with a storm drain system outfall to an open channel, detention/retention basin, or other receiving waters. Outlets that discharge into a body of water

with essentially zero velocity in the direction of the storm drain exit lose all velocity (one velocity head). This includes outlets perpendicular to an open channel and all submerged outlets. The storm drain flow is also assumed to lose all velocity when it discharges to open air and plunges to the receiving waters.

$$h_o = \frac{V_o^2}{2g} - \frac{V_d^2}{2g} \qquad (28.40\text{-}29)$$

Where:

V_o = Flow Velocity at Storm Drain Exit

V_d = Flow Velocity (in the direction of storm drain flow) in Receiving Waters

Allowable storm drain velocities often differ from those for open channels. Chapters 28.32, 28.36 and 28.48 GJMC present criteria for the proper design of outlets to open channels, including the design of riprap and other energy dissipation structures to reduce channel scour potential.

(Res. 40-08 (§ 1003.2), 3-19-08)

28.40.100 Computer hydraulic modeling.

Since the storm drain system design process tends to be somewhat iterative, computer programs are now commonly used to develop and/or model proposed and existing storm drainage networks. Numerous hydrologic modeling programs now exist that can often achieve more accurate results due to hydrograph routing capabilities. Many of these hydrologic programs also include hydraulic simulation modules based on hydrologic computations and system parameters. The tediousness of creating hydrographs for every convergence and divergence point in the system is avoided by using these programs, and hydrograph timing consistency is vastly improved. Other more simple programs are stand-alone hydraulic calculators, and are useful if peak flows have been previously determined.

HGL and EGL calculations may be prepared using computer software subject to review by the local jurisdiction. At this time, a list of approved or disapproved public or proprietary computer programs for hydrologic and hydraulic modeling is not maintained. However, the designer is urged to use sound professional judgment to select the program(s) that are most applicable to local design standards and the requirements of the given project. It is recommended that the designer consult with the local development review engineer before using any software that is newly released or has not already been broadly accepted by the engineering community.

(Res. 40-08 (§ 1003.3), 3-19-08)

28.40.110 Construction standards.

GJMC 28.40.120 through 28.40.150 outline standards for the construction of storm drain systems as based on the most recent versions of all reference publications. The designer is responsible for procuring and complying with the most current version of each applicable reference document. For hydraulic design, the most restrictive criteria among said references and this manual are to be used.

(Res. 40-08 (§ 1004), 3-19-08)

28.40.120 Storm drain pipe.

(a) Minimum Size. Minimum pipe sizes are required in order to allow for maintenance and inspection and to reduce the effects of expected sedimentation and debris build-up. All storm drain pipes within the public right-of-way shall have a minimum diameter of 18 inches. For noncircular pipes, these minimum diameters represent equivalent diameters based on cross-sectional areas.

(b) Maximum Size. There is no maximum pipe size specified. However, the designer shall consider the possibility of utilizing multiple barrels (pipes) where physically and economically advisable.

(c) Pipe Material and Shape. All storm drain pipes shall comply with the Grand Junction Standard Specifications for construction of underground utilities, as well as the most recent revision of the Colorado Department of Transportation Standard Specifications for Road and Bridge Construction (CDOT).

Public storm drain mains (to which laterals are connected) may be circular, elliptical, arch, or box (rectangular – concrete only) pipe of reinforced concrete pipe, corrugated aluminized steel, corrugated aluminum, corrugated polymer coated galvanized steel, corrugated or profile wall polyethylene, or polyvinyl chloride. However, pipe material and shape shall be selected based on not only hydraulic capacity, but also "the ability of a pipeline to maintain full cross-sectional area and function without [excessive] cracking, breaking, or undergoing excessive deflection" (Mesa County SWMM, 1996). The designer should be aware that local jurisdictions may have varied regulations for allowable pipe materials.

(d) Joint Fillers, Sealants, and Gaskets. All pipe joint fillers, sealing compounds, and gaskets, and the installation thereof, shall be governed by the specifications set forth in Section 705 of the CDOT Standard Specifications. Rubber gaskets shall be used at pipe section joints where greater than 5.0 feet of pressure head is expected in the design storm. This is equivalent to locations where the HGL elevation is 5.0 feet higher than the pipe crown.

(e) Backfill Loading. Backfill and cover requirements for storm drain pipe are discussed in GJMC 28.40.060.

(f) Pipe Bedding. Specifications for pipe trenching, bedding, and backfill may be obtained from the City of Grand Junction *General Utility Details and Standard Storm Drain Details*.

(Res. 40-08 (§ 1004.1), 3-19-08)

28.40.130 Manholes.

Construction details for a standard storm drain manhole are provided in the City of Grand Junction *Standard Storm Drain Details*. Nonstandard manhole designs shall meet the design and construction criteria set forth in Section 604 of the CDOT *Standard Specifications*. The EGL for all design flows must be at or below the manhole rim. Locking manhole covers are not permitted.

(Res. 40-08 (§ 1004.2), 3-19-08)

28.40.140 Inlets.

Chapter 28.44 GJMC describes the selection and placement criteria for storm drain inlets in Mesa County. Construction details for street inlets can be found in the City of Grand Junction Standard Storm Drain Details.

Culvert-type inlets, such as those directing ditch flows into a storm drain, are required to include a special end section to increase capacity and reduce erosive potential. See Chapter 28.48 GJMC for culvert inlet design criteria.

(Res. 40-08 (§ 1004.3), 3-19-08)

28.40.150 Outlets.

Storm drain outlets typically discharge to a drainage channel, a natural stream or river, or a detention/retention basin. In order to increase storm drain capacity and reduce erosion potential, outlets are required to include a special end section equivalent to those required for culvert outlets per Chapter 28.48 GJMC.

Due to the erosive potential of high-velocity storm drain flow on unlined channels and detention/retention basins, a riprap apron and/or an energy-dissipation structure shall be constructed at all storm drain outlets per requirements set forth in Chapter 28.48 GJMC.

(Res. 40-08 (§ 1004.4), 3-19-08)

28.40.160 Storm drain system design.

Prior to starting storm drain design, the allowable minor and major street capacities must be determined and inlets preliminarily sized and located. In most cases, the storm drain design flow at a given point is equal to the cumulative minor storm runoff exceeding the minor storm street flow capacity to that point. However, since the street and storm drain must cumulatively carry the major storm event flow without exceeding the major storm street capacity, the storm drain must occasionally be sized to carry the runoff exceeding that capacity. Furthermore, in locations where a vertical sag exists in the street (sump inlets) and no overflow path exists for the major storm flow, the storm drain must be sized to accept the entire major storm flow minus street ponding allowances. Note that the latter two cases require that the inlets be resized to accommodate the larger flows.

(Res. 40-08 (§ 1005), 3-19-08)

28.40.170 Initial storm drain design.

The following step-by-step procedure is for the initial layout and sizing of a storm drain. The results of this process must be validated by the procedures set forth in GJMC 28.40.180 before the system can be deemed a viable design. However, this design may be used for conceptual drainage report submittals per GJMC 28.12.030 through 28.12.050.

(a) Choose a system layout based on street rights-of-way and other drainage easements, developed topography, utility locations, and likely cost and performance. This layout shall include preliminary inlet and manhole locations, if any.

(b) Complete hydrologic analysis of the project area per Chapters 28.24 and 28.28 GJMC. Compute peak flow in each street (see Chapter 28.44 GJMC) starting at the upper end of the project area and working downstream. Typically, the runoff from multiple streets will converge at a point, so all streets that are tributary to that point must be completed before moving on downstream. An inlet shall be located wherever the minor storm peak street flow exceeds the allowable capacity for that street and at all sump locations.

(c) Initial storm drain sizing starts at the uppermost inlet for each street, with individual street storm drains combining where appropriate. The design flow for a given storm drain segment is based on the sum of all flow from upstream pipes and the larger of the major or minor street flow exceeding the respective street capacity at the inlet just upstream from that segment.

(d) Using gravity-flow analysis (Manning's open channel flow) as presented in GJMC 28.40.080, including approximate junction head losses, compute required pipe size and slope for each pipe segment. In many locations, storm drain slope will be limited by topography or other design criteria including cover and utility clearance requirements, so slopes are often held constant during the initial design phase. It may be prudent to increase pipe size and/or slope at locations where the preliminary energy loss coefficient may not apply and significant energy losses may occur, such as large or complex pipe junctions and major pipe bends. Pipe size shall not be decreased in a downstream direction except in special situations.

(Res. 40-08 (§ 1005.1), 3-19-08)

28.40.180 Preliminary/final storm drain design.

Following the completion of an initial storm drain system design, the preliminary/final design may begin. The level of hydraulic analysis presented in this section shall be met before the design may be included in any final drainage reports (see GJMC 28.12.060 through 28.12.110).

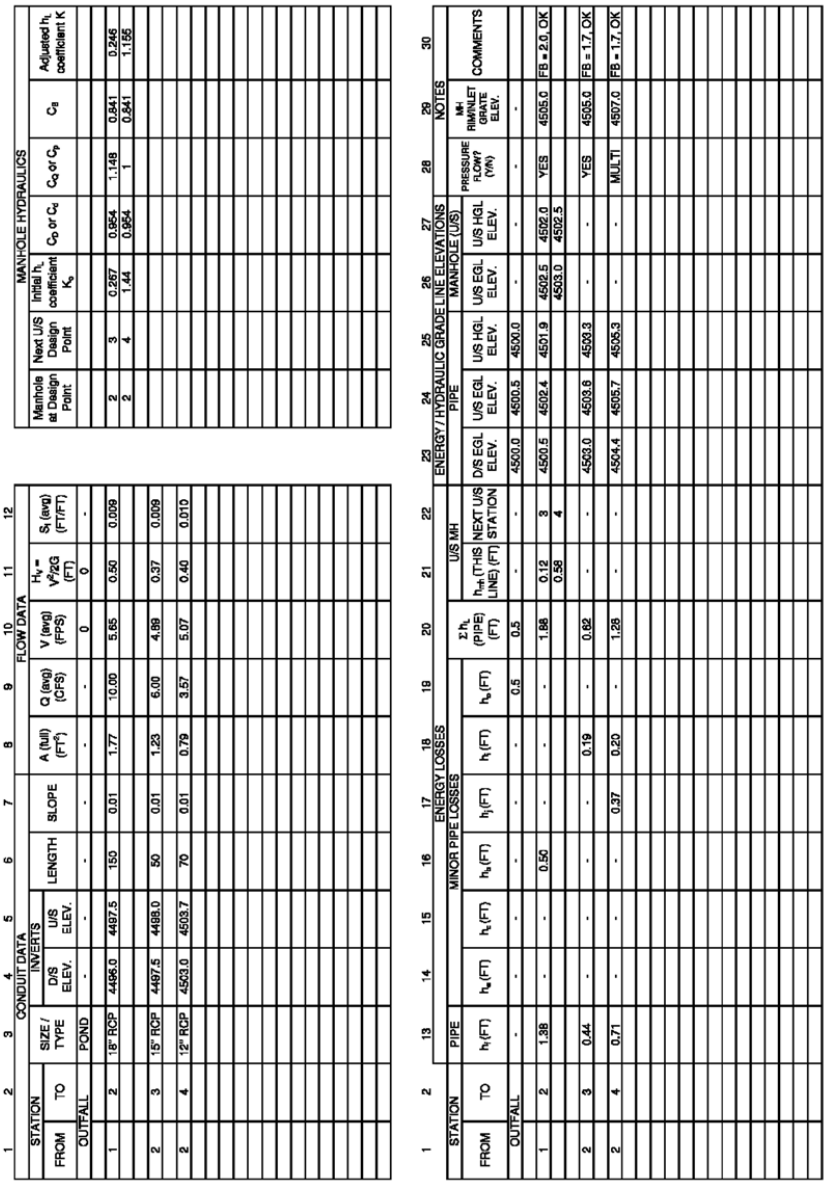
(a) The hydraulics for each system are recomputed using the energy-momentum theory presented in GJMC 28.40.090, starting at each system's outfall point. All applicable energy losses must be included in the calculations, including head loss due to manhole/junction chambers, pipe transitions and bends, no-access junctions, and entrances/exits.

(b) The HGL and EGL shall be calculated and plotted for each end of each pipe segment and each side of all locations of additional energy loss listed in Step 1. The EGL shall be limited to a maximum elevation of manhole rim or inlet throat at all locations along the storm drain.

While many designers may choose to utilize computer software to model storm drain systems, smaller projects are still often completed by hand. Hand calculations are also useful for spot-checking of computer outputs to ensure that software is functioning properly. For this reason, Standard Form 3 in Chapter 28.68 GJMC is provided to assist in tabulation of storm drain hydraulic calculations. **Figure 28.40.180** is Standard Form 3 showing input corresponding to the example design application presented herein.

STORMWATER MANAGEMENT MANUAL

EXAMPLE PROBLEM: STORM DRAIN HYDRAULIC CALCULATIONS



1	2	3	4	5	6	7	8	9	10	11	12
STATION		CONDUIT DATA	INVERTS				FLOW DATA				
FROM	TO	SIZE / TYPE	D/S ELEV.	U/S ELEV.	LENGTH	SLOPE	A (full) (FT^2)	Q (avg) (CFS)	V (avg) (FPS)	$H_V = V^2/2G$ (FT)	S_f (avg) (FT/FT)
OUTFALL		POND	-	-	-	-	-	-	0	0	-
1	2	18" RCP	4496.0	4497.5	150	0.01	1.77	10.00	5.65	0.50	0.009
2	3	15" RCP	4497.5	4498.0	50	0.01	1.23	6.00	4.89	0.37	0.009
2	4	12" RCP	4503.0	4503.7	70	0.01	0.79	3.57	5.07	0.40	0.010

1	2	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
STATION		PIPE	MINOR PIPE LOSSES				ENERGY LOSSES			U/S MH		ENERGY / HYDRAULIC GRADE LINE ELEVATIONS						NOTES	
FROM	TO	h_f (FT)	h_e (FT)	h_x (FT)	h_b (FT)	h_j (FT)	h_f (FT)	h_e (FT)	Σh_L (PIPE) (FT)	h_{ch} (THIS LINE) (FT)	NEXT U/S STATION	D/S EGL ELEV.	U/S EGL ELEV.	U/S HGL ELEV.	Initial h_L coefficient K_e	C_D or C_d	C_Q or C_p	M= RIM/INLET CREST ELEV.	COMMENTS
OUTFALL		-	-	-	-	-	-	0.5	0.5	-	-	4500.0	4500.5	4500.0	-	-	-	-	-
1	2	1.38	-	-	0.50	-	-	-	1.88	0.12	3	4500.5	4502.4	4501.9	0.267	0.954	1.148	0.841	FB = 2.0, OK
										0.58	4				1.44	0.954	1	0.841	
2	3	0.44	-	-	-	-	0.19	-	0.82	-	-	4503.0	4503.8	4503.3	-	-	YES	4505.0	FB = 1.7, OK
2	4	0.71	-	-	-	0.37	0.20	-	1.28	-	-	4504.4	4505.7	4505.3	-	-	MULTI	4507.0	FB = 1.7, OK

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REFERENCE:

FIGURE 28.40.180

(Res. 40-08 (§ 1005.2), 3-19-08)

28.40.190 Example design application.

This section presents an example of energy and hydraulic grade line computation through a simple storm drain system. It is assumed that initial design has previously been completed, the results of which are shown in **Figure 28.40.190**.

(a) Problem: Compute both the energy grade line (EGL) and hydraulic grade line (HGL) at Design Points 1 through 4 for the system shown in **Figure 28.40.180** and check for locations where the EGL reaches any manhole rim or inlet throat.

(b) Solution:

(1) Step 1. Utilizing Standard Form 3 to organize data and calculations, enter "OUTFALL" in the STATION column for the first row. The "pipe" in this case is just the outlet itself, so calculate h_o and enter it in column 19.

$$h_o = \frac{V_o^2}{2g} - \frac{V_d^2}{2g} = \frac{(10\text{cfs}/1.77\text{sf})^2}{2g} - \frac{0^2}{2g} = 0.50'$$

The outfall water surface elevation, 4,500.0 feet, exceeds the crown elevation of the outlet pipe, 4,496.0 feet plus 1.5 feet equals 4,497.5 feet, so the pipe is flowing full at this point (outlet control). The outfall pool has no velocity component in the direction of the outlet pipe, so the EGL equals the HGL and water surface elevation (column 23). The U/S EGL (column 24) in this case represents the point just inside the outlet:

$$EGL_1 = EGL_0 + h_o = 4500.0' + 0.50' = 4500.5'$$

$$HGL_1 = EGL_1 - H_{v,1-2} = 4500.5' - \frac{(10\text{cfs}/1.77\text{sf})^2}{2g} = 4500.0'$$

(2) Step 2. Enter stations 1 and 2 in columns 1 and 2 of the next row, as well as all known pipe and flow data. Since the pipe was already shown to be flowing full under outlet control, velocity (column 10) is:

$$V_{avg} = Q_{avg}/A_{full} = 10/1.77 = 5.65\text{fps}$$

Velocity head (column 11) and friction slope (column 12) are:

$$H_v = \frac{V^2}{2g} = \frac{5.65^2}{2g} = 0.50'$$

$$S_f = \left[\frac{Q_{avg} \cdot n}{0.46 \cdot D^{8/3}}\right]^2 = \left[\frac{10 \cdot 0.013}{0.46 \cdot 1.5^{8/3}}\right]^2 = 0.009$$

Pipe friction head loss is then found and entered in column 13:

$$h_f = S_f \cdot L = 0.009 \cdot 150' = 1.38'$$

The drain schematic (**Figure 28.40.190**) also indicates a 30-degree bend in this pipe reach. Head loss due to the bend is entered in column 16:

$$h_b = 0.0033\Delta\left(\frac{V^2}{2g}\right) = 0.0033 \cdot 30 \cdot 0.50'$$

These total to 1.88 feet lost in the pipe reach (column 20), not including losses from the manhole at Design Point 2.

(3) Step 3. At this point, columns 23, 24, and 25 can be entered. The downstream EGL is in this case simply equal to the upstream EGL (column 24) from the first row. The upstream EGL and HGL are:

$$EGL_{U/S,pipe} = EGL_1 + \Sigma h_{L,pipe} = 4500.5' + 1.88' = 4502.4'$$
$$HGL_{U/S,pipe} = EGL_{U/S,pipe} - H_v = 4502.4' - 0.50' = 4501.9'$$

(4) Step 4. The calculation of losses through a manhole is completed per the procedure presented in GJMC 28.40.090(b), and is dependent on the line being investigated. To find the maximum HGL in a manhole, losses for each line must be calculated and compared. The manhole at Design Point 2 has two inlet pipes, and thus two lines. The line to Station 3 is completed first:

$$K_o = 0.1\frac{b}{D_o}(1-\sin\theta) + 1.4\left(\frac{b}{D_o}\right)^{0.15}\sin\theta = 0.1\frac{4}{1.5}(1-\sin 180°) + 1.4\left(\frac{4}{1.5}\right)^{0.15}\sin 180° = 0.267$$

- Apply C_D? → If $d_{mho}/D_o > 3.2$ → 4.4/1.5 = 2.9 → No (1.0)
- Apply C_d? → If $d_{mho}/D_o < 3.2$ → Yes

  $$C_d = 0.5\left(\frac{d_{mho}}{D_o}\right)^{0.6} = 0.5\left(\frac{4.4}{1.5}\right)^{0.6} = 0.954$$

- Apply C_Q? → If one or more other inlet pipes at manhole does not qualify as plunging flow. Plunging flow if $h_{2-4} > d_{mho}$ → (4503.0'-4497.5-1.5/2) = 4.75 > 4.4 → plunging flow exists → No (1.0)
- Apply C_p? → Yes (see C_Q)

  $$C_p = 1 + 0.2\left(\frac{h}{D_o}\right)\left(\frac{h-d_{mho}}{D_o}\right) = 1 + 0.2\left(\frac{4.75}{1.5}\right)\left(\frac{4.75-4.4}{1.5}\right)$$
  $$C_p = 1.148$$

- Apply C_B? → Yes (always)
  Use **Table 1007** and linearly interpolate with $d_{mho}/D_o = 2.9$.
  C_B = 0.841.

Now apply the correction factors to the initial head loss coefficient:

$$K_{2-3} = K_o C_D C_d C_Q C_p C_B = 0.267 \cdot 1.0 \cdot 0.954 \cdot 1.0 \cdot 1.148 \cdot 0.841 = 0.246$$

STORMWATER MANAGEMENT MANUAL

EXAMPLE PROBLEM: STORM DRAIN SCHEMATIC

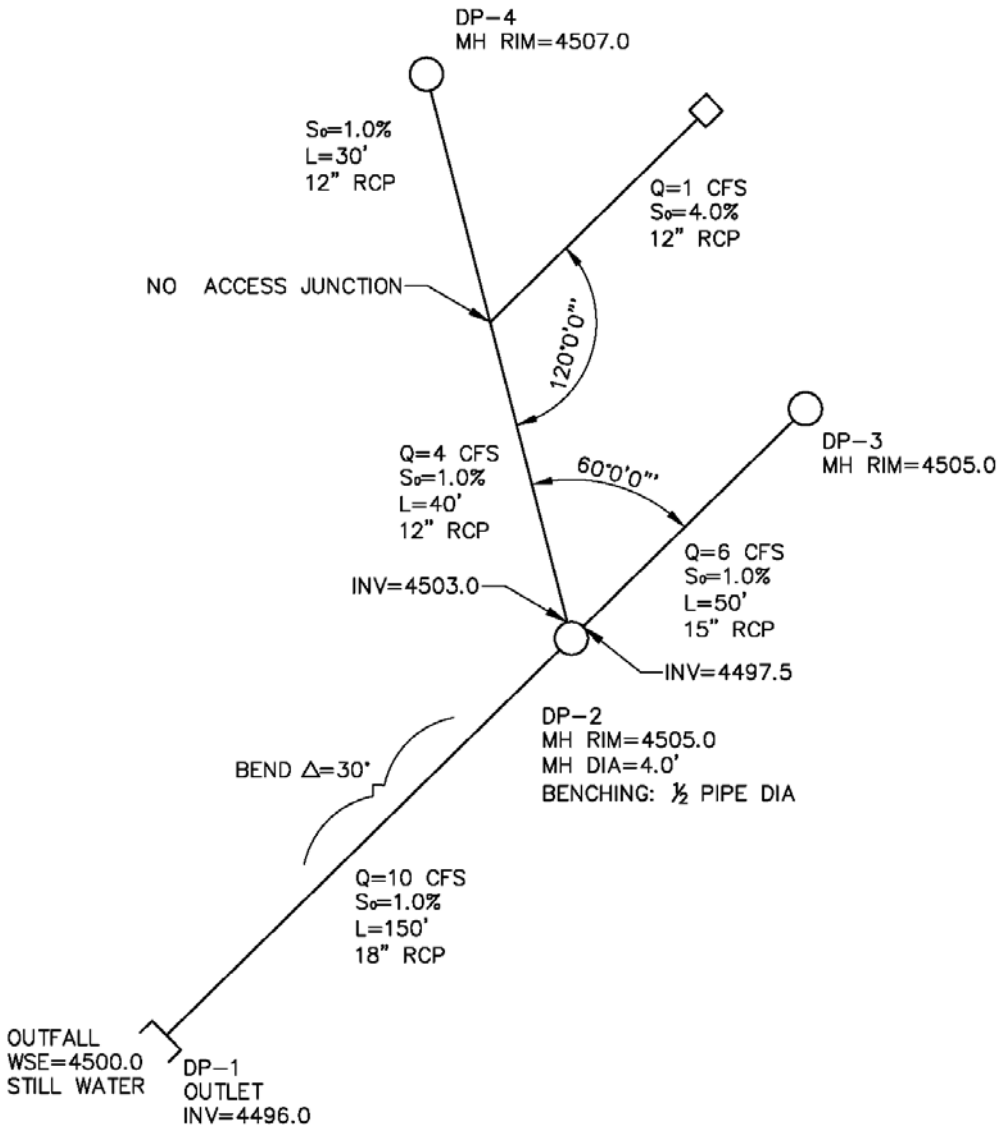

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FIGURE 28.40.190

Then apply the corrected head loss coefficient to find the estimated head loss through the manhole (on this line):

$$h_{mh,2-3} = K\left(\frac{V_o^2}{2g}\right) = 0.246(0.50) = 0.12'$$

Note that the velocity used here is the average velocity in the outlet pipe from the manhole. This value is entered in column 21, and station number "3" in column 22 of the same row.

We now use the same procedure to find the head loss through the same manhole on the other line (2-4). While manhole diameter (b) and outlet pipe diameter (D_o) are the same as before, this pipe enters the manhole at a different angle and a different (invert) elevation:

$$K_o = 0.1\frac{b}{D_o}(1-\sin\theta) + 1.4\left(\frac{b}{D_o}\right)^{0.15}\sin\theta = 0.1\frac{4}{1.5}(1-\sin 120^\circ) + 1.4\left(\frac{4}{1.5}\right)^{0.15}\sin 120^\circ = 1.440$$

- Apply C_D? → If $d_{mho}/D_o > 3.2$ → $4.4/1.5 = 2.9$ → No (1.0)
- Apply C_d? → If $d_{mho}/D_o < 3.2$ → Yes

  $$C_d = 0.5\left(\frac{d_{mho}}{D_o}\right)^{0.6} = 0.5\left(\frac{4.4}{1.5}\right)^{0.6} = 0.954$$

- Apply C_Q? → If one or more other inlet pipes at manhole does not qualify as plunging flow. This pipe plunges to pipe 2-3, and no other pipes enter this manhole. → No (1.0)
- Apply C_p? → This correction factor is applied only to account for the effects of plunging flow by another pipe on the subject pipe. No pipe plunges to this pipe. → No (1.0)
- Apply C_B? → Yes (always)

  Use **Table 1007** and linearly interpolate with $d_{mho}/D_o = 2.9$.

  $C_B = 0.841$.

$$K_{2-4} = K_o C_D C_d C_Q C_p C_B = 1.440 \cdot 1.0 \cdot 0.954 \cdot 1.0 \cdot 1.0 \cdot 0.841 = 1.155$$

and

$$h_{mh,2-4} = K\left(\frac{V_o^2}{2g}\right) = 1.155(0.50) = 0.58'$$

This value is entered in column 21 in the row directly below that containing the 0.12' value. Station "4" is entered in the same row, column 22.

(5) Step 5. The estimated manhole losses on each line (each row) are then added to the upstream EGL (column 24) and HGL (column 25) to get the EGL and HGL at the upper end of the manhole. The larger pair governs:

$$EGL_{U/S,mh,2-3} = EGL_{U/S,pipe(1-2)} + h_{mh,2-3} = 4502.4' + 0.12' = 4502.5'$$
$$HGL_{U/S,mh,2-3} = EGL_{U/S,mh,2-3} - H_{vo} = 4502.5' - 0.50' = 4502.0'$$
$$EGL_{U/S,mh,2-4} = EGL_{U/S,pipe(1-2)} + h_{mh,2-4} = 4502.4' + 0.58' = 4503.0'$$
$$HGL_{U/S,mh,2-4} = EGL_{U/S,mh,2-4} - H_{vo} = 4503.0' - 0.50' = 4502.5'$$

The hydraulic and energy grade line elevations for line 2-4 are used for the manhole freeboard check – the design storm maximum EGL is 4503.0 feet, and the manhole rim at Design Point 2 is at 4505.0 feet. The rim is above the EGL, so the design is acceptable to this point.

(6) Step 6. We now move to analysis of the upper pipe reaches, starting with the pipe between Design Points 2 and 3. As before, fill in known and computed data in columns 1 through 9. Average velocity in the pipe depends on flow conditions, so we must determine outlet conditions. The downstream EGL for this pipe is the larger of the following:

$$EGL_{D/S,pipe(2-3)} = EGL_{mh(2)} = 4503.0'$$

For full flow ($d > 0.80D$):

$$EGL_{D/S,pipe(2-3)} = Invert_{D/S,pipe(2-3)} + D + H_{v(2-3)} = 4497.5'+1.25'+0.37' = 4499.1'$$

For partial flow ($d < 0.80D$):

$$EGL_{D/S,pipe(2-3)} = Invert_{D/S,pipe(2-3)} + d_n + H_{v(2-3)} = 4497.5'+0.95'+0.56' = 4499.0'$$

The first value, 4503.0 feet, is entered in column 23. The downstream HGL, then, is 4503.0 feet – H_v = 4503.0 – 0.37 equals 4502.6 feet, which is above the crown of pipe 2-3. Therefore, the pipe will be assumed to flow full under outlet control. Average velocity under full flow is 4.89 fps, resulting in a velocity head of 0.37 feet. Friction slope is:

$$S_f = \left[\frac{Q_{avg} \cdot n}{0.46 \cdot D^{8/3}}\right]^2 = \left[\frac{6 \cdot 0.013}{0.46 \cdot 1.25^{8/3}}\right]^2 = 0.009$$

This results in pipe friction head loss of:

$$h_f = S_f \cdot L = 0.009 \cdot 50' = 0.44'$$

(7) Step 7. Since there is no known incoming pipe to the manhole at Design Point 3, we will not apply the full energy loss method as before. Instead, we can assume that the outlet pipe from the manhole will act as a culvert, with inlet losses as calculated below:

$$h_i = K_i\left(\frac{V^2}{2g}\right) = 0.5(0.37) = 0.19'$$

The value for K_i was taken from **Table 28.48.110**, assuming a square-edged headwall on concrete pipe. The value of h_i is entered in column 18, and the sum of h_f and h_i is entered in column 20. This is then added to the downstream EGL value in column 23 to find the upstream EGL elevation (column 24):

$$EGL_{U/S,pipe} = EGL_{D/S,mh} + \Sigma h_{L,pipe} = 4503.0'+0.44'+0.19' = 4503.6'$$

$$HGL_{U/S,pipe} = EGL_{U/S,pipe} - H_v = 4503.6'-0.37' = 4503.3'$$

The manhole rim elevation of 4,505.0 feet is above the EGL of 4,503.6 feet, so this reach is acceptable.

(8) Step 8. In a new row, enter stations "2" and "4" in columns 1 and 2. Enter data in columns 1 through 9. The full-pipe gravity-flow discharge for this reach is 3.56 cfs per Manning's equation, so pressure-flow conditions must exist to convey the four cfs design flow. However, there is a no-access junction 40 feet from Design Point 2 to which one cfs of the total four cfs

is attributed. Above this junction, the main pipe is carrying three cfs under gravity-flow conditions. The following table organizes the computation of average values for the reach:

Reach	Length (ft.)	Flow (cfs)	Flow Area (sf)	Velocity (fps)
Downstream	40	4	0.79	5.06
Upstream	30	3	0.59	5.08

Length-weighted averages for flow and velocity are needed for head loss calculations:

$$Q_{avg} = Q_{D/S}\frac{L_{D/S}}{L_{total}} + Q_{U/S}\frac{L_{U/S}}{L_{total}} = 4\frac{40}{70} + 3\frac{30}{70} = 3.57\text{cfs}$$

$$V_{avg} = V_{D/S}\frac{L_{D/S}}{L_{total}} + V_{U/S}\frac{L_{U/S}}{L_{total}} = 5.06\frac{40}{70} + 5.08\frac{30}{70} = 5.07\text{fps}$$

These values are entered in columns 9 and 10, respectively. Velocity head and friction slope (columns 11 and 12) are based on these averages:

$$H_v = \frac{V^2}{2g} = \frac{5.07^2}{2g} = 0.40'$$

$$S_f = \left[\frac{Q_{avg}\cdot n}{0.46\cdot D^{8/3}}\right]^2 = \left[\frac{3.57\cdot 0.013}{0.46\cdot 1.0^{8/3}}\right]^2 = 0.010$$

(9) Step 9. Determine the friction and minor pipe losses. Friction head loss (column 13) is:

$$h_f = S_f\cdot L = 0.010\cdot 70' = 0.71'$$

Head loss at the no-access junction (column 17) is calculated as:

$$h_j = \frac{(Q_oV_o)-(Q_iV_i)-(Q_LV_L\cos\theta)}{0.5\cdot g\cdot(A_o+A_i)} + \frac{V_i^2}{2g} - \frac{V_o^2}{2g}$$

$$h_j = \frac{(4\cdot 5.06)-(3\cdot 5.08)-(1\cdot 6.40\cos 120^\circ)}{0.5\cdot g\cdot(0.79+0.59)} + \frac{5.08^2}{2g} - \frac{5.06_i^2}{2g} = 0.37'$$

Like the manhole at Design Point 3, we will treat the outlet pipe from this manhole as a culvert inlet with a square-edged headwall (column 18):

$$h_i = K_i\left(\frac{V^2}{2g}\right) = 0.5(0.40) = 0.20'$$

Total pipe losses (column 20), then, are:

$$\Sigma h_{L,pipe(2-4)} = h_f + h_j + h_i = 0.71'+0.37'+0.20' = 1.28'$$

(10) Step 10. Find the downstream and upstream EGLs and HGLs.

Downstream EGL (column 23) is the larger of:

$$EGL_{D/S,pipe(2-4)} = EGL_{mh(2)} = 4503.0'$$

$$EGL_{D/S,pipe(2-4)} = Invert_{D/S,pipe(2-4)} + D + H_{v(2-4)} = 4503.0' + 1.0' + 0.40' = 4504.4'$$

Upstream EGL (column 24) is:

$$EGL_{U/S,pipe(2-4)} = EGL_{D/S,pipe(2-4)} + \Sigma h_{L,pipe(2-4)} = 4504.4' + 1.28' = 4505.7'$$

$$HGL_{U/S,pipe(2-4)} = EGL_{U/S,pipe(2-4)} - H_v = 4505.7' - 0.40' = 4505.3'$$

The manhole rim elevation of 4,507.0 feet is above the EGL of 4,505.7 feet, so this reach is acceptable.

(Res. 40-08 (§ 1005.3), 3-19-08)

Chapter 28.44

STREETS

Sections:

28.44.010 Introduction.
28.44.020 Streets as part of the drainage system.
28.44.030 Drainage impacts on traffic and streets.
28.44.040 Sheet flow.
28.44.050 Gutter flow.
28.44.060 Temporary ponding and localized cross flow.
28.44.070 Pavement deterioration effects.
28.44.080 Sedimentation and debris.
28.44.090 Street classification and allowable flow depth and velocities.
28.44.100 Street hydraulic capacity evaluation.
28.44.110 Storm inlet selection, sizing, and location.
28.44.120 Hydraulic capacity of inlets on a continuous grade.
28.44.130 Hydraulic capacity of inlets in sump conditions.
28.44.140 Inlet clogging considerations.
28.44.150 Grate selection and rating.
28.44.160 Inlet location and spacing.

28.44.010 Introduction.

This chapter presents criteria regulating the design of public streets for storm flow drainage and allowable encroachment of these flows within public street rights-of-way. Also included herein are criteria for the selection and placement of storm drain inlets as required to conform to maximum allowable street ponding. All design submittals involving the utilization of public streets for the conveyance of storm flows shall be reviewed based upon the criteria in this chapter.

(Res. 40-08 (§ 1101), 3-19-08)

28.44.020 Streets as part of the drainage system.

The primary function of public streets is the movement of traffic. Therefore, use of streets as part of the drainage system must be limited in order to minimize interference with traffic functions. Street inundation and ponding limits are specified in this chapter in order to limit this potential interference. However, due to the nature of the storms typical to Mesa County, and the resulting ephemeral interference with traffic movement, these limits are not highly restrictive.

Streets typically convey runoff collected not only on the street surface itself, but often from some portion of the surrounding area as well. As an integral part of the drainage system, streets must be capable of conveying some portion of said runoff to a primary drainage conveyance facility such as a storm drain or open channel drainage system. The maximum allowable capacity of a street is based upon its cross-sectional configuration, longitudinal slope, and the maximum allowed ponding depth. Where the calculated minor storm event flow depth exceeds this maximum depth, inlets must be used to reduce street flow. During a major storm event, streets become emergency runoff channels, routing floodwaters away from structures as much as possible. During such an event, many streets will be inundated to a degree such that they are impassable to most vehicles.

(Res. 40-08 (§ 1102), 3-19-08)

28.44.030 Drainage impacts on traffic and streets.

A number of factors may affect traffic movement and the streets themselves when used for drainage purposes. Five of these factors are discussed in the following sections.

(Res. 40-08 (§ 1103), 3-19-08)

28.44.040 Sheet flow.

Rainfall on the paved surface of a street must flow overland (sheet flow) until it reaches a channel. In this case, the channel will be either a curb-and-gutter or a roadside ditch. Ignoring the effects of street inundation due to upgradient runoff, the depth of sheet flow will be near zero at the street crown, increasing in the direction of the collection channel (i.e., the gutter).

Sheet flow can interfere with traffic movement by increasing the risk of hydroplaning or splashing. Hydroplaning is a phenomenon in which one or more of a vehicle's tires lose significant contact with the pavement and become supported by a thin layer of water. This water acts as a lubricant between the pavement and the vehicle, and can cause loss of vehicle control. The potential for hydroplaning increases with vehicle speed and with the depth of water on the road surface, so extra attention shall be paid to this issue during the design of arterial and highway-type roadways. Sheet flow depths can be decreased by increasing the street cross-slope.

Splashing is also dependent on vehicle speeds and water depth, and can interfere with traffic movement by reducing driver visibility. Again, increasing street cross-slope may help to reduce sheet flow depths and splashing potential. In general, a two percent cross slope is desirable to promote swift removal of runoff and reduce sheet flow depths while minimizing potential vehicle side-slippage from ice buildup during winter months.

(Res. 40-08 (§ 1103.1), 3-19-08)

28.44.050 Gutter flow.

Where curb-and-gutter is utilized, all runoff tributary to a street will be directed to, and flow in, a gutter until it reaches a storm drain inlet or other primary conveyance. Generally, flow width will increase in the downstream direction due to an ever-increasing tributary area (and thus higher flows), eventually spreading into the traffic lane(s) and to the street crown. It is important to take into account the gutter flow width and its effect upon traffic movement. For streets where on-street parking is allowed (e.g., residential streets), gutter flow may spread at least to the inner edge of the parking lane without interfering with moving traffic. However, where no street parking is allowed, flow spreading beyond the actual gutter almost immediately reaches a travel lane. Drivers tend to avoid even partially inundated lanes if possible, causing traffic congestion and occasionally vehicular collisions. However, some interference with traffic movement is allowable and expected, even during the minor storm. The duration of such interference is to be minimized wherever possible. Emergency vehicles must be able to travel all streets without encountering extensive (potentially vehicle-disabling) ponding depths. These depths are defined in GJMC 28.44.090 as maximum total gutter depths for the minor storm event.

(Res. 40-08 (§ 1103.2), 3-19-08)

28.44.060 Temporary ponding and localized cross flow.

Grade changes and street crowns at intersections can cause storm runoff to flow at depths greater than the intended design depth and to flow at greater depths for longer durations than anticipated. This localized, temporary ponding poses a high safety risk, especially on roads with higher speed limits (e.g., arterials). Because the ponding is localized, drivers may not be aware of the obstruction and vehicles may enter the ponded area at high speeds (see reference to hydroplaning, GJMC 28.44.040). Even if traffic is moving at low speeds, vehicles encountering a deeper ponded area may stop entirely to avoid entering such an area or may experience engine stalling while attempting to cross such an area. Both of these scenarios have the effect of reducing or halting traffic movement. Therefore, street and drainage design must incor-

porate measures to control the depths at locations where temporary ponding may occur through the use of grading changes or additional inlets. For streets with high traffic volumes, it may be necessary to take steps to effectively eliminate any temporary ponding in order to avoid extensive interference with traffic movement.

Cross flow occurs as a result of a number of scenarios that cause significant flow depths other than that which is the result of sheet flow to travel across traffic lanes. The most common location to encounter this phenomenon is at intersections where gutter flow from the cross-street spills across the intersection. Where allowable, a concrete V-pan may be utilized to control these flows (see City of Grand Junction Standard Details for Construction of Streets, Storm Drains and Utilities, Revised July 2005, page C-12). Localized cross flow can have the same negative effects on vehicular safety and traffic movement as general temporary ponding. Therefore, careful consideration shall be given to potential cross flow locations during design to minimize its effects, especially for streets with higher speed limits and/or higher traffic volume.

(Res. 40-08 (§ 1103.3), 3-19-08)

28.44.070 Pavement deterioration effects.

Utilization of streets for drainage of storm runoff can have a significant effect on roadway maintenance and repair and can, in certain cases, contribute to the structural failure of the roadway pavement. The latter situation may occur if water is able to penetrate the pavement and reach the subgrade. Subgrade saturation and/or material washout will eventually cause subgrade failure, leading to pavement failure and an unsafe/unstable road surface. These locations of distress are caused by other factors such as weathering, overweight vehicles, temperature and temperature changes, heavy traffic, machinery, pavement quality, subgrade inconsistencies, and pavement age. Water flow across undamaged pavement will not typically penetrate to the subgrade. Therefore, consistent roadway maintenance not only affects the efficiency of the street as a drainage system component, but can also reduce the likelihood of roadway failure due to the effects of ponding water.

Although undamaged pavement surfaces for the most part keep water from penetrating through to the subgrade, it is possible for some water to seep through with time. Street designs shall incorporate measures to decrease the duration for which a given section of pavement is submerged to minimize this seepage.

A common practice used to reduce the problem of bituminous surface deterioration is to seal-coat or overlay the existing pavement surface. While this method does effectively reduce pavement deterioration, it reduces the available street flow area with each layer added to the surface. To minimize this effect, it is recommended that the surface be scarified whenever possible before new layers of pavement are added.

(Res. 40-08 (§ 1103.4), 3-19-08)

28.44.080 Sedimentation and debris.

Sediment and debris buildup may occur on streets in any area where flow velocities tend to decrease such as near grade changes and inlets. Sediment and debris buildup can have a significant impact on the flow capacities of gutters and streets, causing increased flow width and thus increased interference with traffic movement.

Locations where significant deposits may occur shall be identified for maintenance purposes to include street sweeping and inlet cleanout as necessary. Inlets shall be designed to function properly based on expected sediment and debris clogging as specified later in this chapter.

Localized sedimentation issues due to construction activities shall be controlled per the criteria presented in Chapter 28.60 GJMC.

(Res. 40-08 (§ 1103.5), 3-19-08)

28.44.090 Street classification and allowable flow depth and velocities.

(a) Streets are classified according to estimated traffic volume and right-of-way width. The City of Grand Junction and Mesa County have adopted the Transportation, Engineering, and Design Standards (TEDS) manual (GJMC Title 24), including standard drawings and details for the construction of streets and location for utilities. While these drawings and details were developed and are maintained by the Grand Junction Department of Public Works and Utilities (Engineering Division), they have been adopted by the Mesa County Board of Commissioners (TEDS Chapter 1, p.1). Eight street classifications are specified therein, but some of these have been grouped together in this manual due to similar hydraulic characteristics. The rural roadway street type is not presented in this chapter since it utilizes a roadside ditch and culverts instead of curb-and-gutter. See Chapter 28.32 GJMC for open channel design criteria.

(b) The local jurisdictions within Mesa County have adopted the policy that streets can be used to convey storm runoff subject to the limits established by this manual. For the minor storm event:

(1) Flow depths must not exceed 0.5 feet at the gutter flowline;

(2) Must not exceed curb height (varies); and

(3) Flow velocities must not exceed 8.0 feet per second.

(c) Street flow depth from the major storm event must not exceed 1.0 foot from the gutter flowline and the flow velocity must not exceed 8.0 feet per second.

(d) **Figures 28.44.090(a)** and **28.44.090(b)** show typical half-street sections and two-year storm event inundation limits for each street classification group. Note that the cross-sections shown include geometric assumptions made for hydraulic computation purposes and do not precisely reflect the approved standard street details.

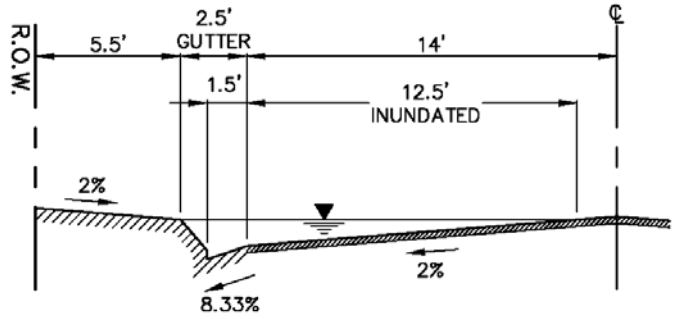
(e) Calculations for flow capacity and velocity in a given street section are based upon these maximum depths and the assumption that any area not within the street right-of-way would not contribute to the capacity of the street system (called “ineffective flow area”). Therefore, for calculation purposes, it is assumed that an infinitely high vertical wall of zero roughness exists at the right-of-way boundary, and any flow area outside this boundary is not considered in analysis. Due to the potential for a single street cross-section to have different half-street cross-sections, all street capacity calculations are to be completed on a half-street basis. Therefore, the same vertical-wall assumption applies to the street centerline as to the right-of-way where the calculated flow width exceeds the half-street width.

(f) At street sag locations, pipes and/or channels must be provided to facilitate compliance with maximum ponding depths for both minor and major storm events as described above. Maintenance access must be provided for these facilities, including permanent easements.

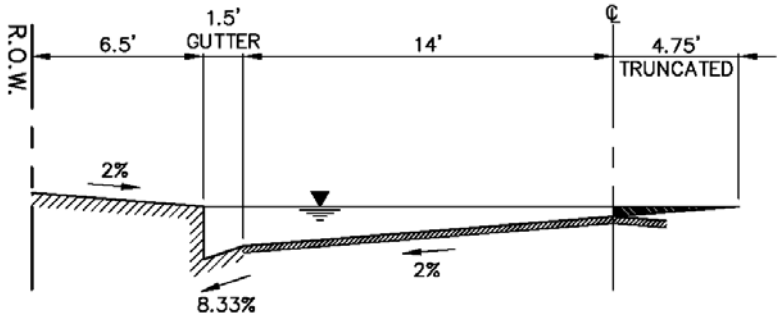
(g) Not inclusive of median spill gutters, the standard concrete details include two curb types, vertical and drive-over (mountable). The vertical curb configuration may be constructed monolithically with or without a sidewalk, and has a height of six inches. This configuration or an approved alternative design must be used for streets with an A.D.T. value of more than 1,000 (Standard Street Details, Page ST-05). A cross-section detail of the vertical curb and gutter is found in **Figure 28.44.090(c)**. The drive-over, or mountable, curb configuration may only be used for residential streets with an A.D.T. value of less than 1,000 (Standard Street Details, Page ST-05). The total vertical height from the gutter flowline to the top of the curb is 4.5 inches, resulting in a lower maximum minor storm event water surface elevation for streets utilizing this gutter type. It does, however, reduce the need for driveway ramps, which are often a major contributor to the reduction of residential gutter capacity. **Figure 28.44.090(d)** is a detail of the standard mountable curb.

STORMWATER MANAGEMENT MANUAL

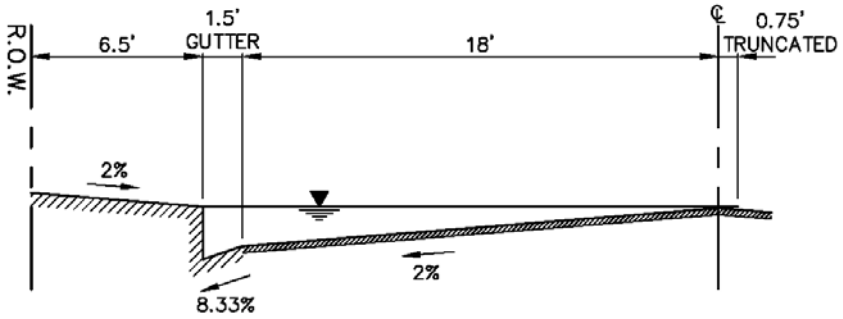
STREET INUNDATION LIMITS FOR THE 2-YEAR STORM



RESIDENTIAL (MOUNTABLE CURB)
N.T.S.



RESIDENTIAL (VERTICAL CURB)
N.T.S.



RESIDENTIAL COLLECTOR/COMMERCIAL/INDUSTRIAL
N.T.S.

NOTE THAT IN NO CASE SHALL THE 100-YEAR FLOW DEPTH EXCEED 1.0 FEET AT THE GUTTER FLOWLINE.

Revision	Date
ORIGINAL ISSUE	3/27/06
ADDED NOTE	12/6/07

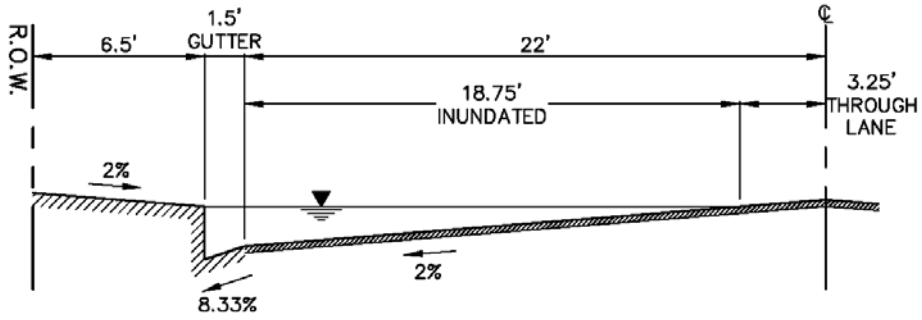
WRC ENGINEERING, INC.

REFERENCE: GRAND JUNCTION STANDARD STREET DETAILS
GRAND JUNCTION STANDARD CONCRETE DETAILS

FIGURE 28.44.090(a)

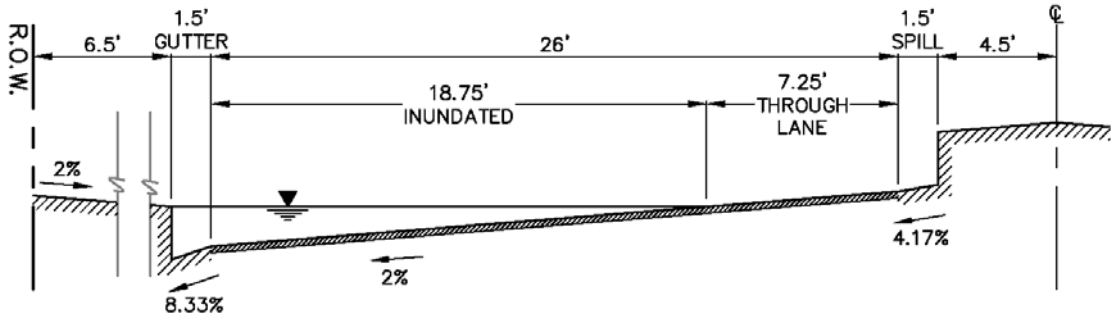
STORMWATER MANAGEMENT MANUAL

STREET INUNDATION LIMITS FOR THE 2-YEAR STORM



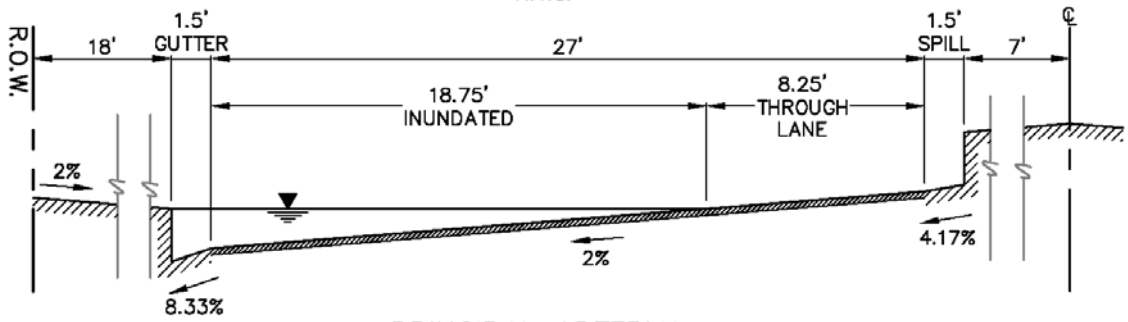
COLLECTOR

N.T.S.



MINOR ARTERIAL

N.T.S.



PRINCIPAL ARTERIAL

N.T.S.

NOTE THAT IN NO CASE SHALL THE 100-YEAR FLOW DEPTH EXCEED 1.0 FEET AT THE GUTTER FLOWLINE.

Revision	Date
ORIGINAL ISSUE	3/27/06
ADDED NOTE	12/6/07

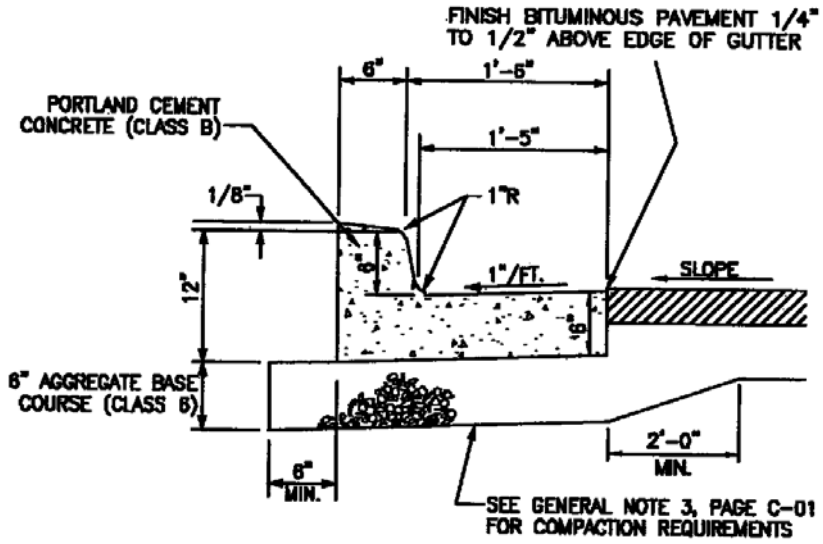
WRC ENGINEERING, INC.

REFERENCE: GRAND JUNCTION STANDARD STREET DETAILS
GRAND JUNCTION STANDARD CONCRETE DETAILS

FIGURE 28.44.090(b)

STORMWATER MANAGEMENT MANUAL

VERTICAL CURB/GUTTER DETAIL



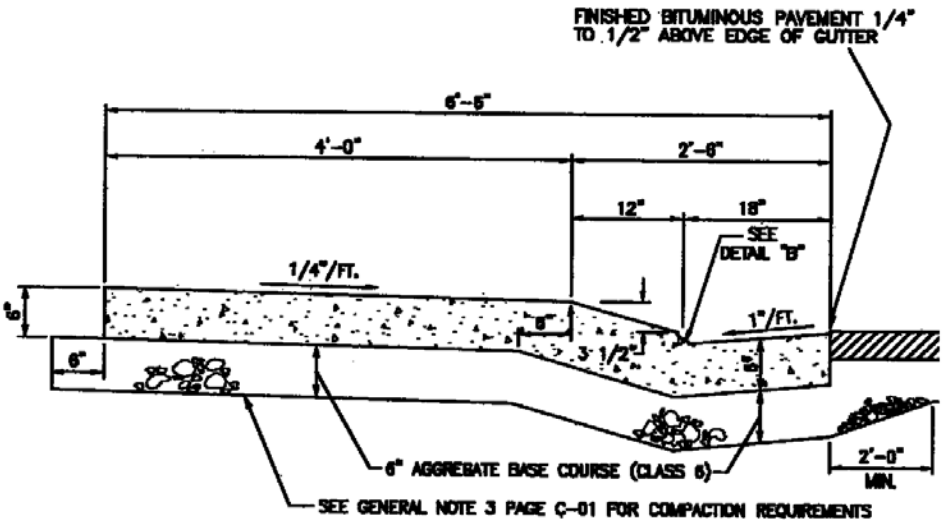
STANDARD CURB AND GUTTER

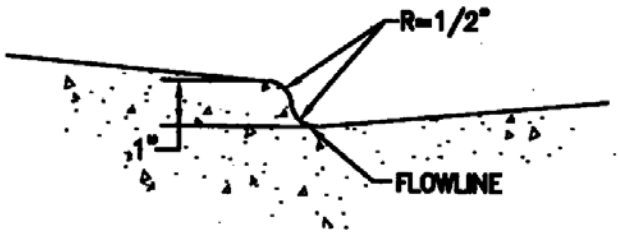
Revision	Date
ORIGINAL ISSUE	3/27/06

WRC ENGINEERING, INC.	REFERENCE: GRAND JUNCTION STANDARD CONCRETE DETAILS	**FIGURE 28.44.090(c)**

STORMWATER MANAGEMENT MANUAL

MOUNTABLE CURB/GUTTER DETAIL





DETAIL "B"

Revision	Date
ORIGINAL ISSUE	3/27/06

WRC ENGINEERING, INC.	REFERENCE: GRAND JUNCTION STANDARD CONCRETE DETAILS	**FIGURE 28.44.090(d)**

(Res. 40-08 (§ 1104), 3-19-08)

28.44.100 Street hydraulic capacity evaluation.

(a) Gutter and street flow can generally be assumed to be uniform for the purpose of hydraulic evaluation and design, but as street flow depth increases, flow width increases at a much faster rate. This wide, relatively shallow flow has the effect of decreasing the hydraulic radius, rendering the standard Manning's equation somewhat inaccurate. The Federal Highway Administration (FHWA) presents a modified form of the equation in Section 5.3.2 of *Introduction to Highway Hydraulics*, taken from HEC-12:

$$Q_S = \frac{K_u}{n} S_X^{5/3} S_L^{1/2} T_S^{8/3} \qquad (28.44\text{-}1)$$

Where:

Q_S	=	Street Flow Capacity (not including gutter) (cfs)
n	=	Manning's Roughness Coefficient
K_u	=	0.56 for English units
K_u	=	0.376 for S.I. units
S_X	=	Street Cross Slope (ft./ft.)
S_L	=	Street Longitudinal Slope (ft./ft.)
T_S	=	Flow Top Width (not including gutter) (ft.)

(b) For streets with a single cross slope for the gutter and street section, Equation 28.44-1 will suffice for determining total gutter/street flow capacity if the T_S term is replaced by *T = Total Flow Top Width (including gutter, inside curb)*. However, the standard concrete details indicate the use of composite cross slopes for all streets – the gutter has a steeper cross slope than the street. In these cases, the above equation specifies capacity in the flow area between the edge of pavement (not including the gutter itself) and the edge of flow. Note that the result of the same equation as applied to any flow area beyond the street centerline must be subtracted from the total capacity (see **Figure 28.44.090(a)**). The total flow capacity in the street and the gutter is calculated as:

$$Q = \frac{Q_S}{1 - E_o} - Q_{S,\text{Outside Street Centerline}} \qquad (28.44\text{-}2)$$

$$E_o = 1 / \left[1 + \frac{S_W / S_X}{\left[1 + \frac{S_W / S_X}{(T/W) - 1} \right]^{8/3} - 1} \right] \qquad (28.44\text{-}3)$$

Where:

S_W	=	Gutter Cross Slope (ft./ft.)
S_X	=	Street Cross Slope (ft./ft.)
T	=	Top Width (inside curb) (ft.)
W	=	Gutter Width (ft.)

(c) **Figures 28.44.100(a)** through **28.44.100(f)** show calculated half-street flow capacities for each street classification group based on longitudinal street slope and flow depth. The HEC-12 equation (Equation 28.44-1) was used to determine most flow capacities for these charts except in cases where the flow width does not exceed gutter width. Where gutter flow does not encroach on the street surface, it is assumed that the width to depth ratio is not large enough to warrant the utilization of the HEC-12 modified Manning's equation. Instead, the standard form is used in these cases:

$$Q = \frac{1.49}{n} A \cdot R^{2/3} \cdot S_L^{1/2} \qquad (28.44\text{-}4)$$

Where:

Q	=	Flow Capacity (cfs)
S_L	=	Street Longitudinal Slope (ft./ft.)
R	=	Hydraulic Radius (ft.) = A/P
A	=	Cross-Sectional Flow Area (sf)
P	=	Wetted Perimeter (ft.)

(d) Major storm event flow depth may exceed curb height, thus the flow area behind the curb – between the curb and the right-of-way – must also be considered in the calculation of total street capacity. The flow in this area is found using Equation 28.44-1, replacing T_S with T_B = Flow Top Width (behind curb). Note that the truncation procedure described above must also be applied here if the calculated top width extends beyond the right-of-way boundary. Therefore, the total flow between the curb and street centerline, Q_B, is:

$$Q_B = Q_{B,Gross} - Q_{B,Outside\ Street\ Right-of-Way} \qquad (28.44\text{-}5)$$

(e) Total street capacity, then, is the sum of the resulting values from Equations 28.44-2 and 28.44-5. The HEC-12 procedure has certain limitations and includes certain assumptions. The most applicable of these are listed below.

(1) One value for Manning's roughness n must be used for the entire cross-section. This can be a composite value derived from multiple roughness segments in the cross-section.

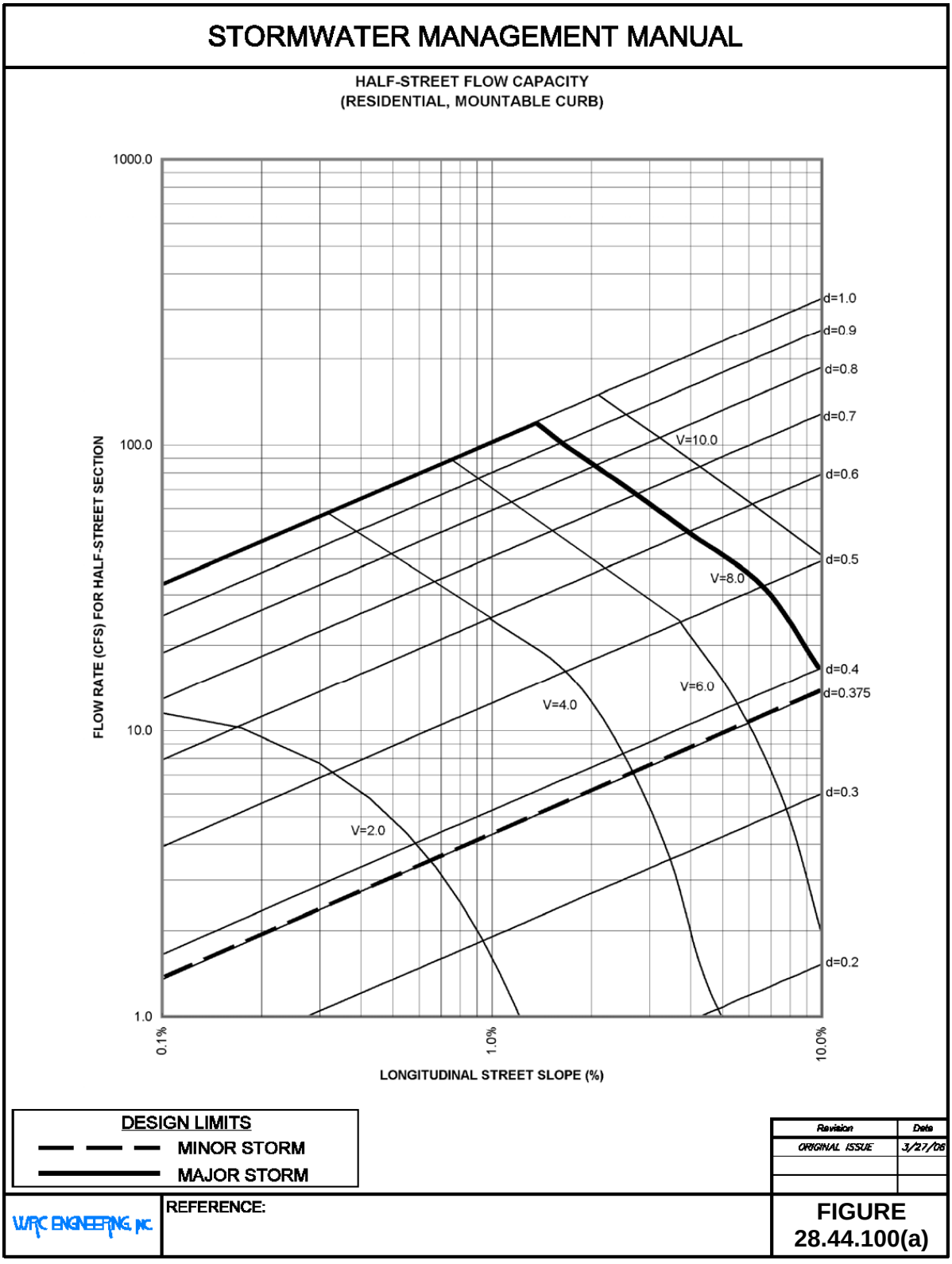
(2) The HEC-12 method ignores any roughness characteristics of the vertical segment of the curb. The energy-dissipating effect of this portion is considered to be negligible when compared to the wide bottom sections.

(3) The vertical curb shown in **Figure 28.44.100(g)** actually slopes back away from the street by one inch while rising six inches. This slope is ignored by the HEC-12 equations. The gutter width is assumed to include this extra one inch with a vertical segment of six-inch height at this point. See **Figure 28.44.100(g)** for detail.

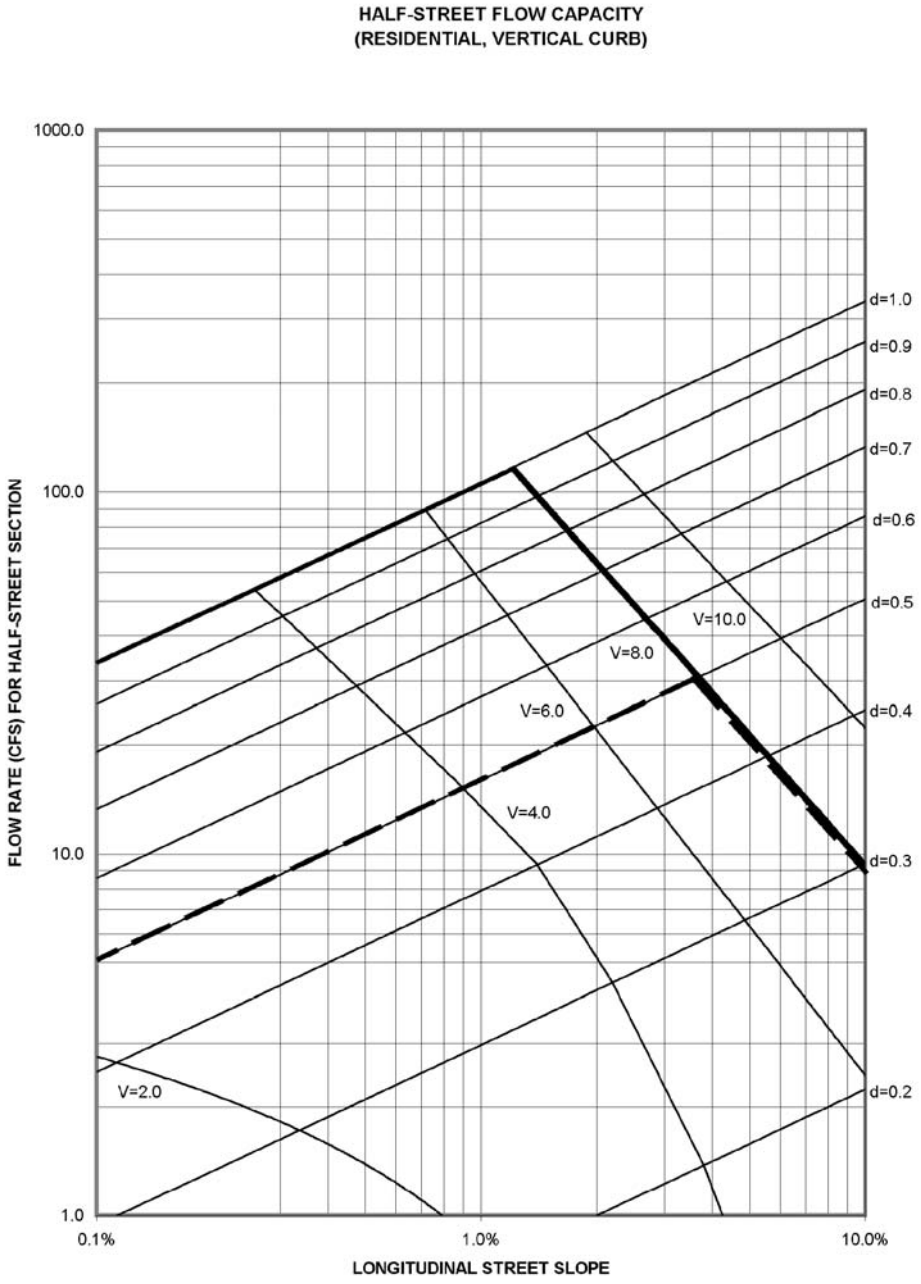
(4) The standard concrete details indicate that the edge of the roadway pavement shall be one-quarter inch to one-half inch above the edge of the concrete gutter. The HEC-12 method is unable to account for this directly, and the hydraulic effects are assumed to be negligible, so this is ignored.

(f) Two of the provided standard street capacity charts, **Figures 28.44.100(a)** and **28.44.100(f)**, were not prepared using the procedure described above. Both residential streets with mountable curbs (**Figure 28.44.100(a)**) and principal arterials (**Figure 28.44.100(f)**) have a more complex cross-section than the HEC-12 method can accurately model. The former is due to the alternate curb-and-gutter configuration, and the latter has a required median to which the flow can spread, adding another flow-control surface to the cross-section. Therefore, Haestad Methods' FlowMaster com-

puter program was used to model these sections and prepare capacity charts. The program uses the Cox open-channel weighting method to determine composite roughness and utilizes the standard form of Manning's equation to compute discharge.



STORMWATER MANAGEMENT MANUAL



DESIGN LIMITS

— — — MINOR STORM

——— MAJOR STORM

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FIGURE 28.44.100(b)

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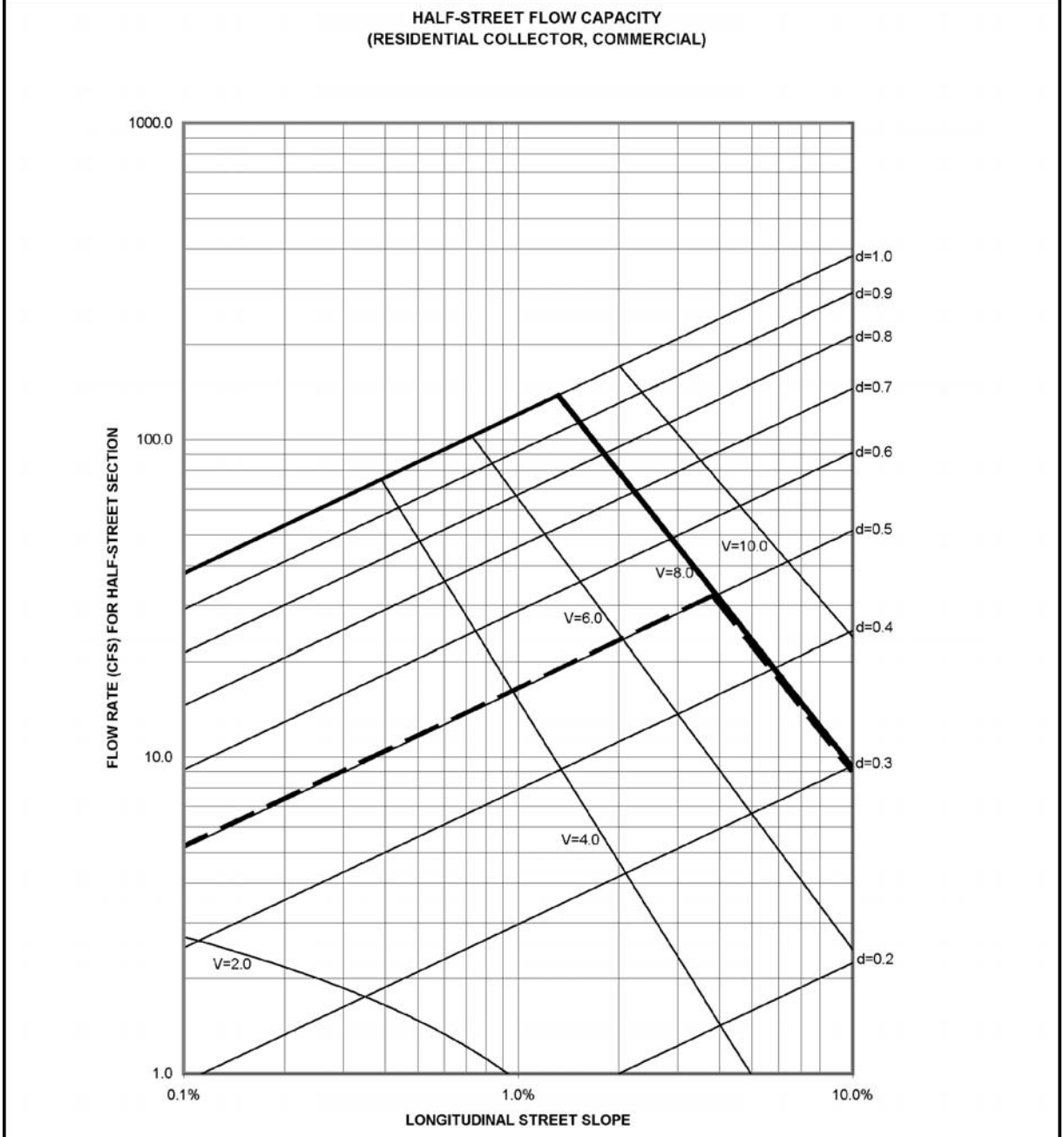

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FIGURE 28.44.100(c)

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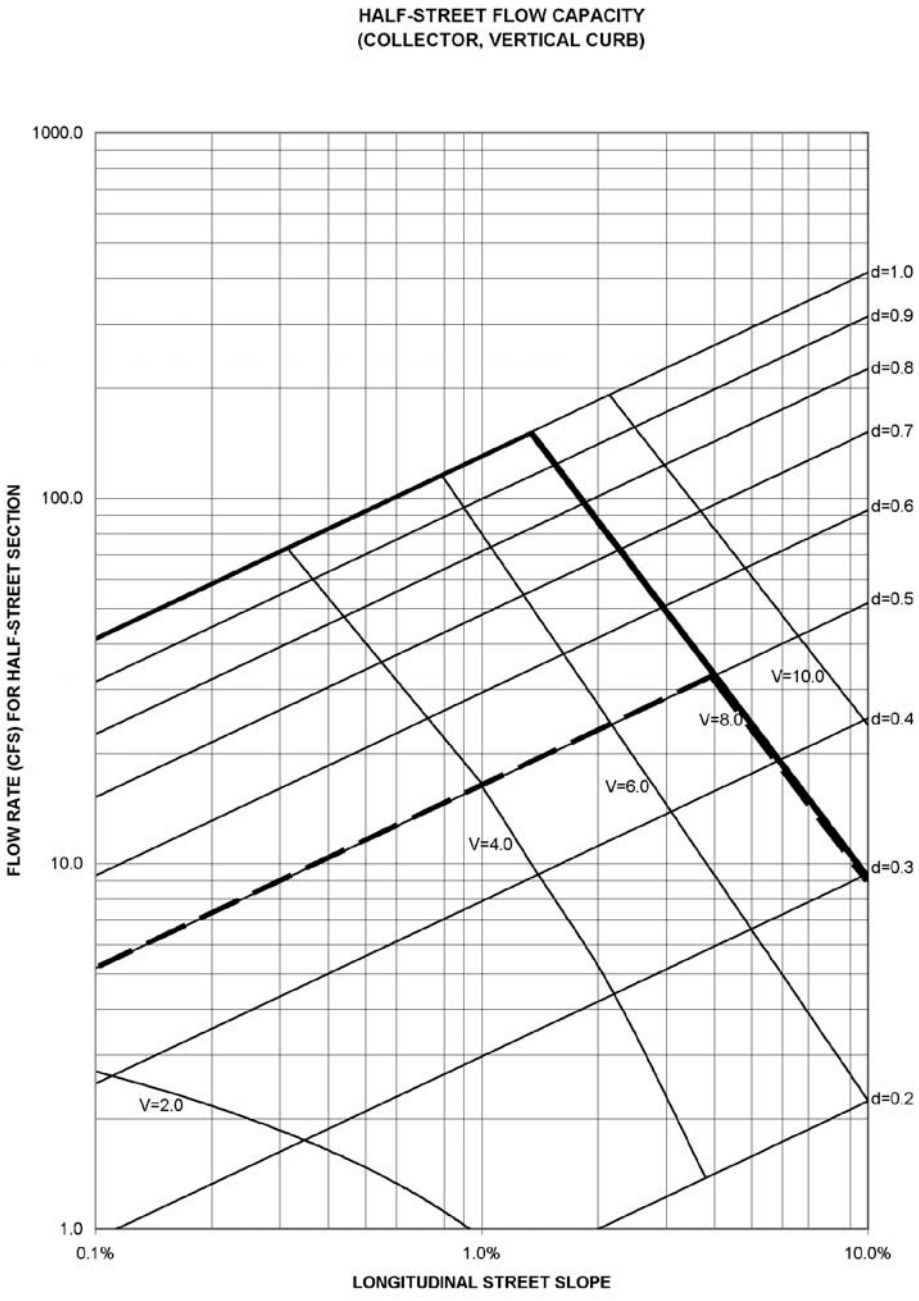

DESIGN LIMITS

MINOR STORM

MAJOR STORM

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REFERENCE:

FIGURE 28.44.100(d)

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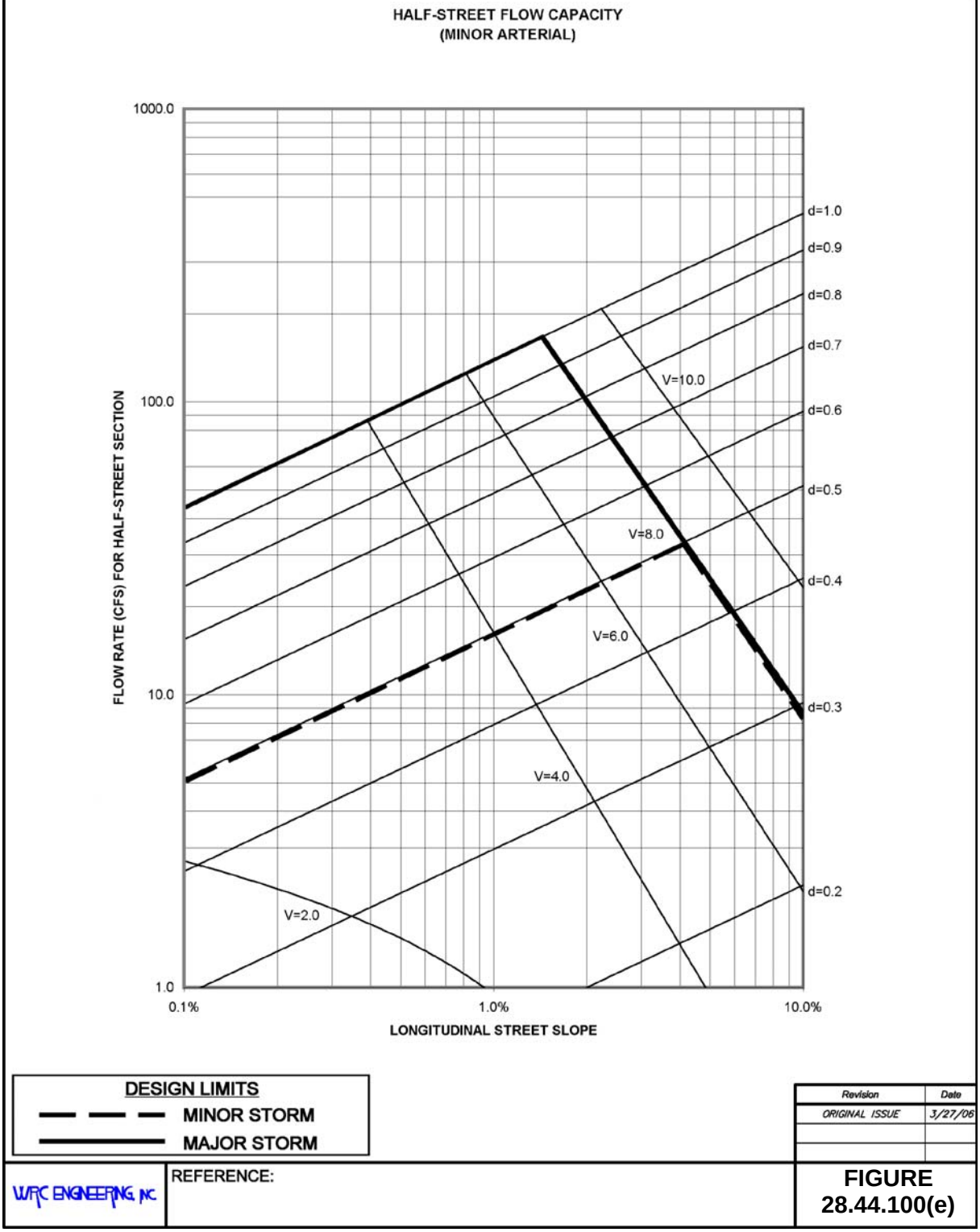

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FIGURE 28.44.100(e)

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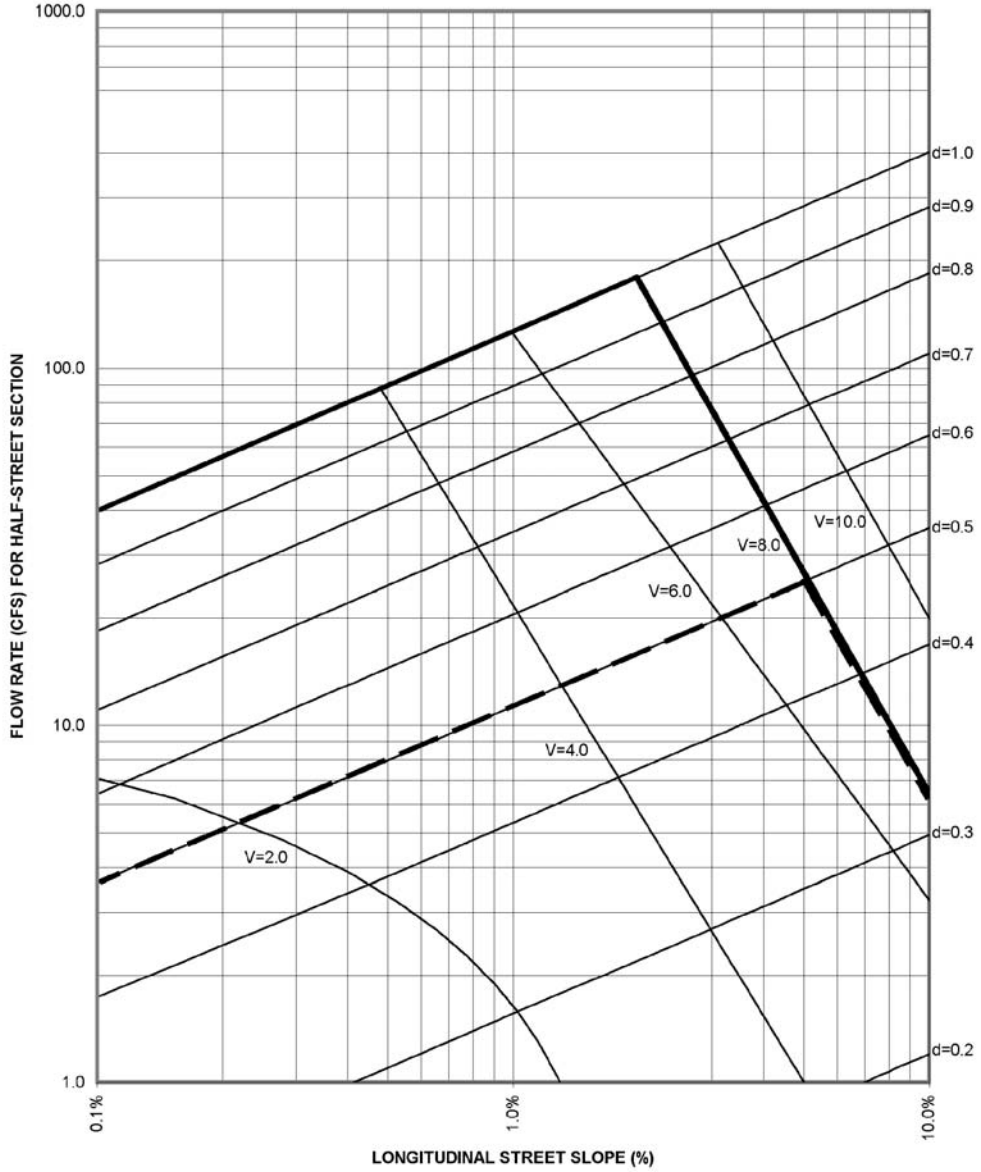
HALF-STREET FLOW CAPACITY
(PRINCIPAL ARTERIAL)



DESIGN LIMITS

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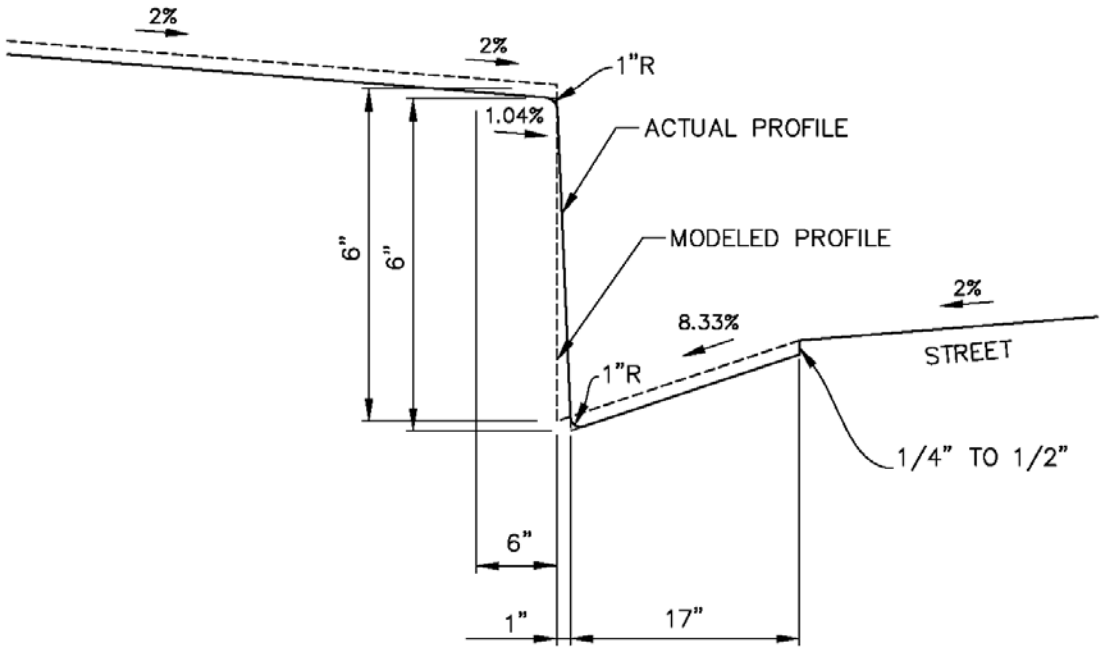
REFERENCE:

FIGURE 28.44.100(f)

STORMWATER MANAGEMENT MANUAL

ACTUAL VS. MODELED VERTICAL CURB DETAIL



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REFERENCE: GRAND JUNCTION STANDARD CONCRETE DETAILS
HEC-12, FHWA

FIGURE 28.44.100(g)

(g) Certain assumptions were made in the creation of the street capacity charts to minimize the required number of figures and to simplify the design process. However, it is the responsibility of the designer to ensure that each assumption is valid for a specific design.

(1) A Manning's roughness value of $n = 0.016$ was assumed for all flow surfaces encountered within the street right-of-way when using the HEC-12 method. Varying values of *n* were used to construct the FlowMaster cross-sections, but composite roughness values were not significantly different from 0.016 for the two special cases.

(2) A street cross slope of 2.0 percent was assumed for all streets.

(3) A gutter cross slope of 8.33 percent was assumed for all gutters.

(4) Velocity curves are provided on the capacity charts for reference only – the designer is responsible for the calculation of actual gutter velocities.

(h) In cases where these assumptions may not be valid, such as designs incorporating the use of non-standard street sections, the designer shall utilize the equations presented above to determine allowable street capacity.

(i) The maximum allowable gutter velocity is 8.0 feet per second. Velocities exceeding this value can create safety issues, cause erosive damage to the street and other surfaces, and reduce the effectiveness of storm drain inlets.

(Res. 40-08 (§ 1105), 3-19-08)

28.44.110 Storm inlet selection, sizing, and location.

(a) Wherever street and gutter capacity exceeds allowable values based on flow spread, velocity, or depth, some or all of the runoff must be intercepted and diverted to an alternate flow path such as a storm drain or designated runoff channel. The most common method of interception is by the utilization of storm drainage inlets, of which there are four major types:

(1) Curb-opening inlets;

(2) Grate inlets;

(3) Combination inlets (curb-opening and grate);

(4) Slotted drain inlet.

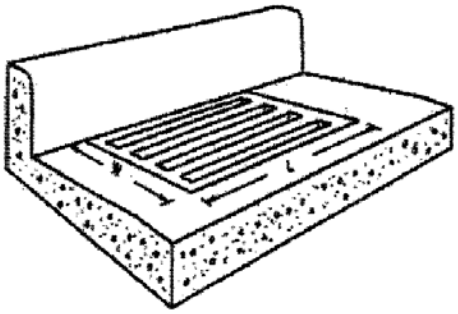
(b) The slotted drain inlet is not recommended due to its high susceptibility to clogging, and may only be used where specifically approved by a local jurisdiction. All inlets must be labeled with "NO DUMPING – DRAINS TO RIVER." Isometric-view examples of the first three types are shown in **Figure 28.44.110**.

(c) Inlets may either be located on a continuous grade – where flow not intercepted by the inlet will pass to another location – or in a sag portion of a street's vertical alignment (or any other sump location). Computation of inlet capacity involves several factors including type of inlet, location (on-grade or in a sump), grate type (if applicable), inlet geometry, flow width and depth, and both longitudinal and cross slopes.

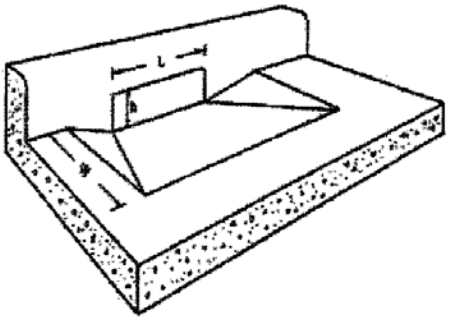
(d) Methods and rationale utilized in this chapter for the calculation of inlet capacities are based on those presented in HEC-12 (1984). However, HEC-12 contains a nomograph for finding grate splash-over velocity, and here we use an empirical formula for this value (Guo, Storm Water System Design, CE 5803, University of Colorado at Denver, 1999). Additionally, clogging must be considered in the selection and location of inlets, and will be addressed in GJMC 28.44.140.

STORMWATER MANAGEMENT MANUAL

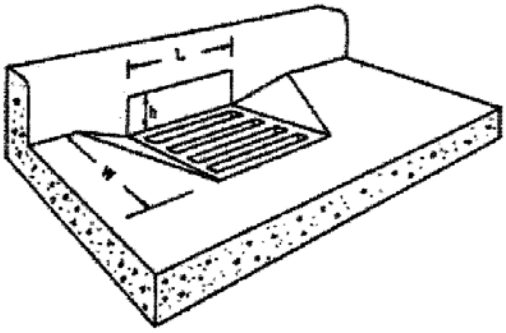
INLET TYPES ISOMETRIC VIEWS



a. Grate



b. Curb-opening Inlet



c. Combination Inlet

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WRC ENGINEERING, INC.	REFERENCE: HEC-12, FHWA	**FIGURE 28.44.110**

(Res. 40-08 (§ 1106), 3-19-08)

28.44.120 Hydraulic capacity of inlets on a continuous grade.

Gutter velocities exceeding a "splash-over" velocity and flow widths greater than grate widths typically result in interception efficiencies of less than 100 percent for an on-grade inlet. Inlet efficiency, E, is defined as:

$$E = Q_i/Q \quad (28.44\text{-}6)$$

Where:

Q_i = Intercepted Flow Rate
Q = Gutter Total Flow Rate

Flow which is not intercepted by the inlet is called bypass flow, Q_b:

$$Q_b = Q - Q_i \quad (28.44\text{-}7)$$

The interception efficiency of an inlet is affected by different factors for different inlet types. Grate inlets are most sensitive to the amount of water flowing directly over the grate (frontal flow) and the velocity of flow in the gutter. Curb-opening inlets vary primarily with inlet length, depth of flow, and both longitudinal and cross slopes of the gutter and street. Combination inlets where the curb opening and grate inlets are of similar length and are installed adjacently have been shown to have essentially the same interception capacity as the same grate configuration acting without a curb opening. However, curb-opening inlets have greater debris-handling capabilities than grates, and therefore combination inlets typically experience significantly less grate clogging than would be experienced if the curb-opening was excluded. A "sweeper inlet" is a type of combination inlet that utilizes a segment of curb opening upstream from the grated portion. This configuration has the highest debris-removal efficiency, and therefore lowest clogging rate, of all types listed here. Total capacity is the sum of the flow intercepted by the curb opening located upstream of the grate(s) and that intercepted by the grated portion of the combination inlet.

(a) Grate Inlets. Grand Junction Standard Storm Drain Details (Page D-05, 2005) lists storm drain grate types which have been approved for use. The four primary types for use on streets are Types R, L, V, and D in single, double, and triple-inlet configurations, and are included in the inlet capacity charts provided herein. Page D-05 also contains two important notes concerning the selection of grates:

(1) Use Type R or Type D grate where inlet is located in sump condition.

(2) Use Type V or Type L where gutter flow is from one direction only.

Type V and Type L grates are vane grates, which are more efficient for on-grade locations, but are very inefficient for sump conditions. Therefore, local jurisdictions do not allow the use of grate Types V and L for locations where sump conditions may exist. However, these types are recommended for on-grade locations where bicycle traffic is expected.

The FHWA and others have extensively researched the hydraulic characteristics of the seven grate types listed in **Table 28.44.120**. The approved grate types were each matched to the FHWA grate type most closely matching in geometry and apparent hydraulic functionality. These assumed pairings are indicated in **Table 28.44.120**.

The total rate of intercepted flow by a grate inlet (or standard combination inlet) is the sum of the intercepted frontal flow and the intercepted side flow. Frontal flow, Q_w is that portion of the total gutter flow

which has a flow width equal to or less than the grate width. Total frontal flow is found using the following HEC-12 equation:

$$Q_w = Q\left[1-\left(1-\left(W/T\right)\right)^{2.67}\right] \quad (28.44\text{-}8)$$

Where:

Q_W = Total Frontal Flow (cfs)
Q = Total Gutter Flow (no behind-curb flow) (cfs)
W = Width of Grate (ft.)
T = Total Top Width of Flow (ft.)

Total side flow is that portion of total gutter flow which is between the inner edge of the grate(s) and the street centerline, and is the remainder of the total flow between the curb and the centerline:

$$Q_s = Q - Q_w \quad (28.44\text{-}9)$$

Where:

Q_s = Total Side Flow

To find the ratio of intercepted frontal flow (Q_{wi}) to total frontal flow (Q_w), R_f, one must first find the splash-over velocity, V_o, for the selected grate type. This function was developed empirically by Guo (1999):

$$V_o = \alpha + \beta L_e - \gamma L_e^2 + \eta L_e^3 \quad (28.44\text{-}10)$$

Where:

L_e = Effective Unit Grate Length (see Equation 28.44-24)
$\alpha, \beta, \gamma, \eta$ = Splash Velocity Constants (see **Table 28.44.120**)

Table 28.44.120: Splash Velocity Constants

Type of Grate	Assumed Equivalent	α	β	γ	η
Bar P-1-7/8	Type D	2.22	4.03	0.65	0.06
Bar P-1-1/8	Not used	1.76	3.12	0.45	0.03
Vane Grate	Type L,V	0.30	4.85	1.31	0.15
45-Degree Bar	Not used	0.99	2.64	0.36	0.03
Bar P-1-7/8-4	Not used	0.74	2.44	0.27	0.02
30-Degree Bar	Not used	0.51	2.34	0.20	0.01
Reticuline	Type R	0.28	2.28	0.18	0.01

Adapted from Guo, *Storm Water System Design*, 1999.

Splash-over velocity is an experimentally-derived value at which frontal flow begins to bypass the grate essentially because water does not spend enough time over the inlet to allow it to fall through the grate. As previously mentioned, this value varies per grate type – some grates tend to better capture higher velocity flows. This allows the designer to calculate the HEC-12 frontal flow interception ratio:

$$R_f = Q_{wi}/Q_w = 1.0 - 0.09(V - V_o) \quad \text{where } V \geq V_o, \text{ otherwise } R_f = 1.0 \tag{28.44-11}$$

Due to the primarily longitudinally-flowing nature of street and gutter flow, the interception ratio of side flow is typically minimal, and in some jurisdictions is ignored altogether. This ratio, $R_{s,}$ is defined as:

$$R_s = Q_{si}/Q_s = \frac{1}{1 + \frac{0.15 \cdot V^{1.8}}{S_X \cdot L_e^{2.3}}} \tag{28.44-12}$$

Where:

Q_{si}	=	Intercepted Side Flow (cfs)
V	=	Gutter Flow Velocity (fps)
S_x	=	Street Cross Slope
L_e	=	Effective Length of Grate(s) (ft.) (see Equation 28.44-24, GJMC 28.44.140)

Total intercepted flow (Q_i), then, is found using Equation 28.44-13:

$$Q_i = Q_{wi} + Q_{si} = R_f \cdot Q_w + R_s \cdot Q_s \tag{28.44-13}$$

Total capture efficiency (E) for a grate inlet can be found using:

$$E = R_f(Q_w / Q) + R_s(Q_s / Q) \tag{28.44-14}$$

Inlet clogging due to the buildup of debris and sediment can adversely affect the interception capacity of an inlet. A clogging factor must be applied to find the design value for Q_i. See GJMC 28.44.140 for an explanation of the calculation of clogging factors.

Included in **Figures 28.44.120(b)** through **28.44.120(k)** are inlet capacity charts for all street types and curb-and-gutter and inlet configurations considered by this manual. **Figure 28.44.120(a)** is a legend for these figures. The capacity curves are specific to grate type, inlet type, and whether the subject inlet is single, double, or triple length. All curves include appropriate clogging factors per GJMC 28.44.140. Inlet capacity values calculated from the provided equations may be used if they do not exceed the values provided in the inlet capacity charts.

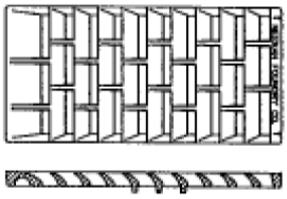
STORMWATER MANAGEMENT MANUAL

Chart Legend
Capacities for On-Grade Inlets

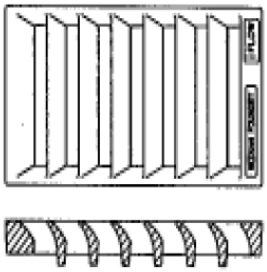
Grate-Only Inlets
Combination Inlets
Curb-Opening Inlets

Single Inlets
Double Inlets
Triple Inlets

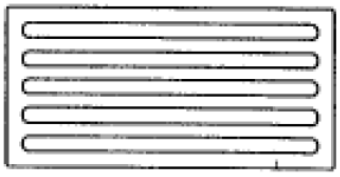
Standard Single Grate-Only or Combination Inlet
Length = 3'
Standard Single Curb-Opening Length = 5'



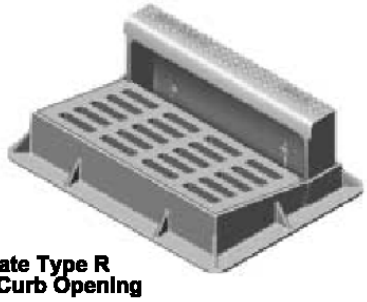
Grate Type L



Grate Type V



Grate Type D



Grate Type R w/Curb Opening

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ADDED GRATE DIAGRAMS	12/6/07
FIGURE VARIABLES	12/31/07

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REFERENCE:

FIGURE 28.44.120(a)

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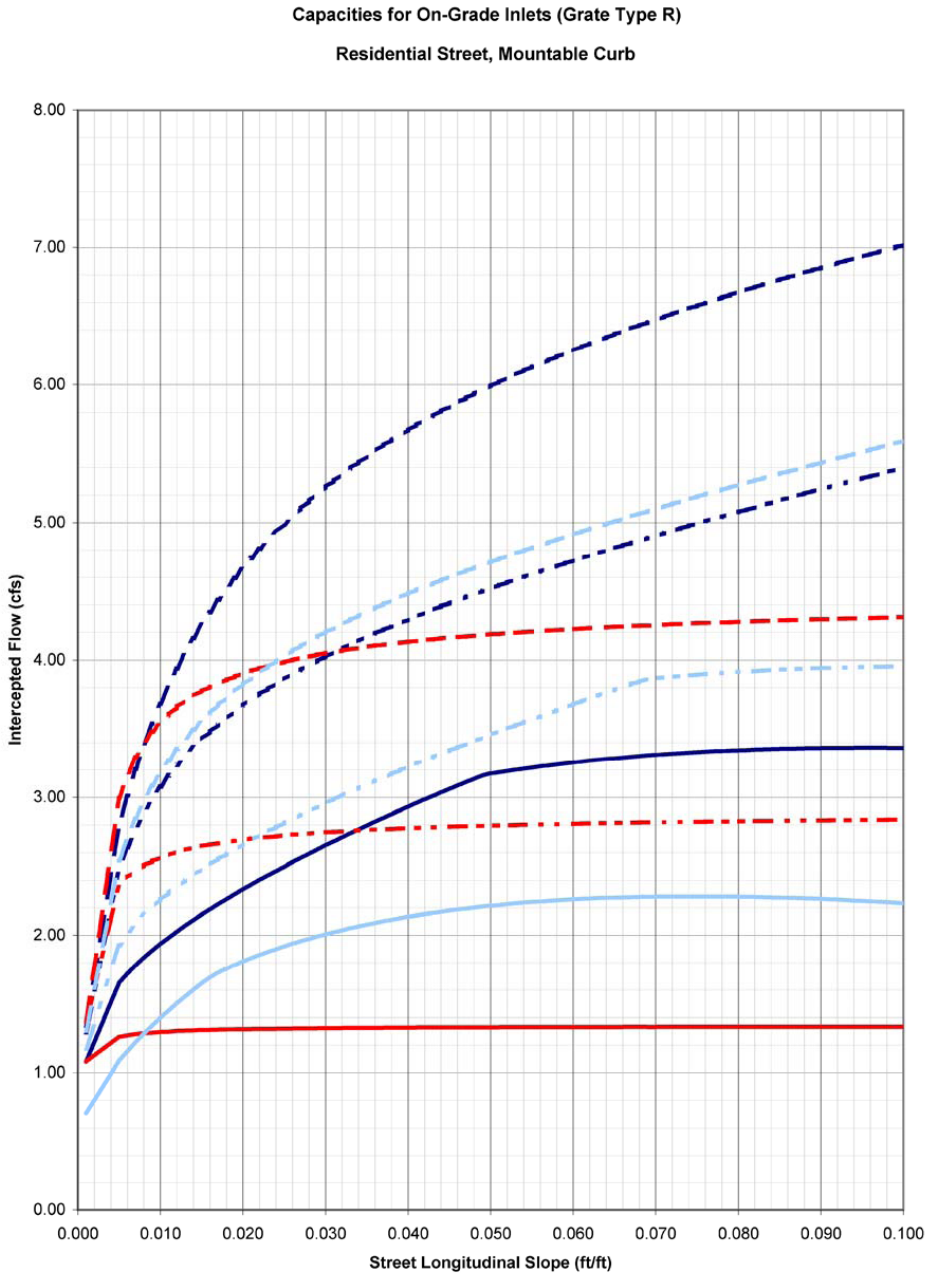

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ORIGINAL ISSUE	3/27/06
FIGURE VARIABLES	12/31/07

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REFERENCE:

FIGURE 28.44.120(b)

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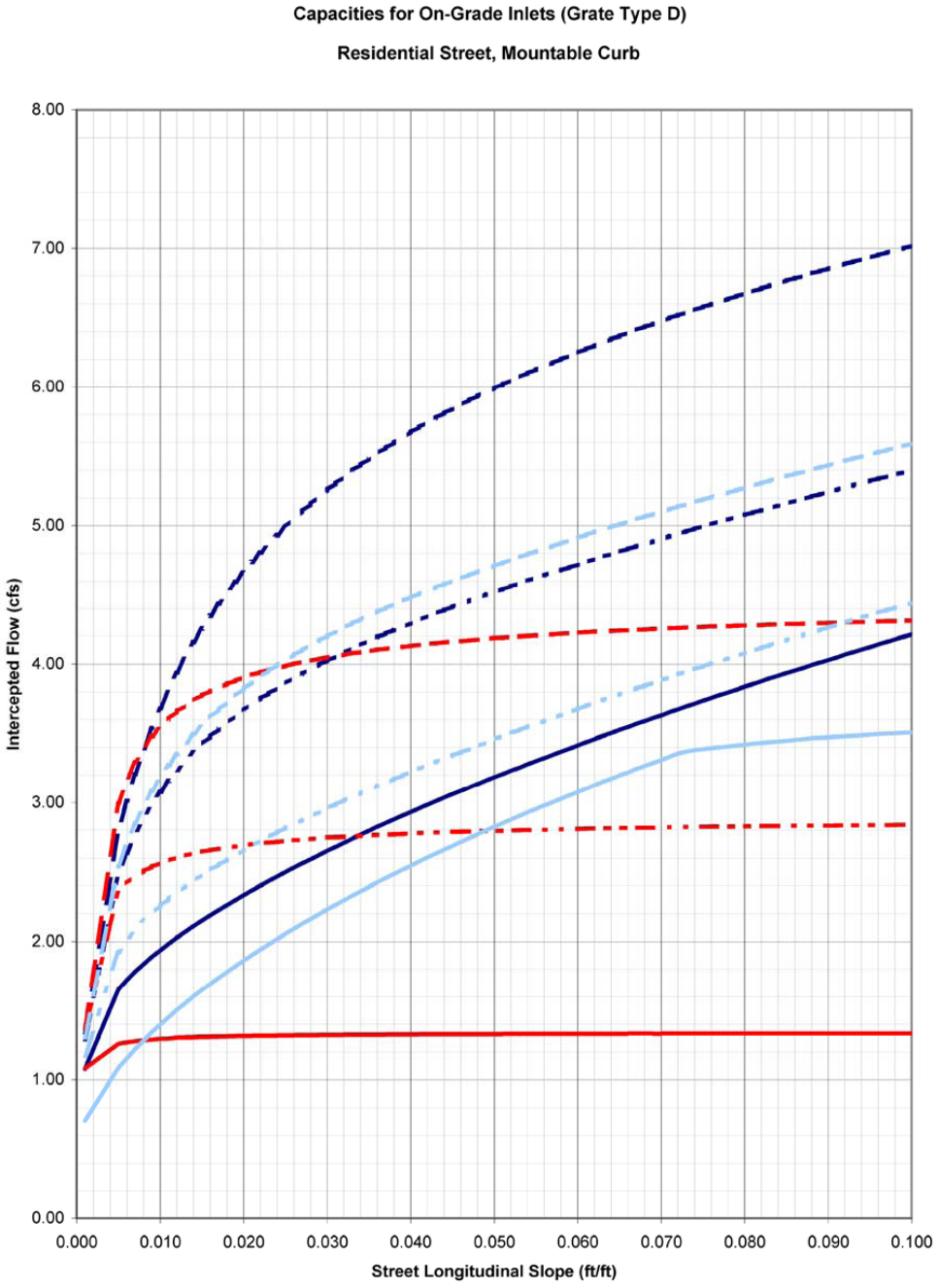

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FIGURE VARIABLES	12/31/07

UTC ENGINEERING, INC.	REFERENCE:	**FIGURE 28.44.120(c)**

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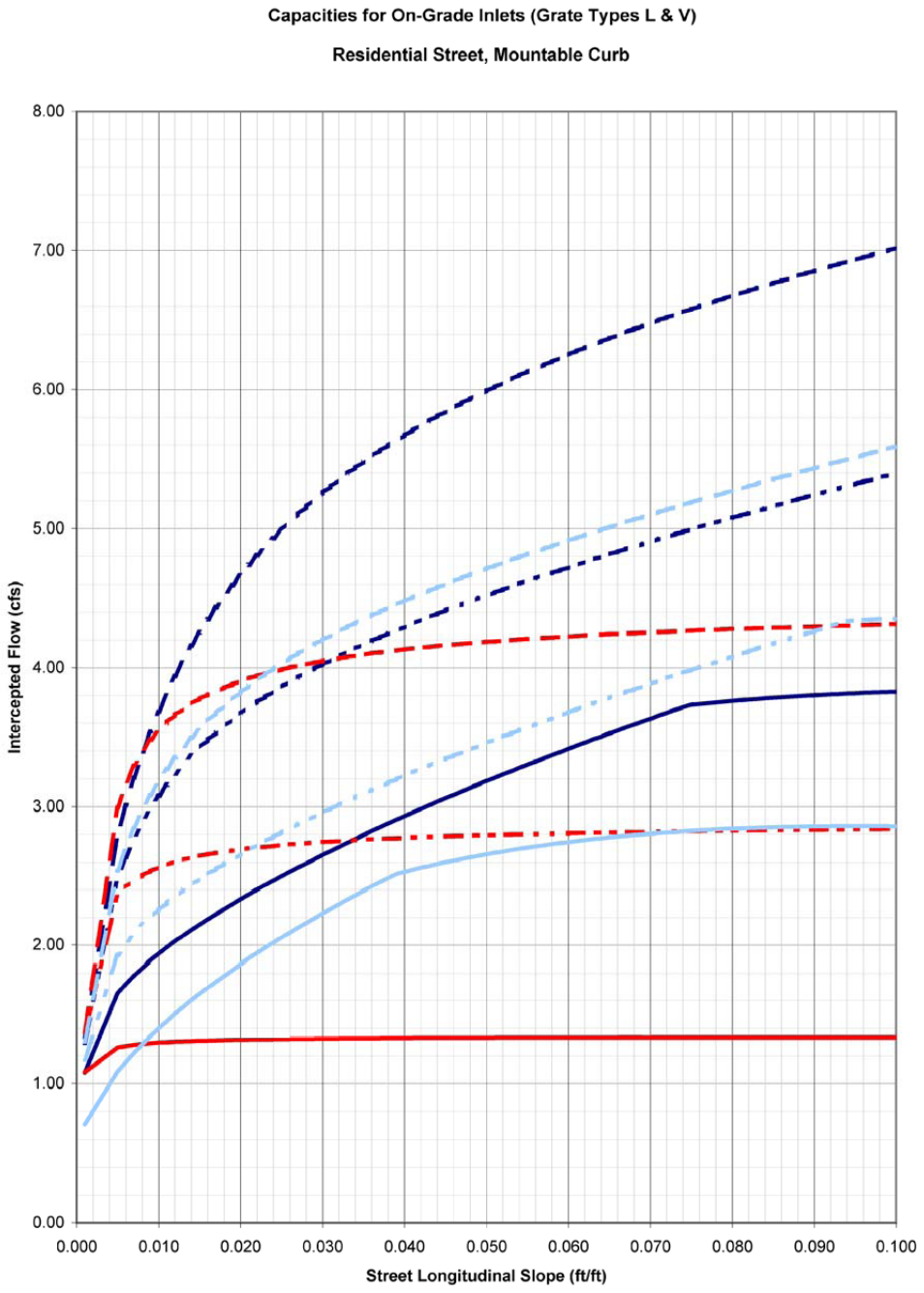

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ORIGINAL ISSUE	12/6/07
FIGURE VARIABLES	12/31/07

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REFERENCE:

FIGURE 28.44.120(d)

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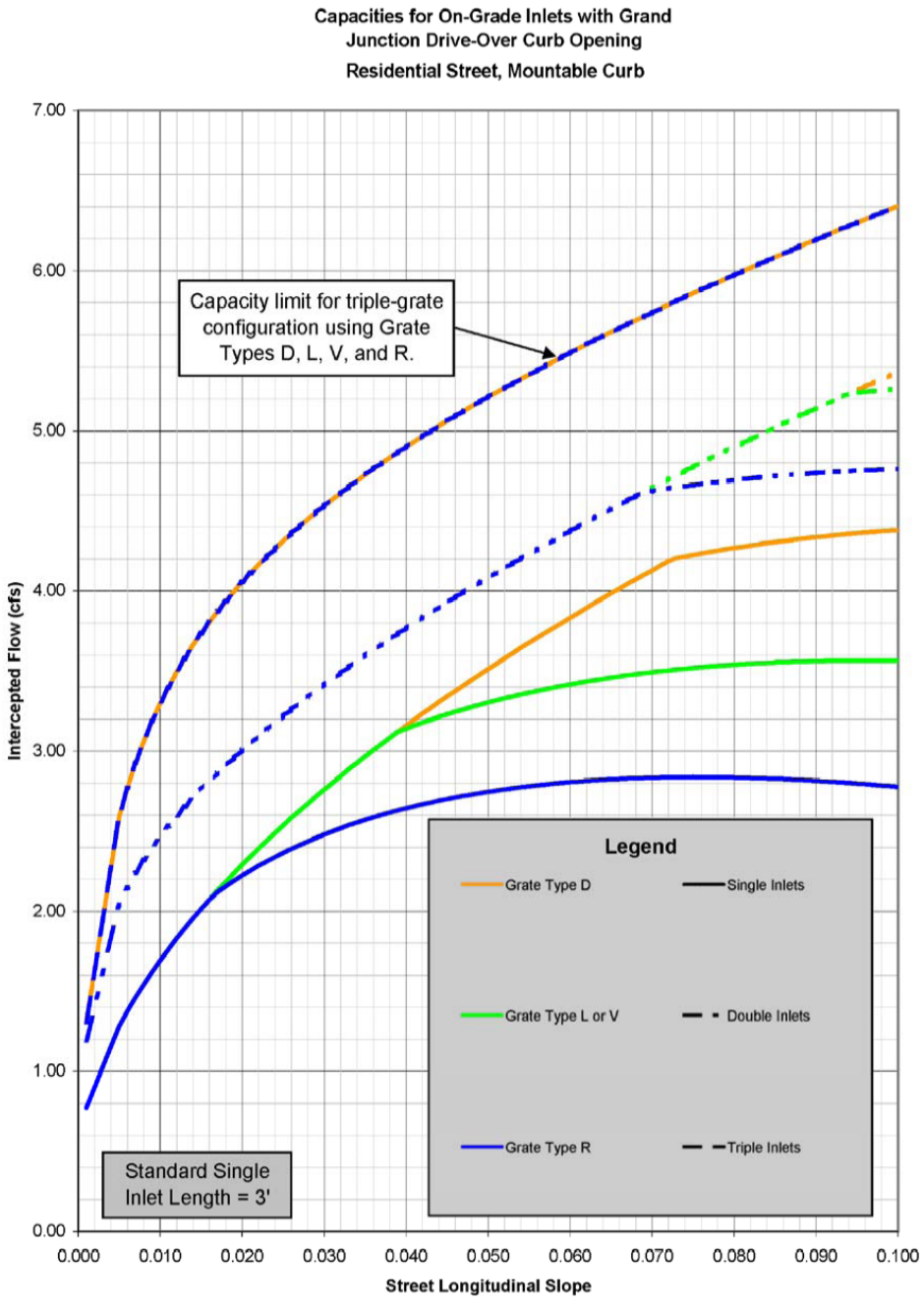

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ORIGINAL ISSUE	12/31/07

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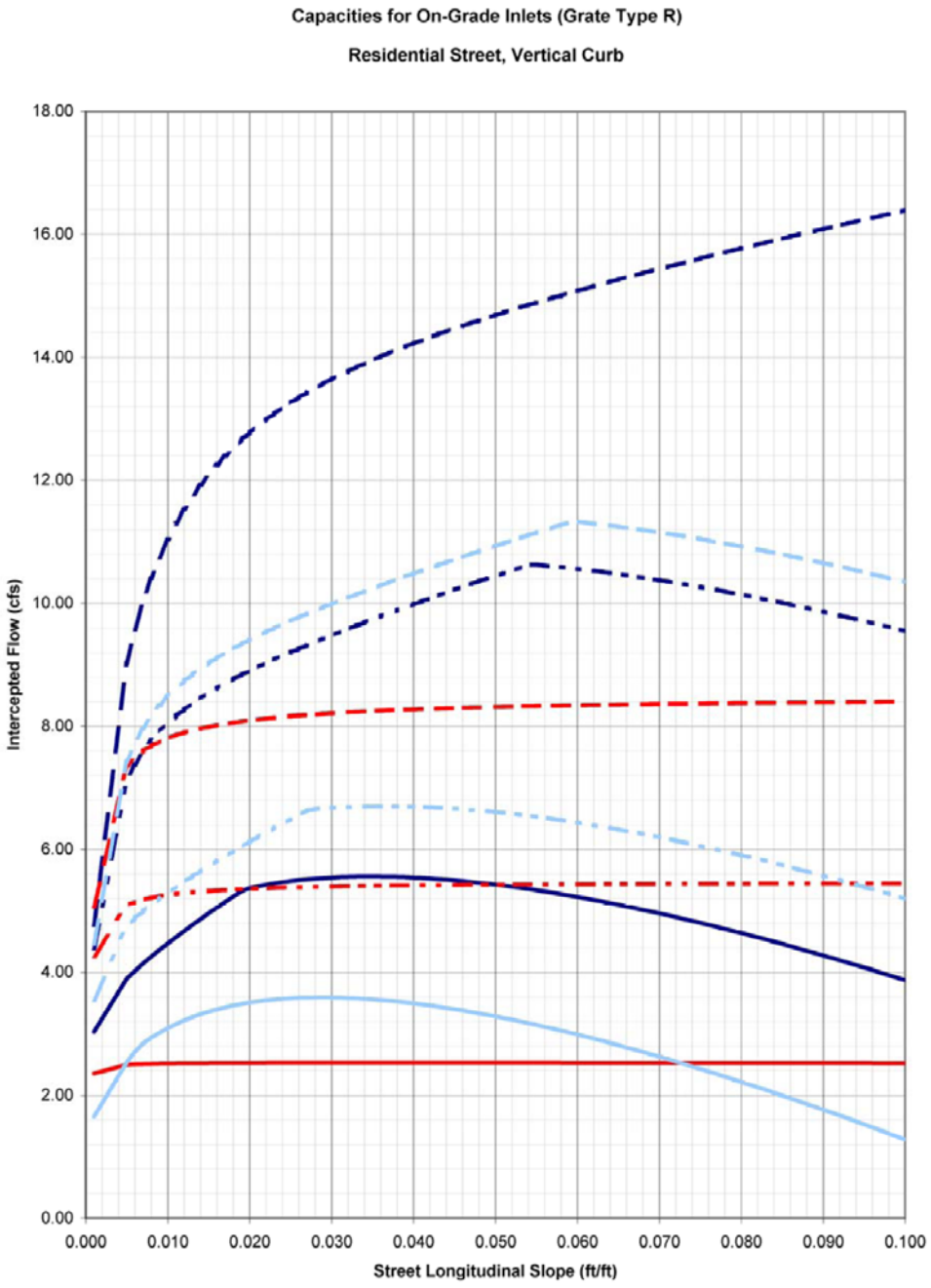
REFERENCE:

FIGURE 28.44.120(e)

STORMWATER MANAGEMENT MANUAL



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ORIGINAL ISSUE	3/27/06
FIGURE VARIABLES	12/31/07

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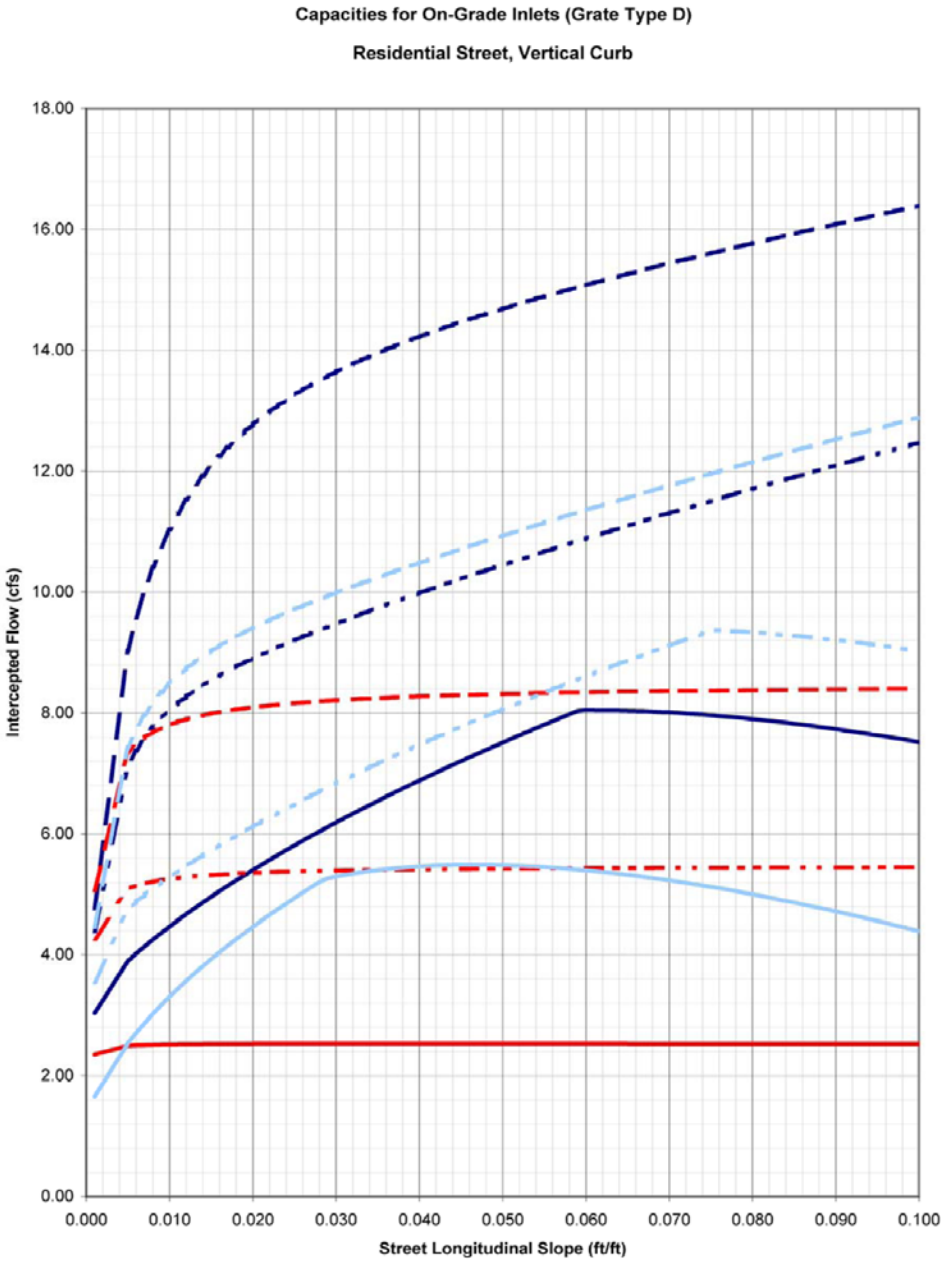
REFERENCE:

FIGURE 28.44.120(f)

STORMWATER MANAGEMENT MANUAL



Revision	Date
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FIGURE VARIABLES	12/31/07

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REFERENCE:

FIGURE 28.44.120(g)

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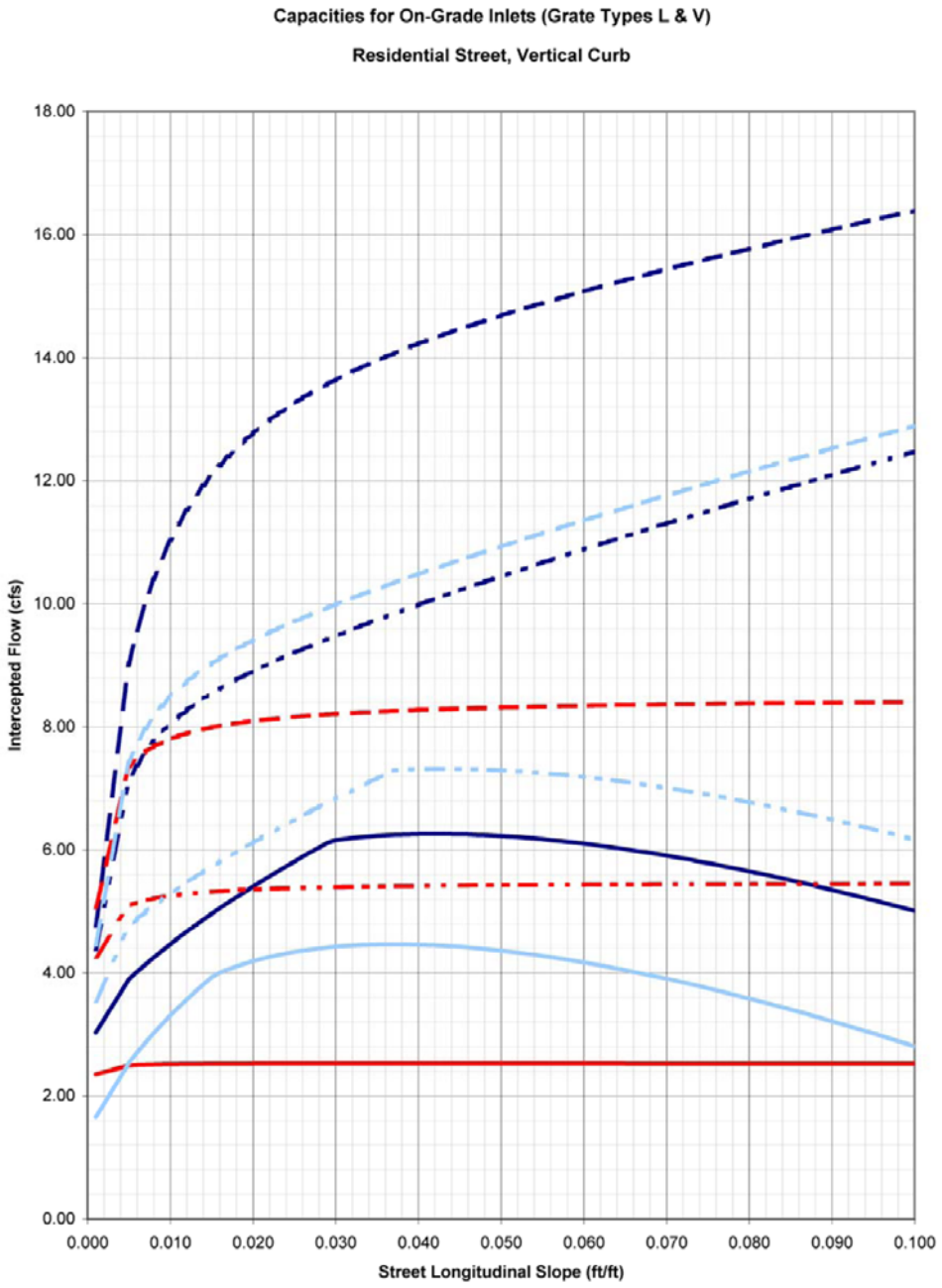

Revision	Date
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FIGURE VARIABLES	12/31/07

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REFERENCE:

FIGURE 28.44.120(h)

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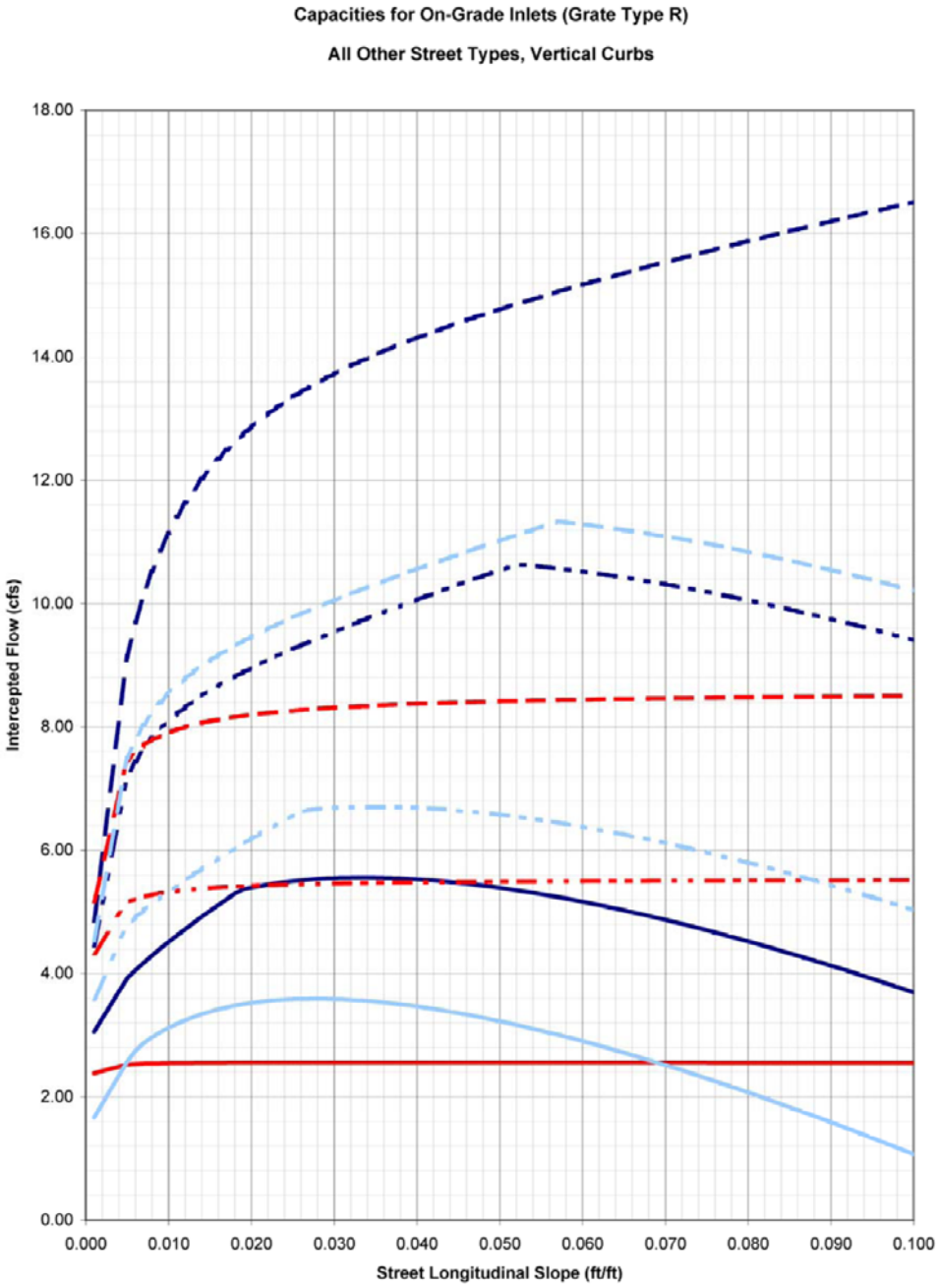

Revision	Date
ORIGINAL ISSUE	3/27/06
FIGURE VARIABLES	12/31/07

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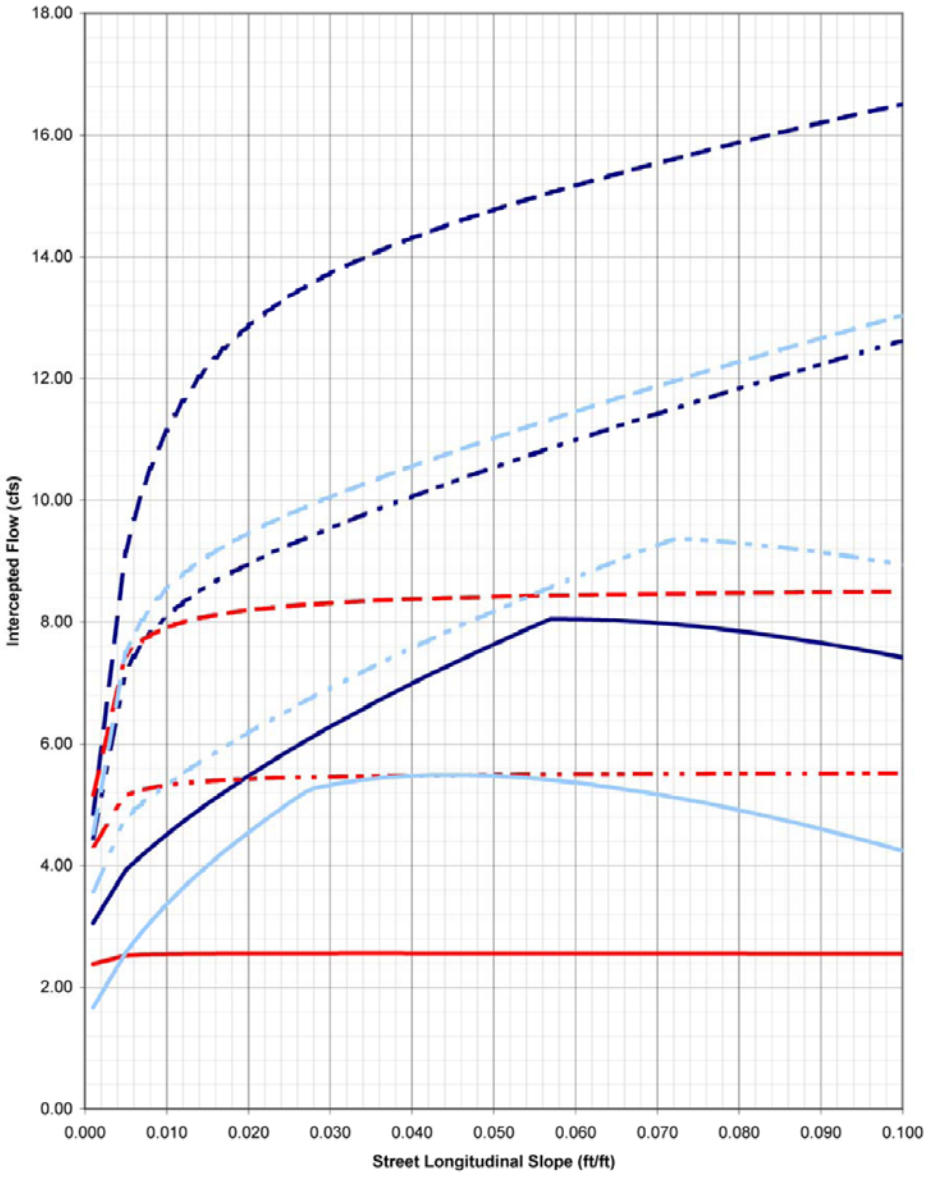
REFERENCE:

FIGURE 28.44.120(i)

STORMWATER MANAGEMENT MANUAL

Capacities for On-Grade Inlets (Grate Type D)

All Other Street Types, Vertical Curbs



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ORIGINAL ISSUE	3/27/06
FIGURE VARIABLES	12/31/07

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REFERENCE:

FIGURE 28.44.120(j)

STORMWATER MANAGEMENT MANUAL

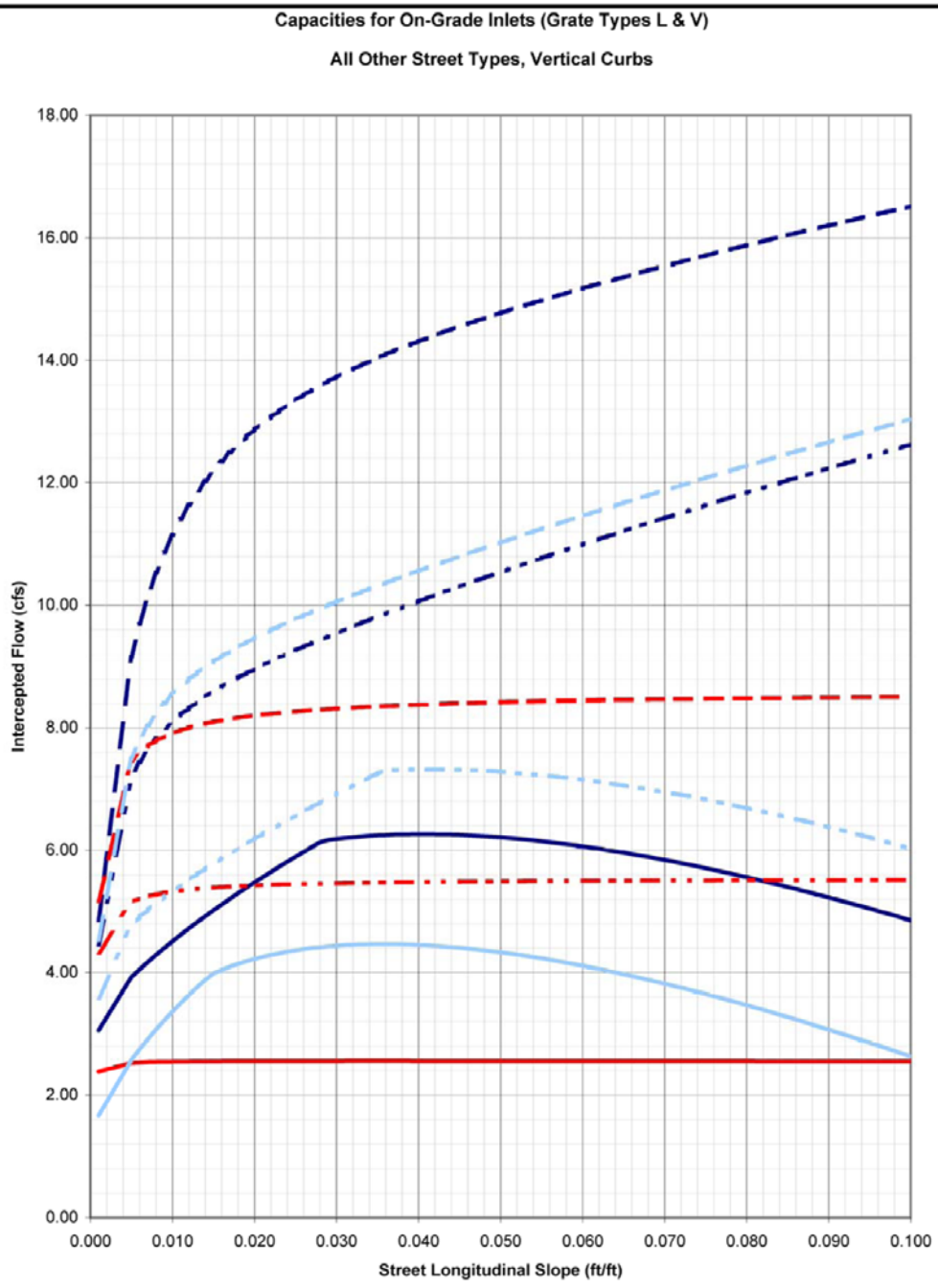

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FIGURE VARIABLES	12/31/07

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REFERENCE:

FIGURE 28.44.120(k)

(b) Curb-Opening Inlets. The interception capacity of a curb-opening inlet on a continuous grade is dependent on inlet length, flow depth, and the longitudinal and cross slopes of the street. To determine the capture efficiency of a curb-opening inlet, one must first calculate the length that would be required for 100 percent interception of the gutter flow at that location (L_T):

$$L_T = 0.6Q^{0.42}S_L^{0.3}\left(\frac{1}{n \cdot S_e}\right)^{0.6} \quad (28.44\text{-}15)$$

$$S_e = S_X + \left(a/W\right)E_o \quad (28.44\text{-}16)$$

Where:

Q	=	Total Gutter Flow (cfs)
S_L	=	Longitudinal Street Slope
n	=	Manning's Roughness Coefficient
S_e	=	Equivalent Cross Slope
S_X	=	Street Cross Slope
a	=	Gutter Depression Below Street Slope (ft.)
W	=	Gutter Width (ft.)
E_o	=	Defined by Equation 28.44-3

The efficiency of a curb-opening inlet is calculated using Equation 28.44-17, where effective length L_e is defined in Equation 28.44-24 (GJMC 28.44.140):

$$E = 1 - \left[1 - \left(L_e / L_T\right)\right]^{1.8} \quad \text{where } L_e < L_T, \text{ otherwise } E = 1.0 \quad (28.44\text{-}17)$$

Included in **Figures 28.44.120(b)** through **28.44.120(k)** are inlet capacity charts for all street types, grate types, inlet types and curb-and-gutter configurations considered by this manual. Each figure is specific to the type of grate used. The capacity curves for all on-grade inlets are specific to a single inlet length of 5.0 feet for curb-opening-only inlets and 3.0 feet for both grate-only and combo inlets. **Figure 28.44.120(e)** is the inlet capacity chart for the Grand Junction Drive-Over inlet with its own legend. It assumes the curb height is 4.5 inches, the flow line of the frame and grate is one inch below normal gutter flow line, and the vertical opening is set at one inch in height. Curves are provided for single, double, or triple length. All curves include appropriate clogging factors per GJMC 28.44.140. Inlet capacity values calculated from the provided equations may be used if they do not exceed the values provided in the inlet capacity charts.

(c) Combination Inlets. Per the introduction to this section, combination inlets are assumed to have the capacity of the same inlet with the grate(s) acting alone except in the case of "sweeper inlets." However, the designer shall note the reduced clogging susceptibility of the combination inlet when compared with a grate-only configuration noted in GJMC 28.44.140.

(d) Slotted Drain Inlets. Slotted drains are effective for intercepting flow over a wide section, such as sheet flow across the pavement of a street. However, these inlets are highly susceptible to clogging, and are only allowed as specifically approved by a local jurisdiction. Methods for the design of such inlets can be found in HEC-12 and HEC-22.

(Res. 40-08 (§ 1106.1), 3-19-08)

28.44.130 Hydraulic capacity of inlets in sump conditions.

A sag or sump condition occurs in a location where water that flows into the area must pond to some depth before any of the flow can escape the area via channel or overland flow. Unlike inlets on a continuous grade, those in a sump condition are not designed to bypass a portion of the flow incident to the inlet location. This means that these inlets must have the capacity to effectively capture all of the runoff that ponds in the sump and to maintain acceptable ponding depths.

These requirements, along with an increased potential for inlet clogging due to low flow velocities, necessitate special provisions for the design of sump inlets. A secondary flow path must be provided to maintain a reasonable ponding depth in the case of inlet failure (near-complete clogging, for instance). The preferred secondary flow path is a designated emergency overflow weir and channel, which must be located within an accessible drainage easement and must be protected from erosive effects as necessary by pavement or riprap. If no easement is available at the inlet location, flanker inlets must be installed in the same gutter on each side of the primary inlet. Flanker inlets are located upgradient 10 to 50 feet from the primary sump inlet. The two flanker inlets shall have a combined design capacity equal to or greater than that of the primary inlet.

Local jurisdictions recommend the use of combination inlets in sumps due to their higher capacity and lower clogging tendency. Curb-opening inlets are also allowable, but grate-only inlets and slotted-drain inlets are not allowed for use in sump conditions.

Per GJMC 28.44.120(a), Type L and Type V grates are prohibited for use with inlets located in sumps. Mesa County and the City of Grand Junction have approved grate Types D and R for inlets in these locations.

The hydraulic capacity of an inlet in a sump condition is dependent on the configuration of the inlet and the depth of the ponded water. At small depths, the flow into the inlet is by weir flow, transitioning to orifice flow at increasing depths. These depths are defined in **Table 28.44.130**.

The gross capacity of an inlet operating as a weir is defined by Equation 28.44-18:

$$Q_i = C_w L_w d^{1.5} \qquad (28.44\text{-}18)$$

Where:

Q_i	=	Inlet Capacity (cfs)
L_W	=	Weir Length (ft.)
d	=	Flow of Ponding Depth (ft.)
C_W	=	Weir Discharge Coefficient (see **Table 28.44.130**)

The gross capacity of an inlet operating as an orifice is defined by Equation 28.44-19:

$$Q_i = C_o A_o (2 \cdot g \cdot d_o)^{0.5} \qquad (28.44\text{-}19)$$

Where:

Q_i	=	Inlet Capacity (cfs)
A_o	=	Orifice Open Area (sf)
g	=	32.2 ft./s^2
d_o	=	Depth to Orifice Centroid (ft.)

C_o = Orifice Discharge Coefficient (see **Table 28.44.130**)

Table 28.44.130: Discharge Coefficients and Variable Definitions for Inlets in a Sump Condition

Type of Inlet	C_w	C_o	Weir	Orifice	L_w
Grate	3.00	0.67	$d < 1.79(A_o/L_w)$	$d > 1.79(A_o/L_w)$	2w+L
Curb-Opening	3.00	0.67	$d < h$	$d > 1.4h$	L
Depressed Curb-Opening	2.30	0.67	$d < h + a$	$d > 1.4h$	2w+L

Where:

A_o = Orifice Open Area (sf)

L_W = Weir Length (ft.)

d = Flow or Ponding Depth

w = Grate Width (ft.)

L = Inlet Length (ft.)

It is important to note that the capacity of a combination inlet in a sump is defined by the capacity of the grate portion only when operating as a weir (the curb opening is ineffectual and thus ignored), but is defined by the cumulative capacity of the grate and curb opening when operating as an orifice. Any curb opening length extending beyond the ends of the grates may be included in the weir length.

For any given inlet, a certain range of depths will result in transitional flow, where neither the weir equation nor the orifice equation accurately models flow through the inlet. Linsley (1992) states that where transition conditions exist, "the capacity is intermediate between that of an orifice and a weir." For design purposes, the capacity for depths in the transitional range is based on the lesser of the results of Equations 28.44-18 and 28.44-19.

Local inlet depression increases the capacity of inlets, especially those in sumps, by increasing the depth over the inlet without increasing street flow depth. Local depression loses effectiveness for curb-opening inlets of 12-foot length or greater, so the "Curb-Opening" information from **Table 28.44.130** shall be used for these. **Figure 28.44.130** contains two tables with maximum inlet capacities for inlets with a two-inch local depression and without depression (level with curb flow line). The first capacity table is for the standard six-inch vertical curb configuration (applies to most streets in Mesa County) and the second table contains values for the 4.5-inch mountable (drive-over) curb. All capacities listed in **Figure 28.44.130** include a clogging factor per GJMC 28.44.140.

STORMWATER MANAGEMENT MANUAL

Maximum Inlet Capacities
Sump or Sag Condition

	INLET TYPE	6-INCH VERTICAL CURB					
		SINGLE		DOUBLE		TRIPLE	
		2-YR	100-YR	2-YR	100-YR	2-YR	100-YR
2-INCH CURB-OPENING DEPRESSION	COMBINATION INLET (TYPE D GRATES)	9.8	12.4	14.7	20.1	19.6	27.8
	COMBINATION INLET (TYPE R GRATES)	9.8	11.1	14.7	18.8	19.6	26.5
	CURB-OPENING INLET CAPACITY	7.7	10.3	12.7	20.6	15.0	30.9
NO CURB-OPENING DEPRESSION	COMBINATION INLET (TYPE D GRATES)	6.4	9.3	9.5	14.2	12.7	19.1
	COMBINATION INLET (TYPE R GRATES)	5.1	8.1	9.5	13.0	12.7	17.9
	CURB-OPENING INLET CAPACITY	4.1	6.5	8.3	13.1	12.4	19.6

	INLET TYPE	4.5-INCH MOUNTABLE CURB					
		SINGLE		DOUBLE		TRIPLE	
		2-YR	100-YR	2-YR	100-YR	2-YR	100-YR
2-INCH CURB-OPENING DEPRESSION	COMBINATION INLET (TYPE D GRATES)	7.2	10.8	10.8	16.8	14.4	22.7
	COMBINATION INLET (TYPE R GRATES)	7.2	9.4	10.8	15.4	14.4	21.4
	CURB-OPENING INLET CAPACITY	5.6	8.0	9.3	16.0	11.0	23.9
NO CURB-OPENING DEPRESSION	COMBINATION INLET (TYPE D GRATES)	4.1	7.8	6.2	10.9	8.3	14.1
	COMBINATION INLET (TYPE R GRATES)	4.1	6.5	6.2	9.7	8.3	12.8
	CURB-OPENING INLET CAPACITY	2.3	4.2	4.7	8.5	7.0	12.7

See Chart Legend (Figure 26.44.120(a)) for standard inlet lengths.

Inlet capacities shown above are based upon the following:
1. Type D grate used for calculation is Neenah model R-3577.
2. Type R grate used for calculation is Neenah model R-3289-C.
3. Angled- and curved-vane grates are not allowed for sump or sag design conditions.
4. Capacities shown are based upon maximum ponding depths for the 2-year and 100-year storm events:
   a. 2-year event maximum ponding depth: curb height
   b. 100-year event maximum ponding depth: 1.0 foot
5. Combination inlets are preferred for sump or sag conditions. Curb-opening inlets without grates are allowed.
6. Grate-only inlets are not allowed for sump or sag conditions.

Revision	Date
ORIGINAL ISSUE	3/27/06
REVISED CALCULATIONS	12/20/07

WRC ENGINEERING, INC.

REFERENCE: HEC-12, FHWA
WATER-RESOURCES ENGINEERING, LINSLEY (1992)
GRAND JUNCTION STANDARD DETAILS

FIGURE 28.44.130

(Res. 40-08 (§ 1106.2), 3-19-08)

28.44.140 Inlet clogging considerations.

Inlets are always susceptible to clogging when water flows to them. Low flows can carry leaves and finer sediments and deposit them at the inlet, while higher flows can deposit larger debris. The latter is of most concern since it is often too large to be washed down the inlet, even with heavy storm flows. Proper inlet design and timely maintenance including street sweeping, visual inspection of inlets, and removal of large debris are essential to the proper operation of inlets. The clogging factors listed in **Table 28.44.140** are based on the assumption that routine maintenance is performed on all drainage structures.

Table 28.44.140 contains the assumed clogging factors for different inlet types. A value of zero percent indicates that no clogging is expected, and a value of 100 percent indicates that the inlet shall be considered completely clogged or is not allowed in the specified conditions.

Table 28.44.140: Clogging Factors for Single Inlets

Type of Inlet	On-Grade	Sag/Sump $d \leq 0.5$ ft.	Sag/Sump $d > 0.5$ ft.
Grate	50%	100%	100%
Curb-Opening	20%	20%	20%
Combination (Grate Portion)	0%	0%	50%
Combination (Curb-Opening Portion)	100%	100%	0%

In the case of multiple (double or triple) inlets, the continuous (linear) application of some of these factors would result in the inability to capture 100 percent of the flow incident to the subject inlet. Although on-grade inlets are rarely designed to capture 100 percent of gutter flow from the minor storm event, inlet design lengths may become unnecessarily long to achieve the desired flow interception rate. It is reasonable to assume that a majority of the sediment and debris is deposited at the inlet by the first few minutes of significant storm flow, possibly before the peak flow occurs at that inlet. Also, the majority of clogging tends to more greatly affect the upgradient segments of a multi-unit inlet. For instance, the first grate of a triple inlet may become 50 percent clogged, while the third grate experiences only 10 percent clogging. This phenomenon was generalized by Guo in *Design of Grate Inlets with a Clogging Factor* (2000) using a decay equation and empirically-derived decay factors. It may be applied to inlets on a continuous grade and inlets in sump conditions.

$$C = \frac{1}{N}\left(C_o + eC_o + e^2C_o + \ldots + e^{N-1}C_o\right) = \frac{C_o}{N}\sum_{i=1}^{i=N} e^{i-1} \qquad (28.44\text{-}20)$$

Where:

C	=	Multiple-Unit Clogging Factor (decimal)
C_o	=	Single-Unit Clogging Factor (decimal)
N	=	Number of Units
e	=	Decay Ratio
e	=	0.5 for grates, 0.25 for curb-opening inlets

This adjusted clogging factor can be applied to the sump-inlet capacity equations (Equations 28.44-18 and 28.44-19) by replacing the variables for weir length L_w with effective weir length (L_{we}) from Equation 28.44-21 and orifice area A_o with effective opening area (A_{oe}) from Equation 28.44-22. The clog-

ging factor may also be applied directly to the gross flow capacities from Equations 28.44-18 and 28.44-19 using Equation 28.44-23.

$$L_{we} = (1 - C)L_w \quad (28.44\text{-}21)$$

$$A_{oe} = (1 - C)A_o \quad (28.44\text{-}22)$$

$$Q_i(\text{net}) = (1 - C)Q_i \quad (28.44\text{-}23)$$

To apply the clogging factor to an on-grade inlet, the designer must first find the effective length (L_e) – that portion of the inlet length which is considered unclogged.

$$L_e = (1 - C)L \quad (28.44\text{-}24)$$

This value is used in the computation of splash-over velocity in Equation 28.44-10, side-flow interception ratio in Equation 28.44-12, and curb-opening efficiency in Equation 28.44-17.

(Res. 40-08 (§ 1106.3), 3-19-08)

28.44.150 Grate selection and rating.

Selection of grates for on-grade and sump inlets must be consistent with GJMC 28.44.120(a) and the page titled "Approved Storm Drain Inlets" (D-05) of the City of Grand Junction Standard Details. The designer is urged to obtain any grate rating data available from the manufacturer of the selected grate. This data may be used to cross-check the values obtained using the methods presented in this manual and/or to obtain interception and capacity values. However, in the latter case, it is imperative that the designer still incorporate all clogging/safety factors that apply to the inlet design per local jurisdictions' requirements.

(Res. 40-08 (§ 1106.4), 3-19-08)

28.44.160 Inlet location and spacing.

Inlets shall be placed at any location where ponding water may encroach on street traffic beyond the allowable limits. These limits are defined by gutter flow depth during the minor storm event (GJMC 28.44.090). An inlet location is determined using an iterative process:

(a) Determine a preliminary location for the inlet based on street configuration and estimated runoff to the gutter.

(b) If the inlet is in a sump, location is essentially fixed during the remainder of the design process. The inlet shall be sized to maintain ponding depths smaller than those required by local jurisdictions. If the required inlet size becomes excessively large, the designer is urged to install additional inlets upgradient from the sump.

(c) For inlets on a grade, the designer must find the flow characteristics at the selected preliminary inlet location to determine whether the inlet needs to be placed further upstream or may be moved downstream based on maximum flow depth for the minor storm event.

(d) The designer shall take into account the change in tributary area to the inlet associated with any upstream or downstream movement.

(e) A typical design interception efficiency of an on-grade inlet is 70 to 80 percent. As mentioned previously, on-grade inlets designed to capture 100 percent of the minor storm runoff tend to be significantly less effective both hydraulically and economically.

(f) The designer shall include any carryover (bypass) flow from an upstream inlet when calculating the flow at a downstream inlet. Although the peak runoff to an inlet may not coincide with the peak carryover flow from an upstream inlet, these two peak flows shall be added to find the total peak flow to the downstream inlet.

Maximizing the use of sump inlets tends to increase the overall efficiency of the inlet system, and inlets must be installed at all street sags (vertical curve low points) and at all sumps formed by intersections except where other drainage provisions have been made. Therefore, it is suggested that sump inlets are located prior to the placement of any on-grade inlets during the design process.

(Res. 40-08 (§ 1106.5), 3-19-08)

Chapter 28.48

CULVERTS AND BRIDGES

Sections:

28.48.010 Introduction.
28.48.020 Culvert hydraulics.
28.48.030 Required design information.
28.48.040 Inlet control.
28.48.050 Outlet control.
28.48.060 Culvert sizing and design.
28.48.070 Size and material.
28.48.080 Location.
28.48.090 Culvert Design Form.
28.48.100 Inlet control calculation.
28.48.110 Outlet control calculation.
28.48.120 Evaluation of results.
28.48.130 Outlet velocity calculation.
28.48.140 Computer applications.
28.48.150 Outlet protection.
28.48.160 Trash/safety racks.
28.48.170 Culvert inlets.
28.48.180 Projecting inlets.
28.48.190 Inlets with headwalls.
28.48.200 Tapered inlets.
28.48.210 Bridge hydraulics.
28.48.220 Hydraulic analysis.
28.48.230 Expression of backwater.
28.48.240 Backwater coefficient.
28.48.250 Effect of M and abutment shape (base curves).
28.48.260 Effect of piers (normal crossings).
28.48.270 Bridge sizing and design.
28.48.280 Example application – Culvert sizing.

28.48.010 Introduction.

The purpose of this chapter is to provide information for the hydraulic design of culverts and bridges. The methodology of culvert and bridge design presented in this chapter is intended for those with a good understanding of basic hydrologic and hydraulic methods and with experience in the design of hydraulic structures. The experienced designer is assumed to be able to understand the variety of flow conditions which are possible in these complex hydraulic structures and make appropriate adjustments.

Culverts and bridges are used to convey surface water through or beneath engineered structures such as highways, railroads, or other embankments. The size, alignment, and support structures of a culvert or bridge will directly affect the carrying capacity of the drainage system. Inadequate culvert or bridge capacity can force water out of the conveyance system, flood an alternate path, and cause damage away from the channel.

In addition to the hydraulic function, culverts and bridges must carry construction, highway, railroad, or other traffic and earth loads. Therefore, culvert and bridge design involves both hydraulic and structural design considerations. The hydraulic aspects of culvert and bridge design are covered in this chapter.

A careful approach to culvert and bridge design is essential, both in new land development and retrofit situations, because culverts and bridges often significantly influence upstream and downstream flood risks, floodplain management, and public safety.

(Res. 40-08 (§ 1201), 3-19-08)

28.48.020 Culvert hydraulics.

This chapter presents the general procedures for hydraulic design and evaluation of culverts. The user is assumed to possess a basic knowledge of culvert hydraulics and is encouraged to review the technical literature on the subject.

The information and references necessary to design culverts according to the procedure given in this chapter can be found in the Federal Highway Administration (FHWA) Hydraulic Design of Highway Culverts, Hydraulic Design Series No. 5 (HDS-5). Research by the National Bureau of Standards sponsored and supported by the FHWA resulted in a series of reports providing a comprehensive analysis of culvert hydraulics under various flow conditions. These data were used to develop culvert design aids, called nomographs. These nomographs are the basis for the culvert design process. The more commonly used nomographs from HDS-5 are provided in this chapter. HDS-5 is the required method for design of culverts in Mesa County and in the City of Grand Junction and shall be used for all situations not covered in this chapter.

Inlet and outlet control are the two basic types of flow in culverts. Under inlet control, the flow through the culvert is controlled by the headwater on the culvert and the inlet geometry. Under outlet control, the flow through the culvert is controlled primarily by culvert slope, roughness, and tailwater elevation.

When designing a culvert, the designer must evaluate both inlet and outlet control conditions for the given design constraints (e.g., discharge, headwater, tailwater, outlet velocity, etc.). The control condition which produces the greater energy loss for the design condition determines the appropriate control to use for the culvert design. Culvert hydraulic calculations shall be performed using rating nomographs and/or culvert hydraulic analysis programs.

(Res. 40-08 (§ 1202), 3-19-08)

28.48.030 Required design information.

(a) Discharge. Culverts are required where natural or manmade channels are crossed by roads or streets. The amount of channel flow which crosses over the road shall be minimized to protect the road embankment and pavement from erosion damage as well as to protect vehicles and pedestrians from dangerous flow depths and velocities. The policy of Mesa County and the City of Grand Junction shall be to require culvert crossings of streets within the following limitations:

Right-of-Way Width	Minimum Capacity (Recurrence Interval)
Major and minor arterial highways/greater than or equal to 80 feet	100-year (No Overflow)
Collector and local streets/less than 80 feet	100-year (See Note)

Note: A dipped overflow section may be allowed by the local jurisdiction if the maximum velocity does not exceed six feet per second and the maximum depth does not exceed 1.0 foot at the street crown.

All other culverts not crossing streets shall be designed to convey the 100-year flow unless otherwise approved by the local jurisdiction. In all cases 1.0 foot of freeboard must be maintained between the lowest point of the drive lane and the minor stormwater surface elevation. See GJMC 28.16.150 for additional discussion.

(b) Headwater. Energy is required to force flow through a culvert. This energy takes the form of an increased water surface elevation on the upstream side of the culvert. The depth of the upstream water surface measured from the invert at the culvert entrance is referred to as headwater. The maximum headwater for the 100-year design flow shall be 1.5 times the culvert diameter or culvert rise dimension.

A considerable volume of water may be ponded upstream of a culvert installation under high fills or in areas with flat ground slopes. The pond which is created may attenuate flood peaks under such conditions. This peak discharge attenuation may justify a reduction in the required culvert size, provided it is in compliance with applicable floodplain regulations.

(c) Tailwater. Tailwater is defined as the depth of water downstream of the culvert measured from the outlet invert. Tailwater may be caused by an obstruction in the downstream channel or by the hydraulic resistance of the channel. Backwater calculations from the downstream control point are required to precisely define tailwater. When appropriate, normal depth approximations may be used instead of backwater calculations.

(d) Outlet Velocity. Since a culvert usually constricts the available channel area, flow velocities in the culvert are likely to be higher than in the channel. These increased velocities can cause streambed scour and bank erosion in the vicinity of the culvert outlet. Minor problems can occasionally be avoided by increasing the barrel roughness.

The design of culverts shall include an analysis of the channel stability at the outlet to be governed by a maximum permissible mean velocity. This design method assumes that a given channel section will remain stable up to a maximum permissible velocity. **Table 28.32.200** in Chapter 28.32 GJMC, Open Channels, presents the maximum permissible velocities for several types of natural, improved, unlined, and lined channels. In the case of unlined channels, velocities exceeding the values shown shall require outlet protection. Velocities shall not exceed the values given for lined channels. See GJMC 28.48.150 for specific erosion protection requirements.

(Res. 40-08 (§ 1202.1), 3-19-08)

28.48.040 Inlet control.

Inlet control occurs when the culvert barrel is capable of conveying more flow than the inlet will accept. This is controlled at the entrance by the depth of headwater, cross-sectional area, inlet edge configuration, and/or barrel shape. Under inlet control, the culvert barrel usually flows partially full. The control section of a culvert operating under inlet control is located just inside the entrance. Critical depth occurs at or near this location, and the flow regime immediately downstream is supercritical. Hydraulic characteristics downstream of the inlet control section do not affect the culvert capacity.

Inlet control for culverts may occur in two ways, unsubmerged or submerged. In an unsubmerged condition, the headwater is not sufficient to submerge the top of the culvert and the culvert slope is supercritical, shown in **Figure 28.48.040(a)** (Urban Drainage and Flood Control District). In this situation, the culvert inlet acts like a weir.

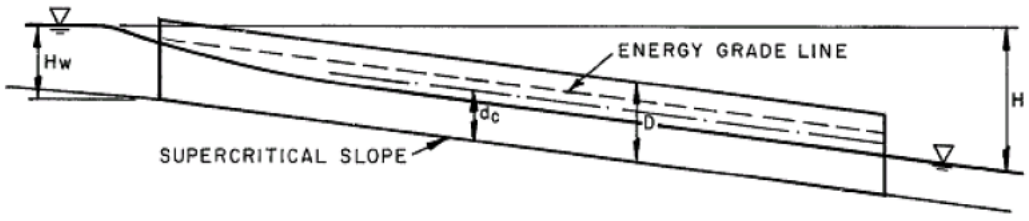


Figure 28.48.040(a): Inlet Control – Unsubmerged Inlet

In a submerged condition, the headwater submerges the top of the culvert but the pipe does not flow full, shown in **Figure 28.48.040(b)** (Urban Drainage and Flood Control District). In this situation, the culvert inlet acts like an orifice.

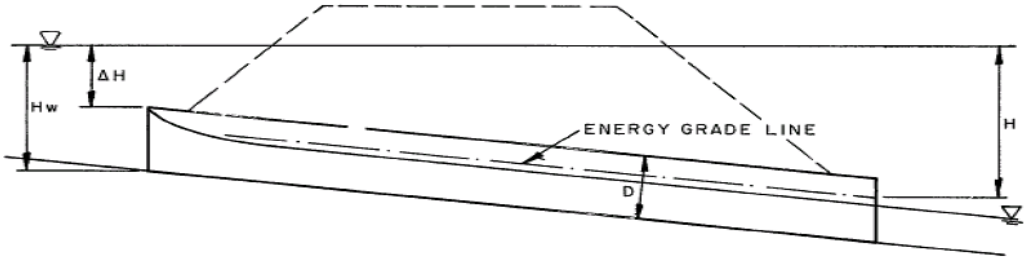


Figure 28.48.040(b): Inlet Control – Submerged Inlet

For a culvert operating with inlet control, the upstream water surface elevation and the inlet geometry represent the major flow controls. Roughness, slope, and length of the culvert barrel and outlet conditions, including tailwater, are not factors in determining culvert hydraulic performance.

(Res. 40-08 (§ 1202.2), 3-19-08)

28.48.050 Outlet control.

Outlet control flow occurs when the culvert barrel is not capable of conveying as much flow as the inlet opening will accept. The control section for the outlet control flow in a culvert is located at the barrel exit or further downstream. Either subcritical or pressure flow exists in the culvert barrel under these conditions. All of the geometric and hydraulic characteristics of the culvert play a role in determining its capacity. These characteristics include all of the factors governing inlet control, the water surface elevation at the outlet, and the slope, length, and hydraulic roughness of the culvert barrel.

Outlet control will govern if the headwater and/or tailwater are/is high enough, the culvert slope is relatively flat, and the culvert relatively long. Outlet control will exist under two conditions. The first and least common is that where the headwater is insufficient to submerge the top of the culvert, and the culvert slope is subcritical, shown in **Figure 28.48.050(a)** (Urban Drainage and Flood Control District).

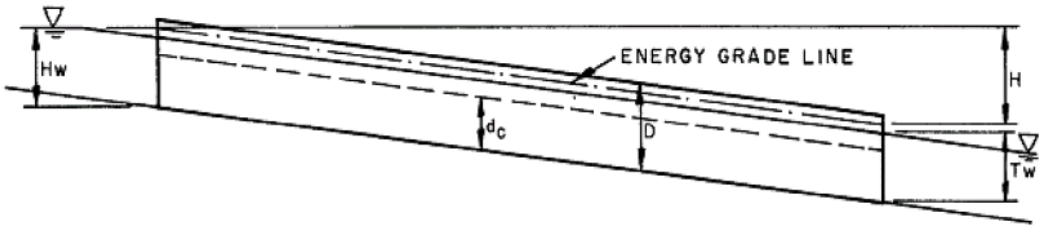


Figure 28.48.050(a): Partially Full Conduit

The most common condition exists when the culvert is flowing full, shown in **Figure 28.48.050(b)** (Urban Drainage and Flood Control District).

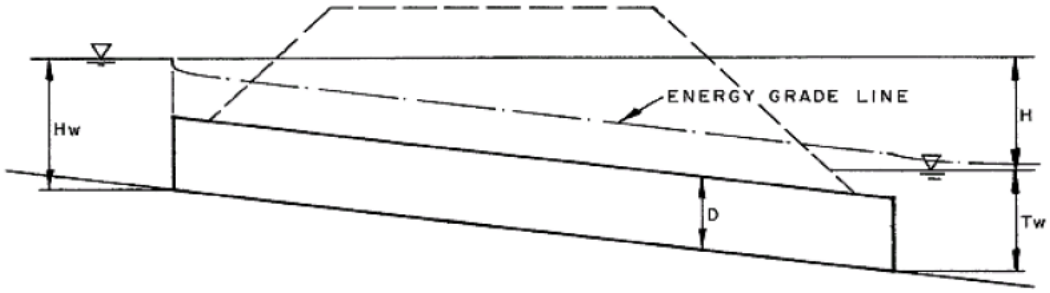


Figure 28.48.050(b): Full Conduit

Under outlet control, culverts may flow full or partly full depending on various combinations of the above factors. Performance of a culvert under outlet control may be affected by culvert length, roughness, and tailwater depth.

(Res. 40-08 (§ 1202.3), 3-19-08)

28.48.060 Culvert sizing and design.

All culverts shall be designed and constructed using the standards in GJMC 28.48.070 through 28.48.170. The analysis and design shall consider design flow, culvert size and material, upstream channel and entrance configuration, downstream channel and outlet configuration, and erosion protection.

(Res. 40-08 (§ 1203), 3-19-08)

28.48.070 Size and material.

Culverts shall be constructed from reinforced concrete, or acceptable polymers. For material other than concrete, documentation must be submitted for review which shows that the subject pipe material has a design equal to that of concrete and that the interior lining, if any, will maintain the design Manning's roughness coefficient, *n*, for the life of the pipe material. The minimum pipe size shall be a 12-inch diameter round pipe or shall have an equivalent 12-inch diameter round cross-sectional area for other shapes. Corrosion resistance shall be evaluated and determined as specified in Section 624 of the Colorado Department of Transportation *Standard Specifications for Road and Bridge Construction*, 2005.

(Res. 40-08 (§ 1203.1), 3-19-08)

28.48.080 Location.

Culvert location is an integral part of the total design. The designer shall identify all live stream crossings, springs, low areas, gullies, and impoundment areas created by the new embankment for possible culvert locations. Culverts shall be located on existing stream alignments and aligned to give the stream a direct entrance and direct exit. Abrupt changes in direction at either end may retard the flow and make a larger structure necessary. If possible, a culvert shall have the same alignment as its channel. If this is not practical and the water must be turned into the culvert, headwalls, wingwalls, and aprons shall be used as protection against scour and to provide an efficient inlet.

Where the natural alignment would result in an exceptionally long culvert, modification to the natural alignment may be necessary. Since such modifications will change the natural stability of the channel, an investigation into other options is recommended. Although the economic factors are important, the hydraulic effectiveness of the culvert must be given major consideration.

Roadway alignment also affects culvert design. The vertical alignment of roadways may define the maximum culvert diameter that can be used. Low vertical clearance may require the use of elliptical or arched culverts, or the use of a multiple-barrel culvert system. All culverts shall have a minimum of 1.5 feet of

cover from top of asphalt (or gravel for gravel road) to outside top of pipe. Culverts for which less than 1.5 feet of cover is available will require additional structural analysis and other provisions (i.e., full depth concrete paving to compensate for the loss of proper cover).

(Res. 40-08 (§ 1203.2), 3-19-08)

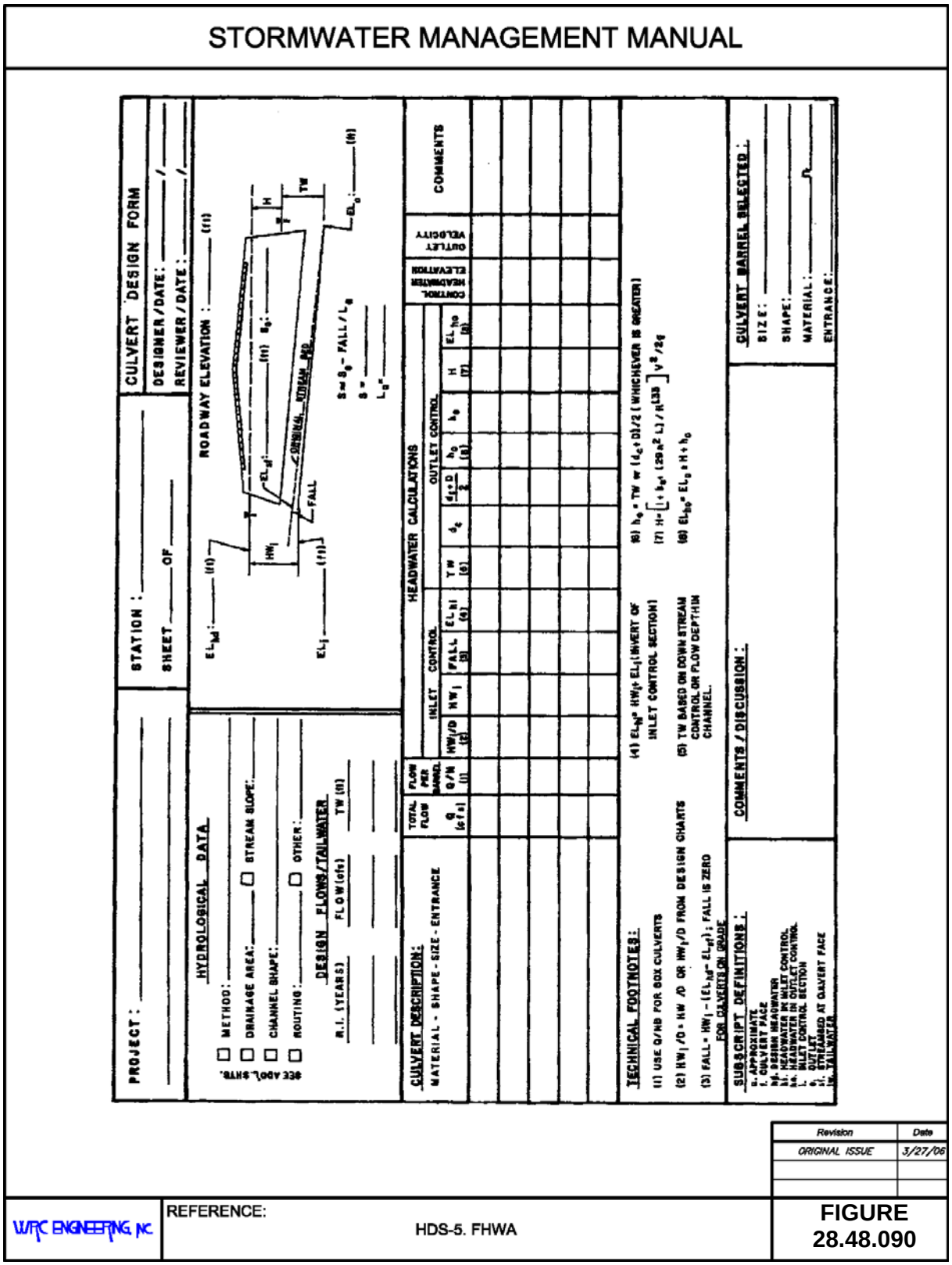
28.48.090 Culvert Design Form.

The Culvert Design Form, shown in **Figure 28.48.090**, has been formulated to guide the user through the design process. Summary blocks are provided at the top of the form for the project description and the designer's identification. Summaries of hydrologic data are also included. At the top right is a small sketch of the culvert with blanks for inserting important dimensions and elevations.

The central portion of the design form contains lines for inserting the trial culvert description and calculating the inlet and outlet control headwater elevations. Space is provided at the lower center for comments and at the lower right for a description of the culvert barrel selected.

The first step in the design process is to summarize all known data for the culvert at the top of the Culvert Design Form. This information will have been collected or calculated prior to performing the actual culvert design. The next step is to select a preliminary culvert material, shape, size, and entrance type. The user then enters the design flow rate and proceeds with the inlet control calculations.

The Culvert Design Form is also included in Chapter 28.68 GJMC as Standard Form 4.



(Res. 40-08 (§ 1203.3), 3-19-08)

28.48.100 Inlet control calculation.

The inlet control calculations determine the headwater elevation required to pass the design flow through the selected culvert configuration in inlet control. The approach velocity head may be included as part of the headwater, if desired. Inlet control nomographs are used in the design process. Inlet control nomographs for typical configurations are included at the end of this section, **Figures 28.48.100(b)** through **28.48.100(e)**. For all other situations, refer to the FHWA's HDS-5. For the following discussion, refer to the schematic inlet control nomograph shown in **Figure 28.48.100(a)**.

(a) Step 1. Locate the selected culvert size (point 1) and flow rate (point 2) on the appropriate scales of the inlet control nomograph. For box culverts, the flow rate per foot of barrel width is used.

(b) Step 2. Using a straightedge, carefully extend a straight line from the culvert size (point 1) through the flow rate (point 2) and mark a point on the first headwater/culvert height (*HW/D*) scale (point 3). The first *HW/D* scale is also a turning line.

(c) Step 3. Each scale represents a different inlet type. If another *HW/D* scale is required, extend a horizontal line from the first *HW/D* scale to the desired scale and read the result.

(d) Step 4. Multiply *HW/D* by the culvert height, *D*, to obtain the required headwater depth, *HW*, from the invert of the control section to the energy grade line. If the approach velocity is neglected, *HW* equals the required headwater depth, HW_i. If the approach velocity is included in the calculations, deduct the approach velocity head from *HW* to determine HW_i.

(e) Step 5. Calculate the required depression (FALL) of the inlet control section below the stream bed as follows:

$$HW_d = EL_{hd} - EL_{sf} \quad (28.48\text{-}1)$$

$$FALL = HW_i - HW_d \quad (28.48\text{-}2)$$

Where:

HW_d	=	design headwater depth (ft.)
EL_{hd}	=	design headwater elevation (ft.)
EL_{sf}	=	elevation of the stream bed at the face (ft.)
HW_i	=	required headwater depth (ft.)

Possible results and consequences of this calculation are:

(1) If the FALL is negative or zero, set FALL equal to zero and proceed to step 6.

(2) If the FALL is positive, the inlet control section invert must be depressed below the streambed at the face by that amount. If the FALL is acceptable, proceed to step 6.

(3) If the FALL is positive and greater than is judged to be acceptable, select another culvert configuration and begin again at step 1.

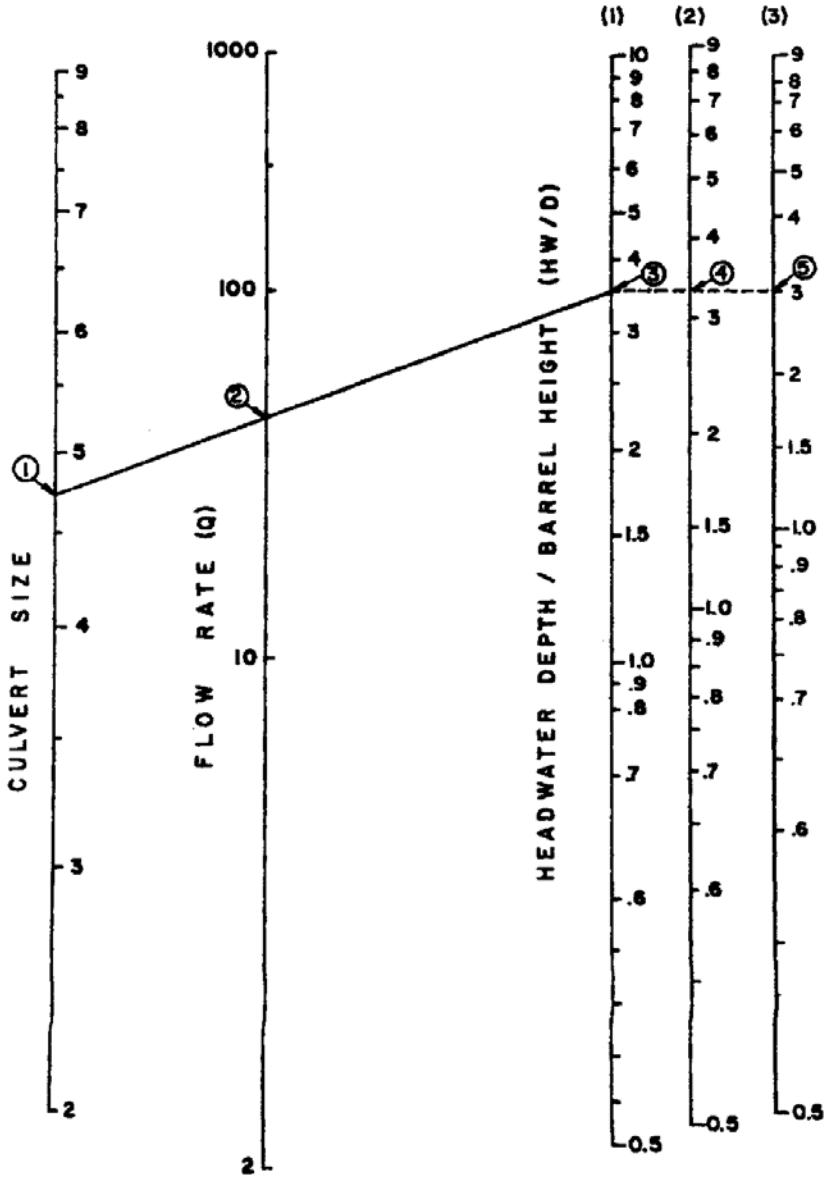
(f) Step 6. Calculate the inlet control section invert elevation as follows:

$$EL_i = EL_{sf} - FALL \quad (28.48\text{-}3)$$

where EL_i is the invert elevation at the face of a culvert or at the throat of a culvert with a tapered inlet.

STORMWATER MANAGEMENT MANUAL

INLET CONTROL NOMOGRAPH (SCHEMATIC)



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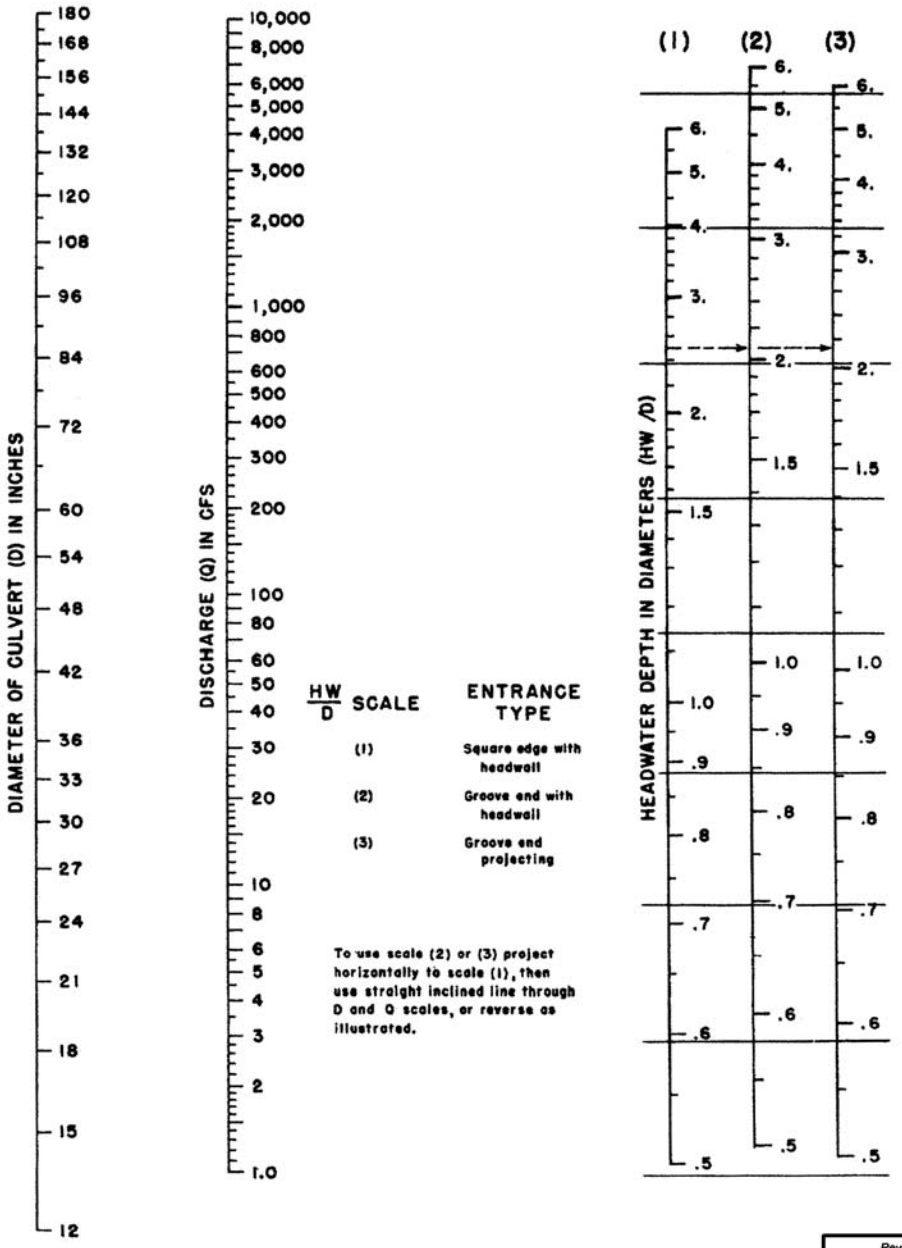
REFERENCE: HDS-5. FHWA

FIGURE 28.48.100(a)

STORMWATER MANAGEMENT MANUAL

HEADWATER DEPTH FOR CONCRETE PIPE CULVERTS WITH INLET CONTROL



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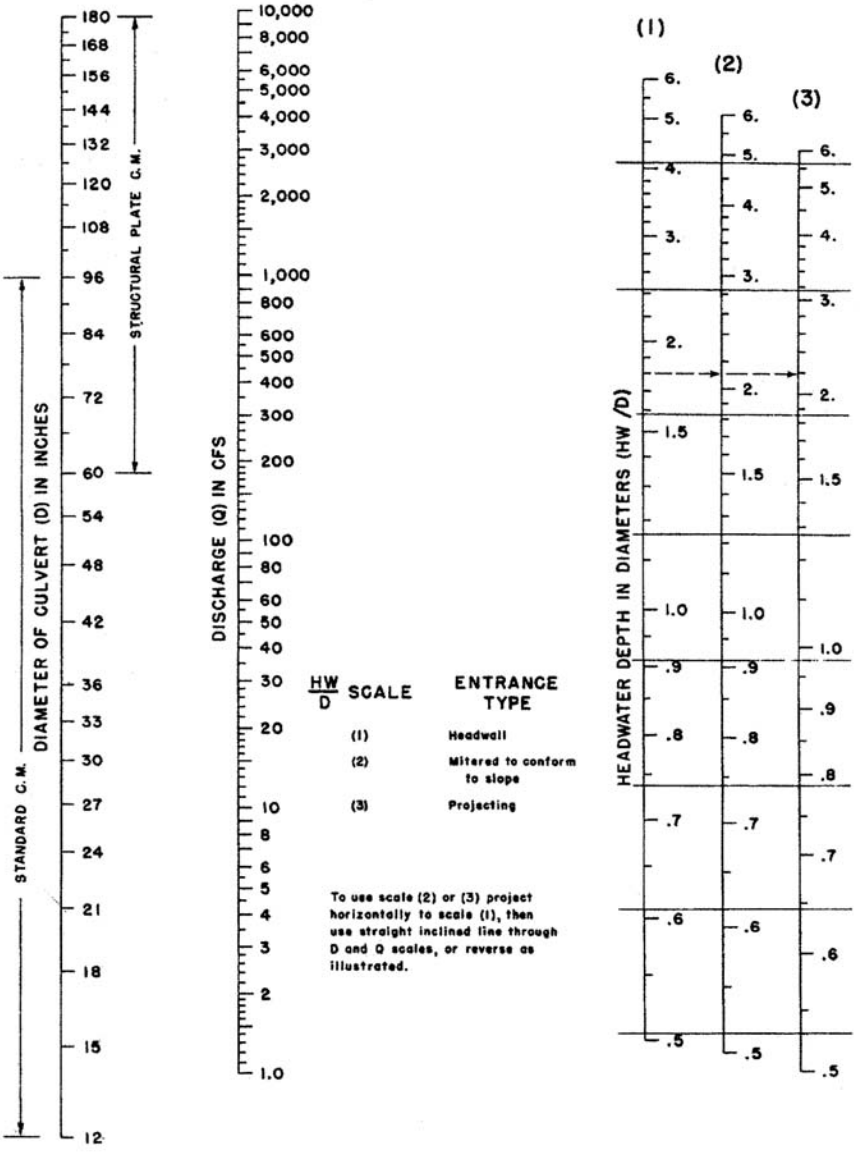
REFERENCE: HDS-5. FHWA

FIGURE 28.48.100(b)

STORMWATER MANAGEMENT MANUAL

HEADWATER DEPTH FOR CORRUGATED METAL PIPE CULVERTS WITH INLET CONTROL



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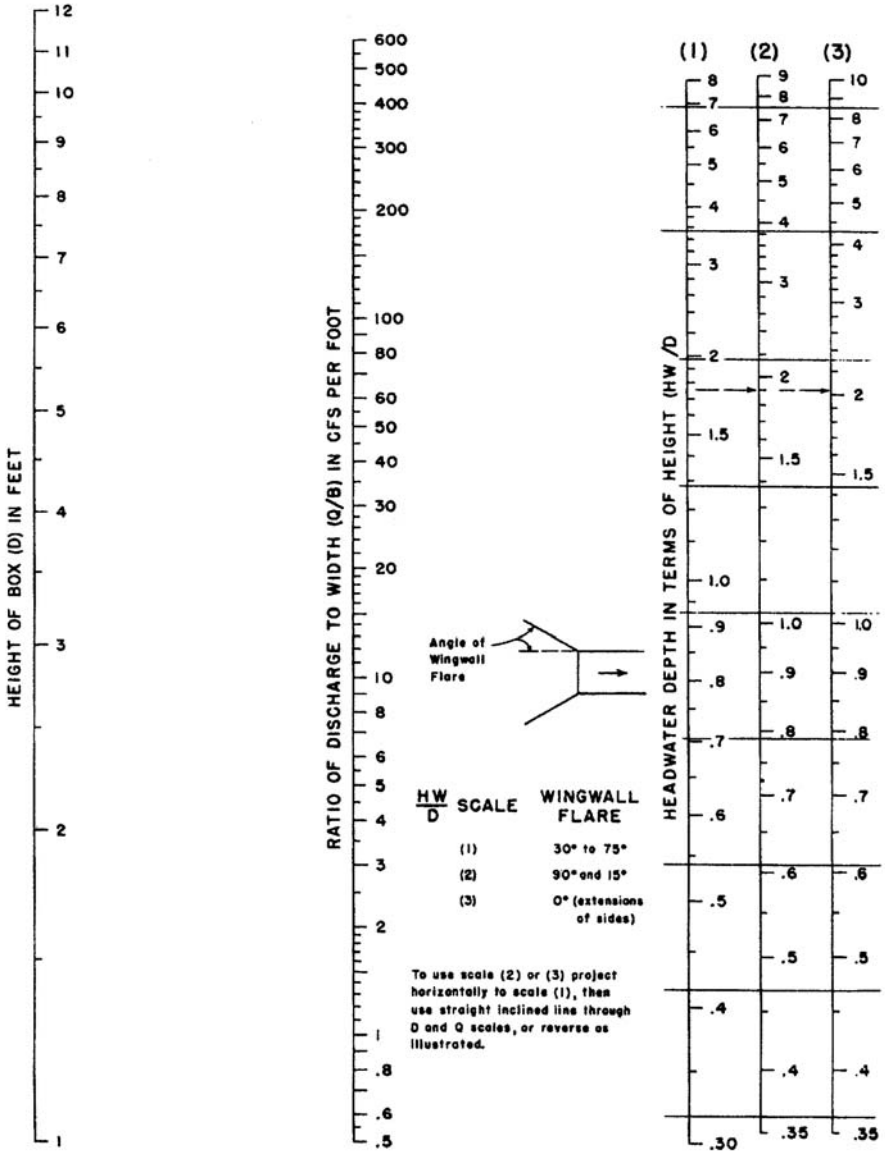
REFERENCE: HDS-5. FHWA

FIGURE 28.48.100(c)

STORMWATER MANAGEMENT MANUAL

HEADWATER DEPTH FOR CONCRETE BOX CULVERTS WITH INLET CONTROL



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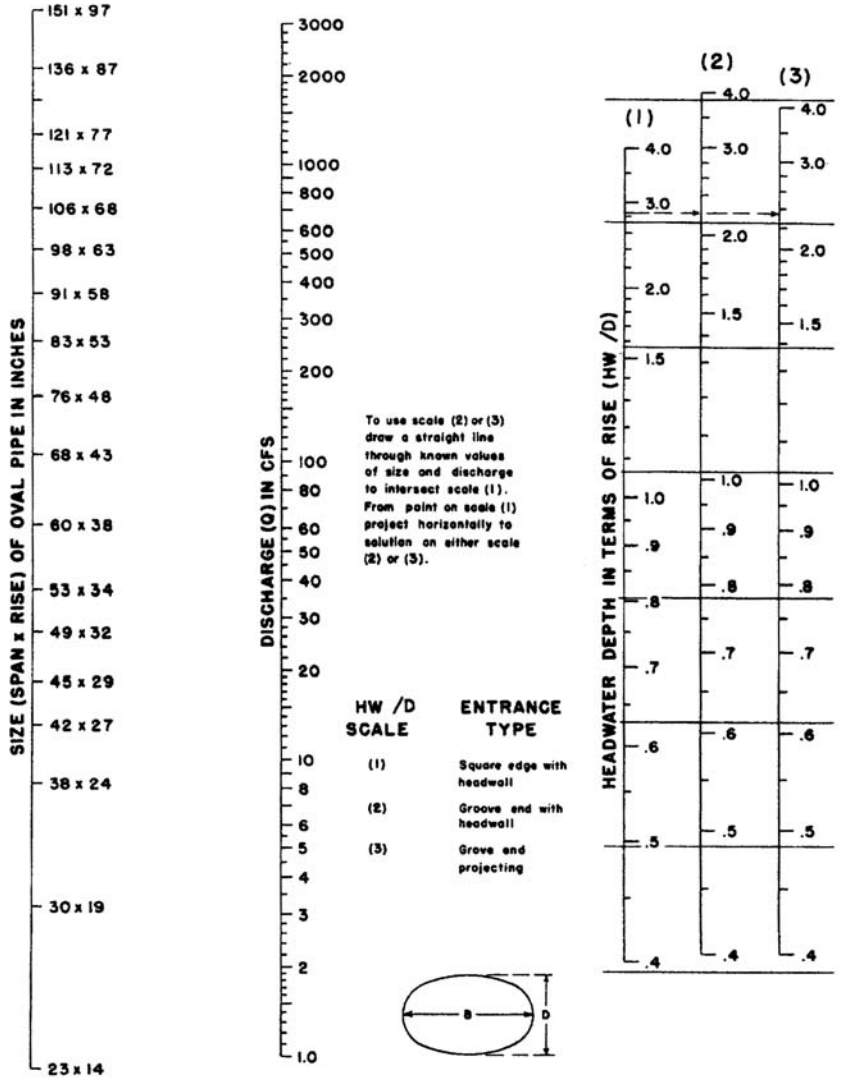
REFERENCE: HDS-5. FHWA

FIGURE 28.48.100(d)

STORMWATER MANAGEMENT MANUAL

HEADWATER DEPTH FOR OVAL CONCRETE PIPE CULVERTS
LONG-AXIS HORIZONTAL WITH INLET CONTROL



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REFERENCE: HDS-5. FHWA

FIGURE 28.48.100(e)

(Res. 40-08 (§ 1203.4), 3-19-08)

28.48.110 Outlet control calculation.

The outlet control calculations result in the headwater elevation required to convey the design discharge through the selected culvert in outlet control. The approach and downstream velocities may be included in the design process, if desired. Critical depth charts and outlet control nomographs are used in the design process. Critical depth charts and outlet control nomographs for typical configurations are included at the end of this section, **Figures 28.48.110(a)** through **28.48.110(g)**. For all other situations, refer to the FHWA's HDS-5. For illustration, refer to the schematic critical depth chart and outlet control nomograph shown in **Figures 28.48.110(h)** and **28.48.110(i)**, respectively.

(a) Determine the tailwater depth, TW, above the outlet invert at the design flow rate. This is obtained from backwater or normal depth calculations, or from field observations.

(b) Enter the appropriate critical depth chart, **Figure 28.48.110(h)**, with the flow rate and read the critical depth, d_c. The critical depth, d_c, cannot exceed the culvert diameter, D.

The d_c curves are truncated for convenience when they converge. If an accurate d_c is required for $d_c > .9D$ consult the *Handbook of Hydraulics* or other hydraulic reference.

(c) Calculate $(d_c + D)/2$.

(d) Determine the depth from the culvert outlet invert to the hydraulic grade line, h_o.

h_o = TW or $(d_c + D)/2$, whichever is larger.

(e) From **Table 28.48.110**, obtain the appropriate entrance loss coefficient, K_e, for the culvert inlet configuration.

(f) Determine the head losses through the culvert barrel, H, using the outlet control nomograph, **Figure 28.48.110(i)**.

(1) Required Manning's *n* values are presented in **Table 28.40.050** of Chapter 28.40 GJMC, Storm Drain Systems. If the Manning's *n* value given in the outlet control nomograph is different than the required Manning's *n* for the culvert, adjust the culvert length using the formula:

$$L_1 = L(n_1/n)^2 \qquad (28.48\text{-}4)$$

Where:

L_1	=	adjusted culvert length (ft.)
L	=	actual culvert length (ft.)
n_1	=	desired Manning's *n* value
n	=	Manning's *n* value from the outlet control chart

(2) Using a straightedge, connect the culvert size (point 1) with the culvert length on the appropriate k_e scale (point 2). This defines a point on the turning line (point 3).

(3) Again using the straightedge, extend a line from the discharge (point 4) through the point on the turning line (point 3) to the head loss, *H*, scale. *H* is the energy loss through the culvert, including entrance, friction, and outlet losses.

Careful alignment of the straightedge is necessary to obtain good results from the outlet control nomograph.

(g) Calculate the required outlet control headwater elevation, EL_{ho}.

$$EL_{ho} = EL_o + H + h_o \qquad (28.48\text{-}5)$$

where EL_o is the invert elevation at the outlet.

(h) If the outlet control headwater elevation exceeds the design headwater elevation, a new culvert configuration must be selected and the process repeated. Generally, an enlarged barrel will be necessary since inlet improvements are of limited benefit in outlet control.

STORMWATER MANAGEMENT MANUAL

ENTRANCE LOSS

Type of Structure and Design of Entrance	Coefficient K_e
• Pipe, Concrete	
Projecting from fill, socket end (groove-end)	0.2
Projecting from fill, sq. cut end	0.5
Headwall or headwall and wingwalls	
Socket end of pipe (groove-end)	0.2
Square-edge	0.5
Rounded (radius = D/12)	0.2
Mitered to conform to fill slope	0.7
* End-Section conforming to fill slope	0.5
Beveled edges, 33.7° or 45° bevels	0.2
Side- or slope-tapered inlet	0.2
• Pipe, or Pipe-Arch, Corrugated Metal	
Projecting from fill (no headwall)	0.9
Headwall or headwall and wingwalls square-edge	0.5
Mitered to conform to fill slope, paved or unpaved slope	0.7
* End-Section conforming to fill slope	0.5
Beveled edges, 33.7° or 45° bevels	0.2
Side- or slope-tapered inlet	0.2
• Box, Reinforced Concrete	
Headwall parallel to embankment (no wingwalls)	
Square-edged on 3 edges	0.5
Rounded on 3 edges to radius of D/12 or B/12 or beveled edges on 3 sides	0.2
Wingwalls at 30° to 75° to barrel	
Square-edged at crown	0.4
Crown edge rounded to radius of D/12 or beveled top edge	0.2
Wingwall at 10° to 25° to barrel	
Square-edged at crown	0.5
Wingwalls parallel (extension of sides)	
Square-edged at crown	0.7
Side- or slope-tapered inlet	0.2

*Note: "End Sections conforming to fill slope," made of either metal or concrete, are the sections commonly available from manufacturers. From limited hydraulic tests they are equivalent in operation to a headwall in both inlet and outlet control. Some end sections, incorporating a closed taper in their design have a superior hydraulic performance. These latter sections can be designed using the information given for the beveled inlet.

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WRC ENGINEERING, INC.	REFERENCE:	TABLE 28.48.110

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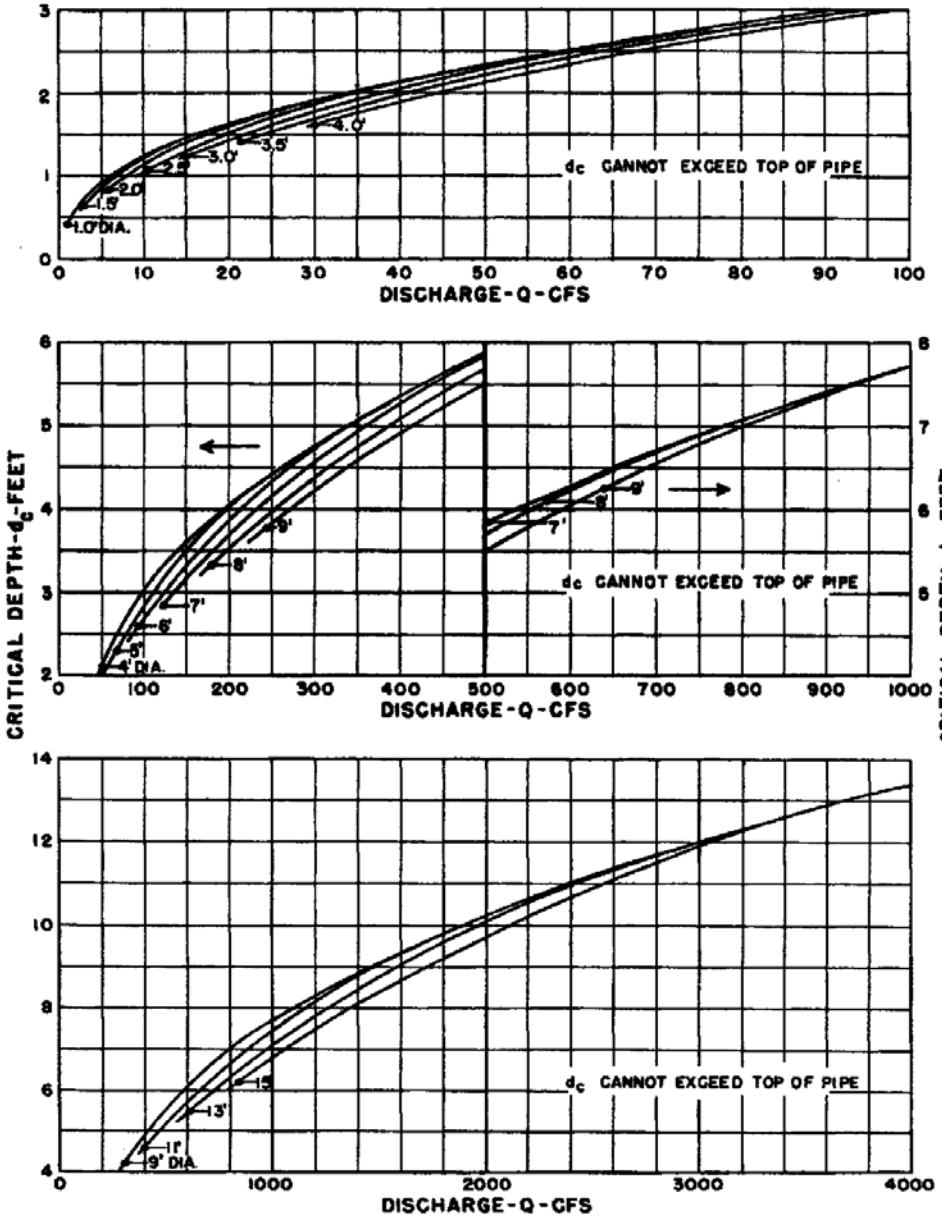
CRITICAL DEPTH - CIRICULAR PIPE



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WRC ENGINEERING, INC.	REFERENCE: HDS-5. FHWA	**FIGURE 28.48.110(a)**

STORMWATER MANAGEMENT MANUAL

CRITICAL DEPTH - RECTANGULAR SECTION

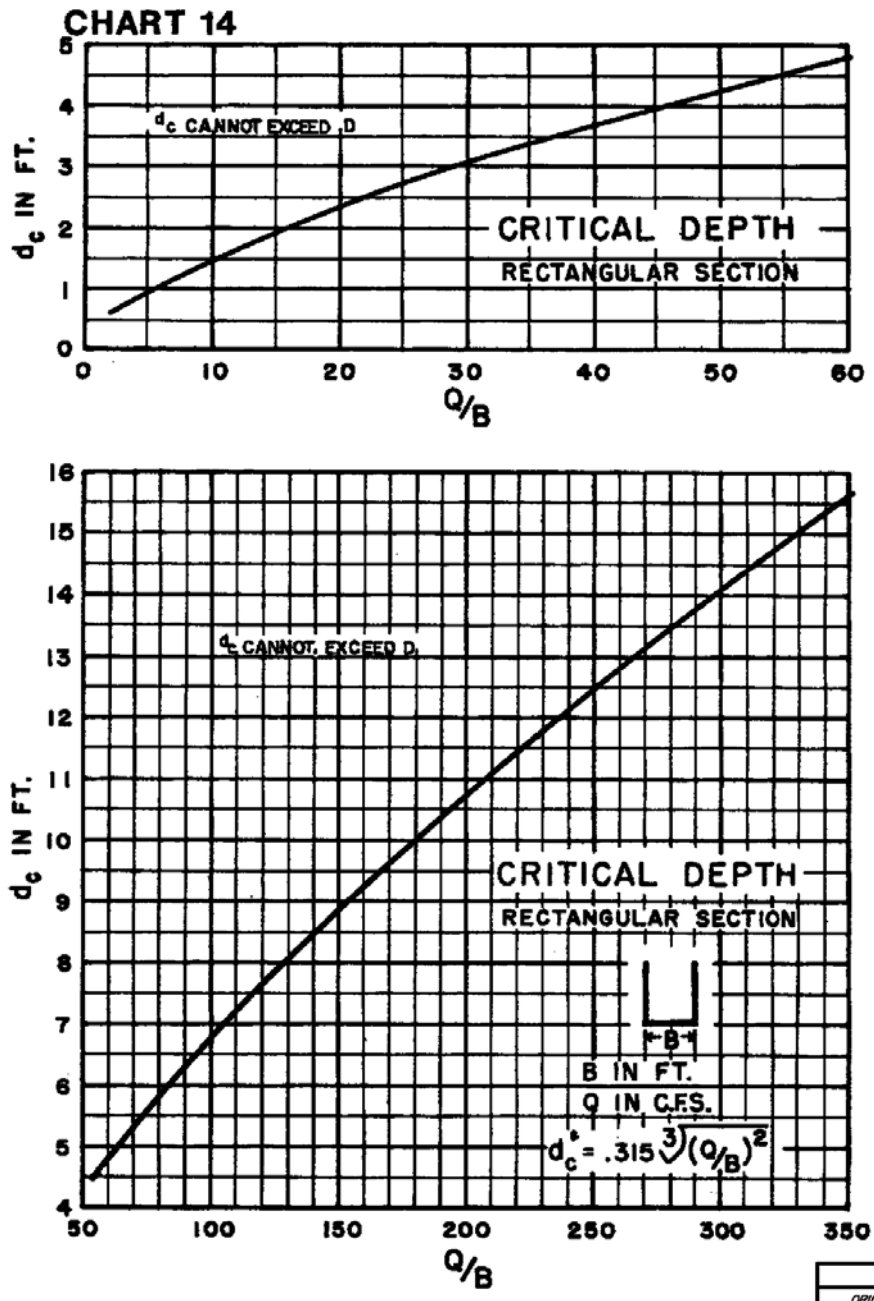

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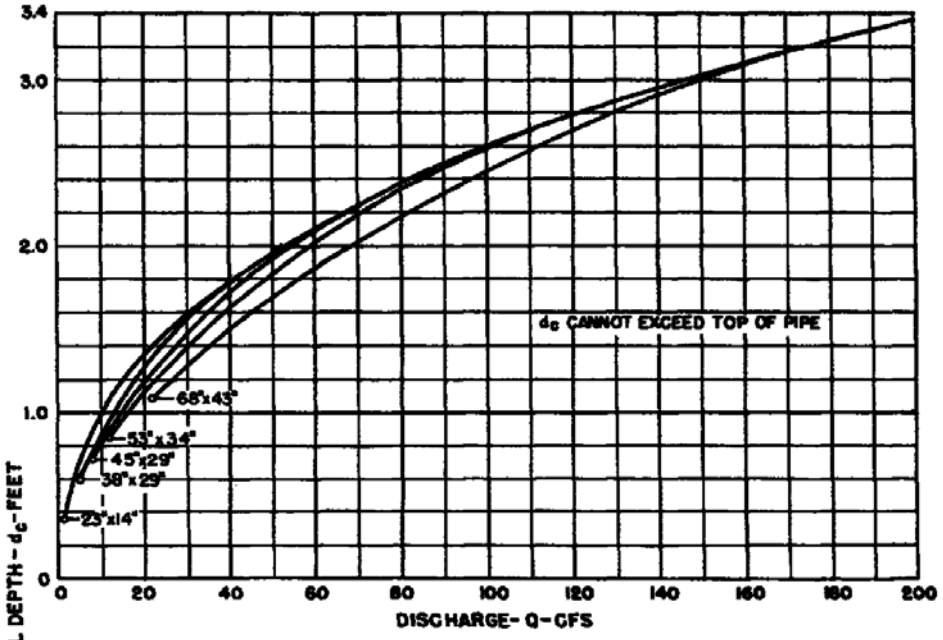
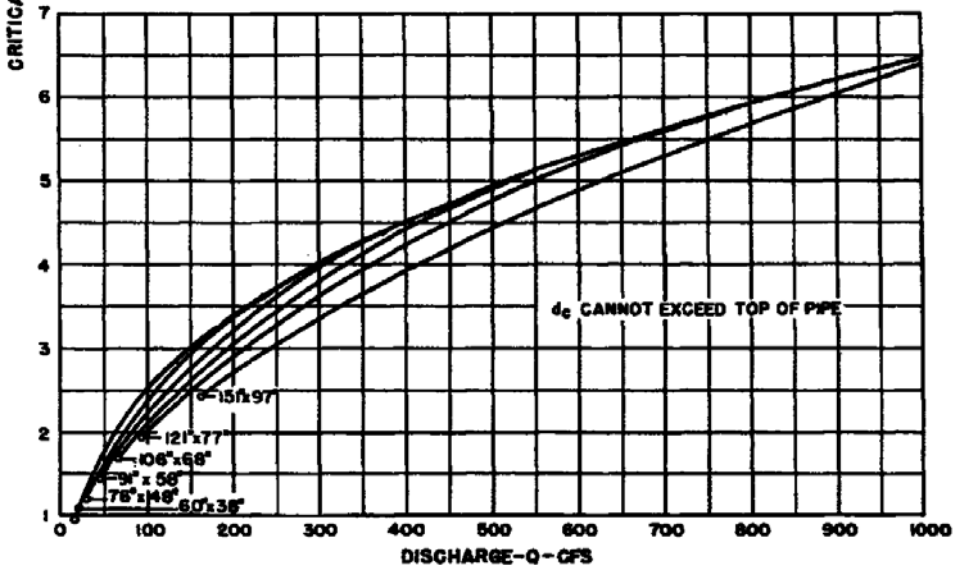
FIGURE 28.48.110(b)

STORMWATER MANAGEMENT MANUAL

CRITICAL DEPTH - OVAL CONCRETE PIPE
LONG-AXIS HORIZONTAL





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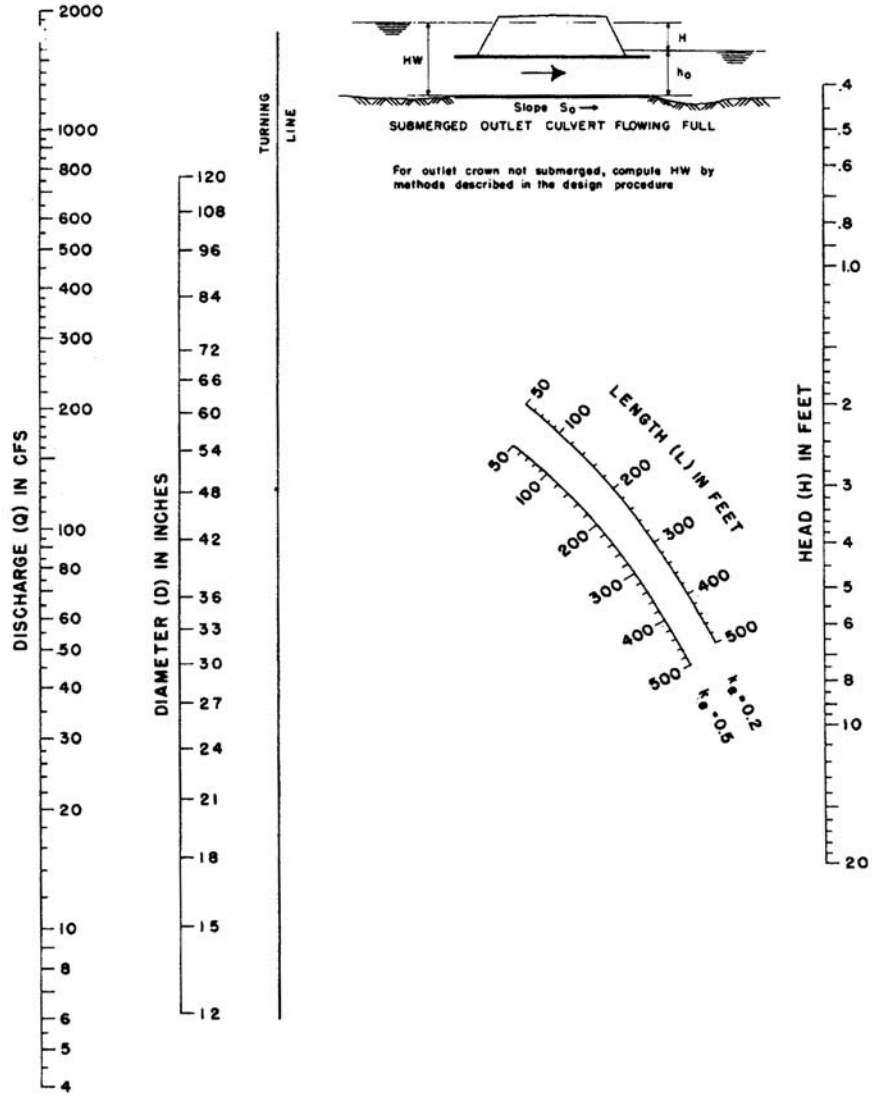
REFERENCE: HDS-5. FHWA

FIGURE 28.48.110(c)

STORMWATER MANAGEMENT MANUAL

HEAD FOR CONCRETE PIPE CULVERTS WITH OUTLET CONTROL, n=0.012



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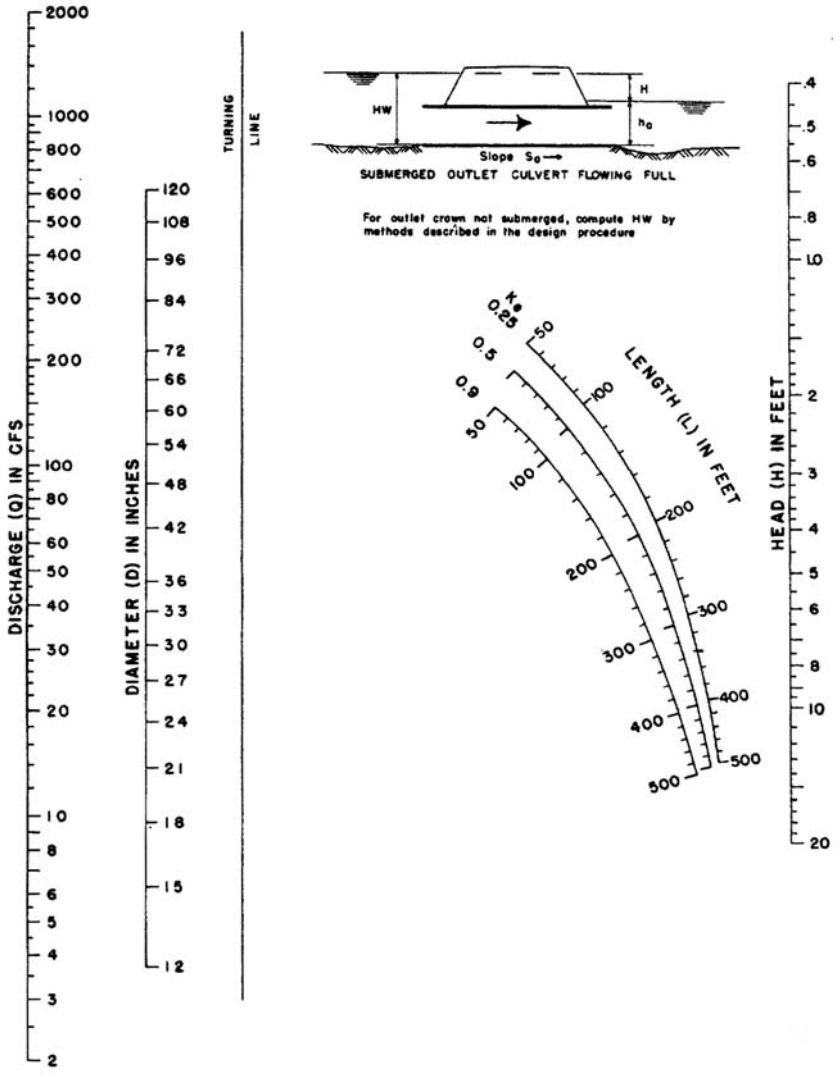
WRC ENGINEERING, INC.	REFERENCE: HDS-5. FHWA	**FIGURE 28.48.110(d)**

STORMWATER MANAGEMENT MANUAL

HEAD FOR CORRUGATED METAL PIPE CULVERTS WITH OUTLET CONTROL, n=0.024



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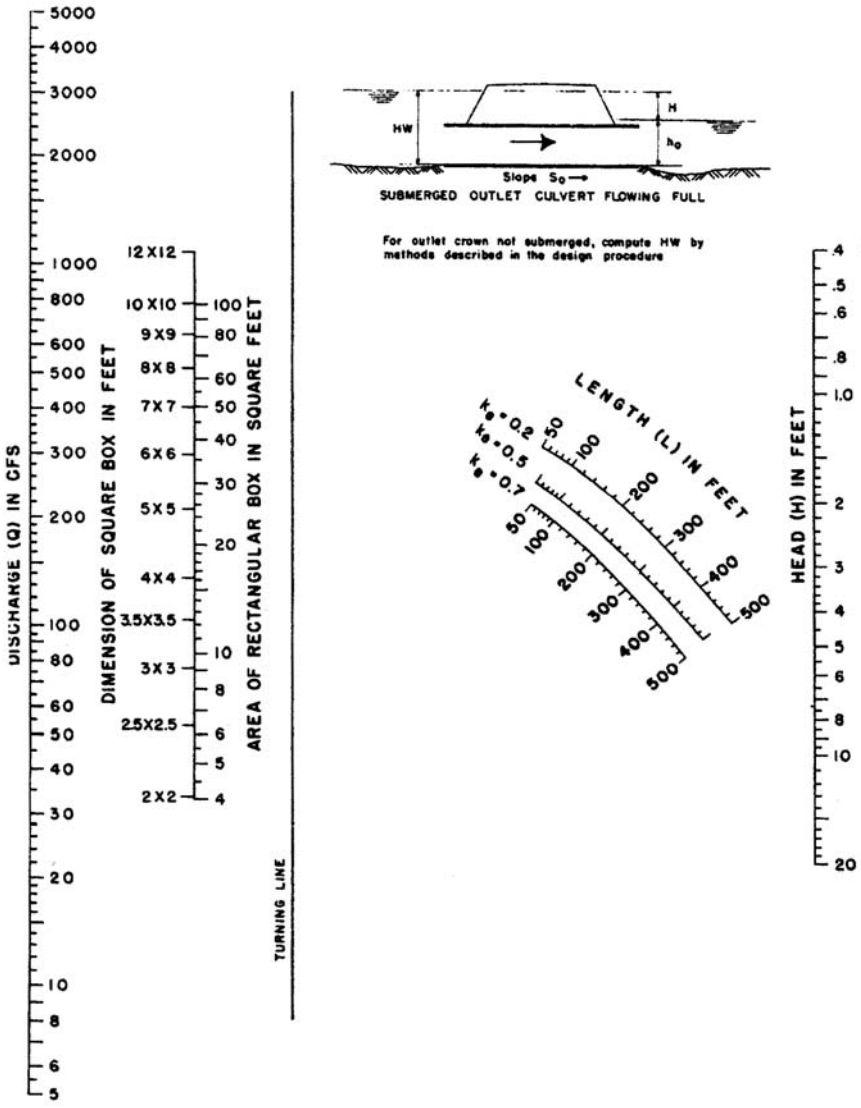
REFERENCE: HDS-5. FHWA

FIGURE 28.48.110(e)

STORMWATER MANAGEMENT MANUAL

HEAD FOR CONCRETE BOX CULVERTS WITH OUTLET CONTROL, n=0.012



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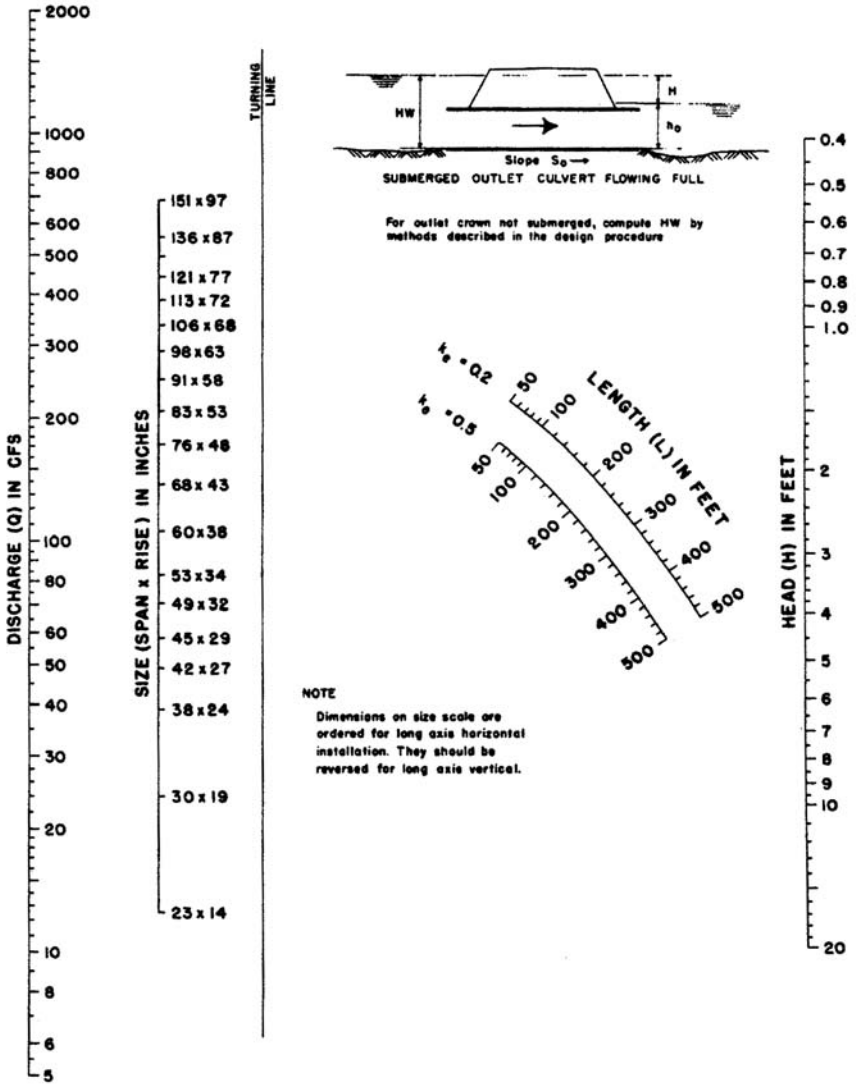
REFERENCE: HDS-5. FHWA

FIGURE 28.48.110(f)

STORMWATER MANAGEMENT MANUAL

HEAD FOR OVAL CONCRETE PIPE CULVERTS LONG-AXIS HORIZONTAL OR VERTICAL WITH OUTLET CONTROL, n=0.012



NOTE
Dimensions on size scale are ordered for long axis horizontal installation. They should be reversed for long axis vertical.

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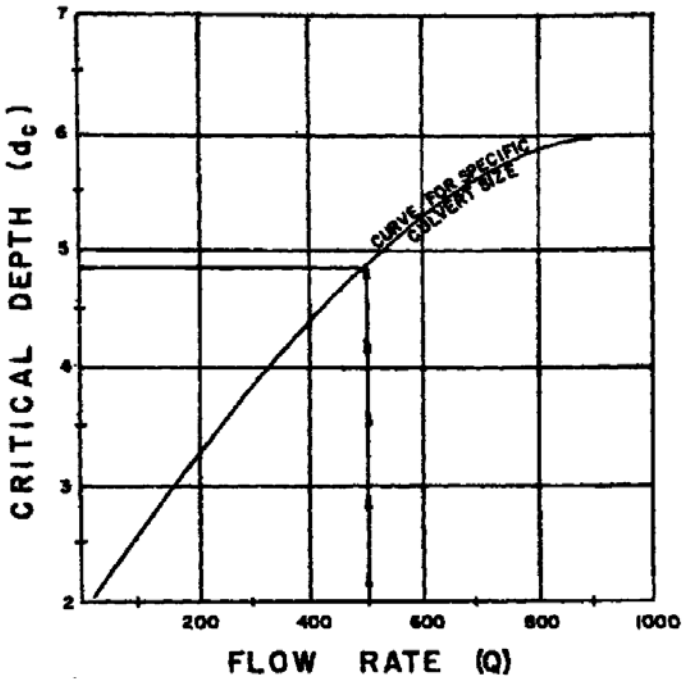
REFERENCE: HDS-5. FHWA

FIGURE 28.48.110(g)

STORMWATER MANAGEMENT MANUAL

CRITICAL DEPTH CHART (SCHEMATIC)



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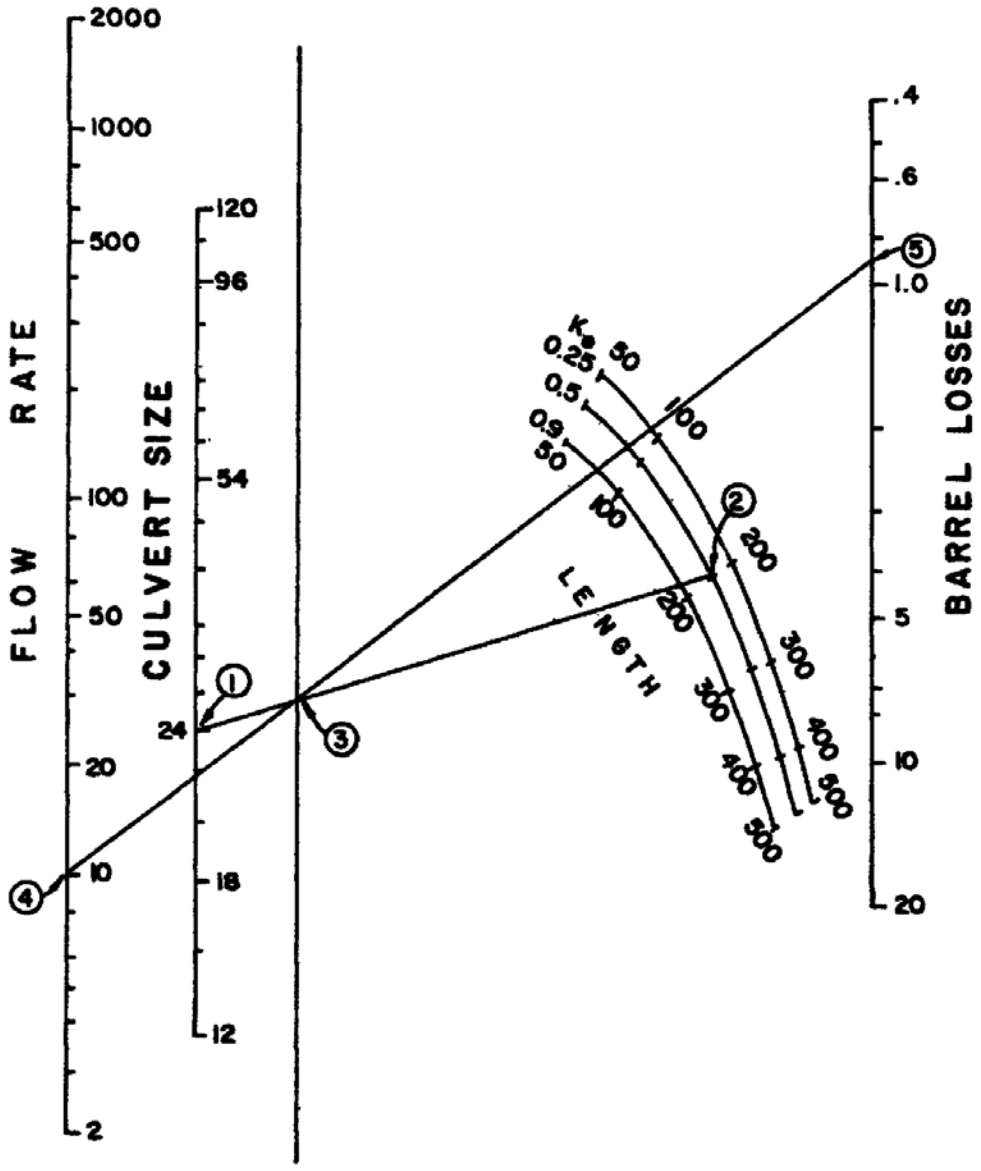
WRC ENGINEERING, INC.	REFERENCE: HDS-5. FHWA	**FIGURE 28.48.110(h)**

STORMWATER MANAGEMENT MANUAL

OUTLET CONTROL NOMOGRAPH (SCHEMATIC)



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REFERENCE: HDS-5. FHWA

FIGURE 28.48.110(i)

(Res. 40-08 (§ 1203.5), 3-19-08)

28.48.120 Evaluation of results.

Repeat the design process until an acceptable culvert configuration is determined. If the culvert selected will not fit the site, return to the design process and select another culvert. Compare the headwater elevations calculated for inlet and outlet control. The higher of the two is designated the controlling headwater elevation. The culvert can be expected to operate with that higher headwater for at least part of the time.

If outlet control governs and the headwater depth is less than 1.2*D*, it is possible that the barrel flows partly full through its entire length. In this case, caution shall be used in applying the approximate method of setting the downstream elevation based on the greater of tailwater or $(d_c + D)/2$. If an accurate headwater is necessary, backwater calculations shall be used to check the result from the approximate method. If the headwater depth falls below 0.75*D*, the approximate method shall not be used.

Due to problems arising from topography and other considerations, the actual design of a culvert installation is more difficult than the simple process of sizing culverts. However, the process presented herein shall be followed to ensure that some special problem is not overlooked. Several combinations of entrance types, invert elevations, and pipe diameters shall be tried to determine the most economic design that will meet the conditions imposed by topography and engineering.

(Res. 40-08 (§ 1203.6), 3-19-08)

28.48.130 Outlet velocity calculation.

The outlet velocity is calculated as follows:

(a) If the controlling headwater is based on inlet control, determine the normal depth and velocity in the culvert barrel. The velocity at normal depth is assumed to be the outlet velocity.

(b) If the controlling headwater is in outlet control, determine the area of flow at the outlet based on the barrel geometry and the following:

(1) Critical depth if the tailwater is below critical depth.

(2) Tailwater depth if the tailwater is between critical depth and the top of the barrel.

(3) Height of the barrel if the tailwater is above the top of the barrel.

(Res. 40-08 (§ 1203.7), 3-19-08)

28.48.140 Computer applications.

Although the nomographs discussed in this chapter are still used, engineers are increasingly designing culverts using computer applications. Among these applications are the FHWA's HY8 Culvert Analysis and numerous proprietary applications. If a computer application other than HY8 is to be used, the designer must first submit documentation of the program to the local jurisdiction for approval.

(Res. 40-08 (§ 1203.8), 3-19-08)

28.48.150 Outlet protection.

Table 28.32.310 in Chapter 28.32 GJMC, Open Channels, presents maximum permissible mean channel velocities. For unlined channels, erosion protection in the form of a horizontal riprap lined apron is required for all culvert outlets when the outlet velocity exceeds the values presented in **Table 28.32.310**. The length of the apron, L_a, is determined using the following empirical relationships that were developed for the U.S. Environmental Protection Agency:

$$L_a = \frac{1.8Q}{D_0^{3/2}} + 7D_0 \text{, for } TW < \frac{D_0}{2} \qquad (28.48\text{-}6)$$

and

$$L_a = \frac{3Q}{D_0^{3/2}} + 7D_0 \text{, for } TW > \frac{D_0}{2} \quad (28.48\text{-}7)$$

Where:

D_0 = maximum inside culvert width (ft.)
Q = pipe discharge (cfs)
TW = tailwater depth (ft.)

Where there is no well-defined channel downstream of the apron, the width, W, of the apron shall be as follows, as shown in **Figure 28.48.150(a)**:

$$W = 3D_0 + 0.4L_a \text{, for } TW \geq \frac{D_0}{2} \quad (28.48\text{-}8)$$

and

$$W = 3D_0 + L_a \text{, for } TW < \frac{D_0}{2} \quad (28.48\text{-}9)$$

The width of the apron at the culvert outlet shall be at least three times the culvert width.

Where there is a well-defined channel downstream of the apron, the bottom width of the apron shall be at least equal to the bottom width of the channel and the lining shall extend at least 1.0 foot above the tailwater elevation and at least two-thirds of the vertical conduit dimension above the invert.

The side slopes shall be 2:1 or flatter, the bottom grade shall be level, and there shall be overfall at the end of the apron or culvert.

The median stone diameter required, d_{50}, is determined from the following equation:

$$d_{50} = \frac{0.02(Q)^{4/3}}{TW(D_0)} \quad (28.48\text{-}10)$$

Preformed scour holes may be used where flat aprons are impractical. **Figure 28.48.150(b)** shows a general design of a scour hole. The stone diameter is determined using the following equations:

$$d_{50} = \frac{0.0125(Q)^{4/3}}{TW(D_0)}, \text{ for } y = \frac{D_0}{2} \quad (28.48\text{-}11)$$

and

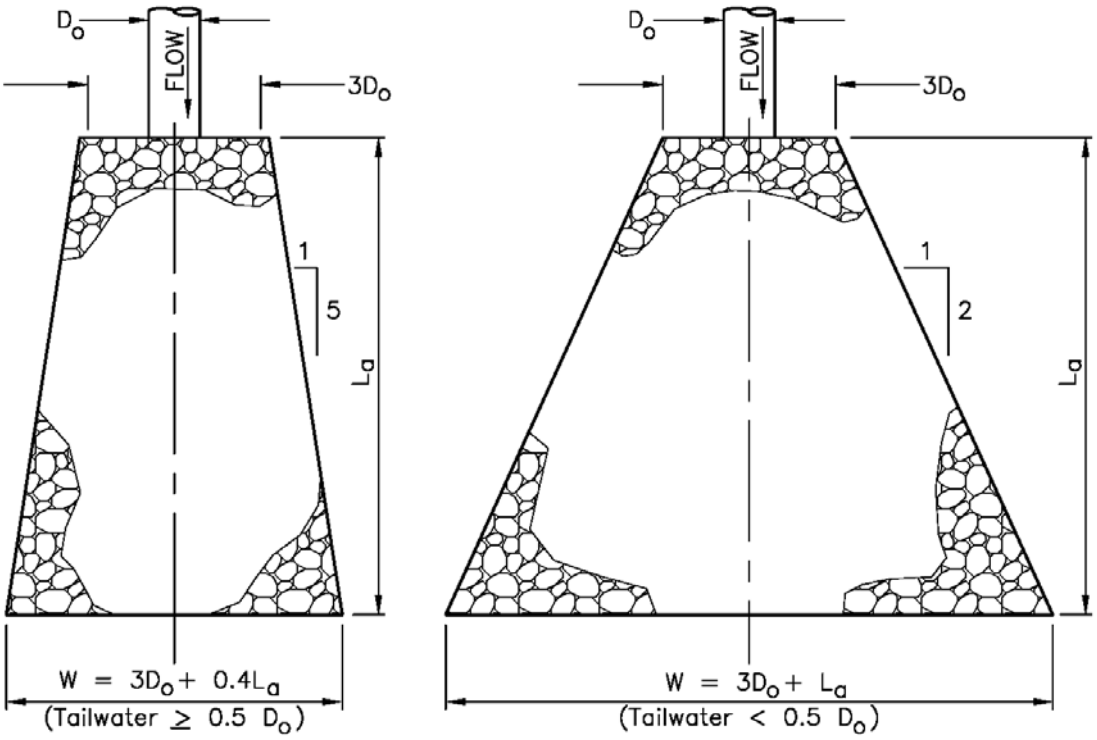
$$d_{50} = \frac{0.0082(Q)^{4/3}}{TW(D_0)}, \text{ for } y = D_0 \quad (28.48\text{-}12)$$

where y = depth of scour hole below culvert invert.

When riprap is not an option or is unavailable, the engineer has other natural and manmade materials available for use in erosion protection. Other options include gabions, concrete, recycled concrete, shotcrete, masonry, geotextiles, and woody plants. Outlet protection measures other than riprap may be used if first approved by the local jurisdiction.

STORMWATER MANAGEMENT MANUAL

CONFIGURATION OF CULVERT OUTLET PROTECTION



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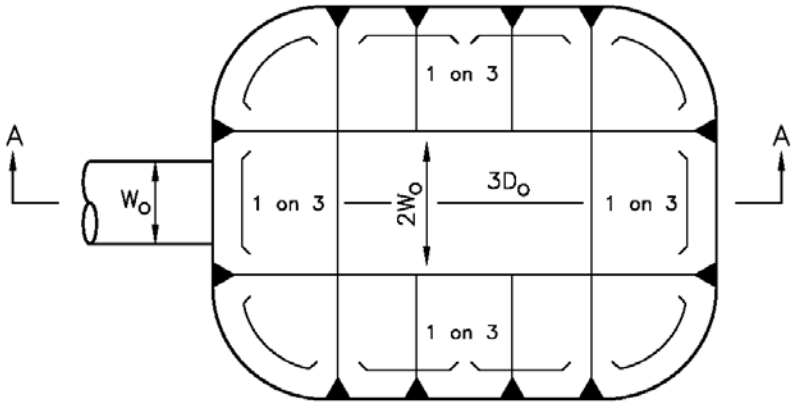
REFERENCE: U.S. EPA

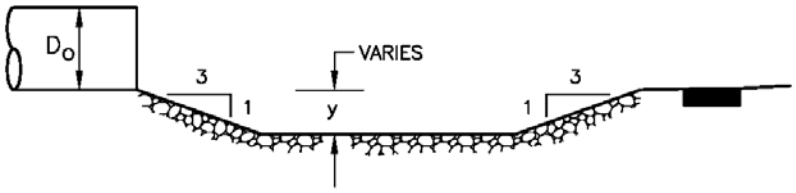
FIGURE 28.48.150(a)

STORMWATER MANAGEMENT MANUAL

CULVERT OUTLET PROTECTION AT PREFORMED SCOUR HOLE



PLAN VIEW



SECTION VIEW

Revision	Date
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WRC ENGINEERING, INC.	REFERENCE: DESIGN AND CONSTRUCTION OF URBAN STORMAWATER MANAGEMENT SYSTEMS, ASCE	**FIGURE 28.48.150(b)**

(Res. 40-08 (§ 1203.9), 3-19-08)

28.48.160 Trash/safety racks.

(a) The use of typical gratings at inlets to culverts and long underground pipes shall be considered on an individual basis. While there is a sound argument for the use of gratings for safety reasons, field experience has clearly shown that when the culvert is operating during heavy runoff, normal gratings often become clogged and the culvert is rendered ineffective. A general rule of thumb is that if it will be possible to see daylight from one side of the culvert to the other, a trash/safety rack will not be needed. At entrances to longer culverts, a trash rack is necessary. Engineering judgment shall be used to determine if trash/safety racks will be used. Factors which may influence whether or not trash/safety racks will be used include the following:

(1) Tributary land use (urban, rural, forest).

(2) Location (urban/rural).

(3) Design flow.

(4) Size of culvert.

(5) Anticipated debris loading.

(6) Performance of nearby existing structures.

(b) Trash/safety racks shall be required for all culverts located adjacent to schools, parks, playgrounds, and other recreational facilities where the pipe alignment or length does not allow for an unobstructed view through the culvert. Where it is found that trash/safety racks are needed, the open area through the grate at the design water surface shall be four times the design flow area of the culvert.

(Res. 40-08 (§ 1203.10), 3-19-08)

28.48.170 Culvert inlets.

One of the most important considerations in the design of a culvert is the inlet configuration. Since the natural channel is usually wider than the culvert barrel, the culvert inlet edge represents a flow contraction and may be the primary flow control. The provision of a more gradual flow transition will lessen the energy loss and thus create a more hydraulically efficient inlet condition. The inlet type can also increase the overall structural integrity by retaining fill slope and preventing inlet scour with subsequent undermining of the culvert. All culverts shall be designed either with headwalls and wingwalls or flared-end sections at the inlet and outlet.

A multitude of different inlet configurations are utilized on culvert barrels. These include both prefabricated and constructed-in-place installations. Commonly used inlet configurations include projecting culvert barrels, cast-in-place concrete headwalls, precast or prefabricated end sections, and culvert ends mitered to conform to the fill slope. Structural stability, aesthetics, erosion control, and fill retention are considerations in the selection of various inlet configurations.

(Res. 40-08 (§ 1204), 3-19-08)

28.48.180 Projecting inlets.

Projecting inlets vary greatly in hydraulic efficiency and adaptability to requirements with the type of pipe material used. The primary advantage of projecting inlets is relatively low cost. Corrugated metal pipe projecting inlets have limitations which include low efficiency and susceptibility to damage. A projecting entrance of corrugated metal pipe is equivalent to a sharp-edged entrance with a thin wall and has an entrance coefficient of approximately 0.9, **Table 28.48.110**. Bell-and-spigot concrete pipe or tongue-and-groove concrete pipe with the bell end or grooved end used as the inlet section are quite efficient hydraulically, having an entrance coefficient of approximately 0.2, **Table 28.48.110**. For concrete pipe that has been cut, the entrance is square-edged, the entrance coefficient is approximately 0.5, **Table 28.48.110**.

(Res. 40-08 (§ 1204.1), 3-19-08)

28.48.190 Inlets with headwalls.

Headwalls may be used for a variety of reasons, including increasing the efficiency of the inlet, providing embankment stability, and providing embankment protection against erosion. The relative efficiency of the inlet varies with the pipe material used. Corrugated metal pipe in a headwall is essentially a squared-edged entrance with an entrance coefficient of approximately 0.5. The entrance losses may be reduced by rounding the entrance. For tongue-and-groove or bell-end concrete pipe, little increase in hydraulic efficiency is realized by adding a headwall. The primary reasons for using headwalls are embankment protection and ease of maintenance.

Wingwalls are used where the side slopes of the channel adjacent to the entrance are unstable and where the culvert is skewed to the normal channel flow. Little increase in hydraulic efficiency is realized with the use of wingwalls, regardless of the pipe material used and, therefore, the use shall be justified for reasons other than an increase in hydraulic efficiency.

(Res. 40-08 (§ 1204.2), 3-19-08)

28.48.200 Tapered inlets.

Inlet configuration is one of the prime factors influencing the performance of a culvert operating under inlet control. Inlet edges can cause severe contraction of the flow, as in the case of a thin edge, projecting inlet. In a flow contraction, the effective cross-sectional area of the barrel may be reduced to about one-half of the actual available barrel area. As the inlet configuration is improved, the flow contraction is reduced, thus improving the performance of the culvert.

A tapered inlet is a flared culvert inlet with an enlarged face section and a hydraulically efficient throat section. Tapered inlets improve culvert performance by providing a more efficient control section (the throat). However, tapered inlets are not recommended for use on culverts flowing under outlet control because the simple beveled edge is of equal benefit. The two most common improved inlets are the side-tapered inlet and the slope-tapered inlet. FHWA's HDS-5 provides guidance on the design of improved inlets.

(Res. 40-08 (§ 1204.3), 3-19-08)

28.48.210 Bridge hydraulics.

Bridges are required across nearly all open channels sooner or later and, therefore, sizing the bridge openings is of great importance. Open channels with improperly designed bridges will either have excessive scour or deposition or not be able to carry the design flow. Confining flood waters by bridges can cause excessive backwater resulting in flooding of upstream property, backwater damage suits, overtopping of roadways, costly maintenance, or even loss of a bridge. Bridge openings shall be designed to have as little effect on the flow characteristics as reasonable, consistent with good design and economics.

(Res. 40-08 (§ 1205), 3-19-08)

28.48.220 Hydraulic analysis.

The hydraulic analysis procedures described in this chapter are suitable, although methods such as FHWA HY-4 or HEC-RAS are acceptable as well. If a computer application other than HY-4 or HEC-RAS is to be used, the designer must first submit documentation of the program to the local jurisdiction for approval. The preliminary assessment approach described below is presented in greater detail in the FHWA *Hydraulics of Bridge Waterways.*

(Res. 40-08 (§ 1205.1), 3-19-08)

28.48.230 Expression of backwater.

A practical expression for backwater has been formulated by applying the principle of conservation of energy between the point of maximum backwater upstream from the bridge and a point downstream from

the bridge at which normal stage has been reestablished, as shown in Section 4 of **Figure 28.48.230**. The expression is reasonably valid if the channel in the vicinity of the bridge is reasonably uniform, the gradient of the bottom is approximately constant between Sections 1 and 4, there is no appreciable erosion of the bed in the constriction due to scour, and the flow is subcritical.

The expression for computation of backwater upstream from the bridge constricting the flow is as follows:

$$h_1^* = (K^*)\left(\frac{(V_{n2})^2}{2g}\right) + \propto 1\left[\left(\frac{A_{n2}}{A_4}\right)^2 - \left(\frac{A_{n2}}{A_1}\right)^2\right]\frac{V_{n2}^2}{2g} \qquad (28.48\text{-}13)$$

Where:

h_1^* = total backwater (ft.)

K^* = total backwater coefficient

$\propto 1 = \frac{qv^2}{QV_1^2}$ = kinetic energy coefficient

A_{n2} = gross water area in constriction measured below normal stage (ft.^{2})

V_{n2} = average velocity in constriction or Q/A_{n2}(ft./s). The velocity V_{n2} is not an actual measurable velocity but represents a reference velocity readily computed for both model and field structures

A_4 = water area at Section 4 where normal stage is reestablished (ft.^{2})

A_1 = total water area at Section 1 including backwater (ft.^{2})

g = acceleration constant (32.2 ft./sec^2)

To compute backwater by Equation 28.48-13, it is necessary to obtain the approximate value of h_1^* by using the first part of the equation:

$$h_1^* = (K^*)\left(\frac{V_{n2}^2}{2g}\right) \qquad (28.48\text{-}14)$$

The value of A_1 in the second part of Equation 28.48-13, which depends on h_1^*, can then be determined. This part of the expression represents the difference in kinetic energy between Sections 4 and 1, expressed in terms of the velocity head $V_{n2}^2/2g$. Equation 28.48-13 may appear cumbersome, but it was set up as shown to permit omission of the second part when the difference in kinetic energy between Sections 4 and 1 is small enough to be insignificant in the final result.

To permit the designer to readily recognize cases in which the kinetic energy term may be ignored, the following guides are provided:

$M > 0.7$, where $M =$ bridge opening ratio

$V_{n2} < 7$ ft/s

$$\left(K^{*}\right)\left(\frac{V_{n2}^{2}}{2g}\right) < 0.5 \text{ ft}$$

If values meet all three conditions, the backwater obtained from Equation 28.48-14 can be considered sufficiently accurate. Should one or more of the values not meet the conditions set forth, it is required to use Equation 28.48-13 in its entirety. The use of the guides is further demonstrated in the examples given in FHWA *Hydraulics of Bridge Waterways* that shall be used in all bridge design work.

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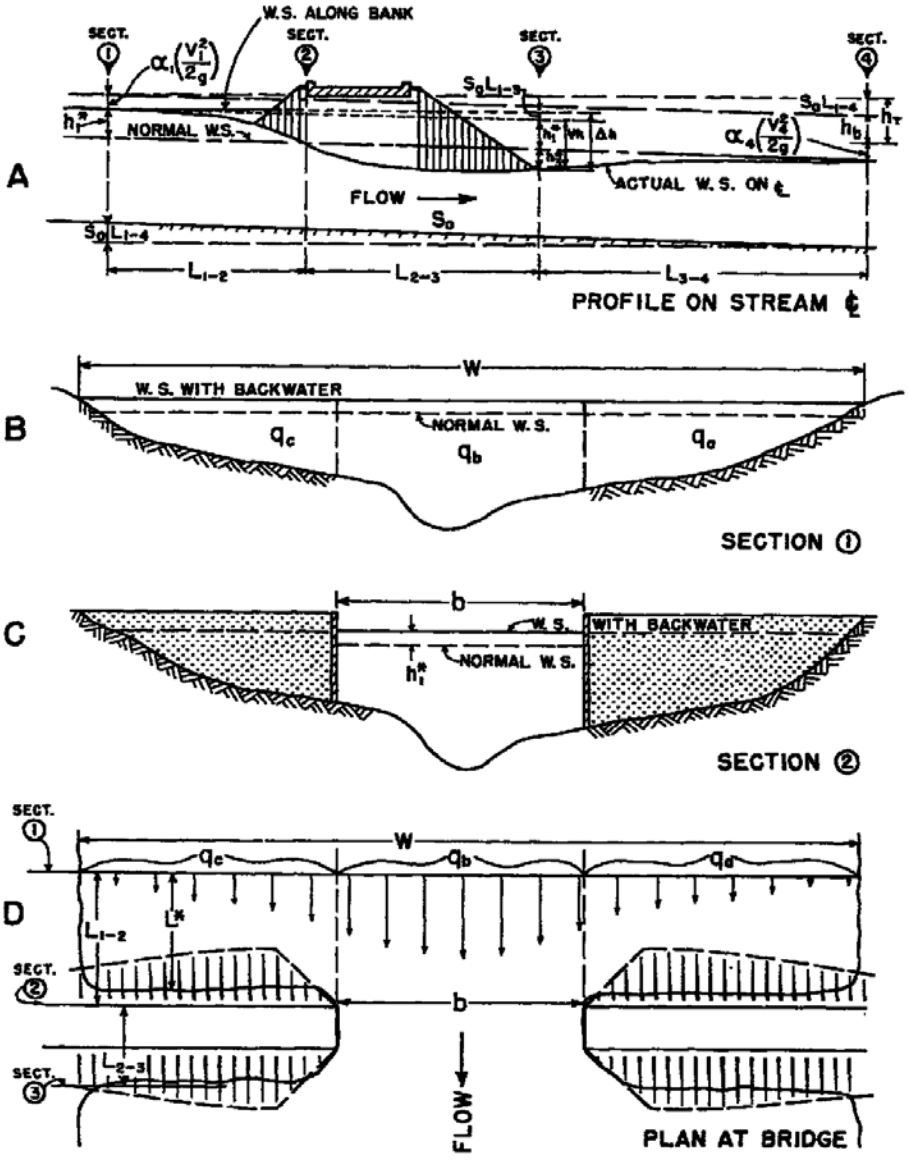
NORMAL BRIDGE CROSSING DESIGNATION



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REFERENCE: HDS-1, FHWA

FIGURE 28.48.230

(Res. 40-08 (§ 1205.2), 3-19-08)

28.48.240 Backwater coefficient.

The value of the overall backwater coefficient K*, which was determined experimentally, varies with the following:

(a) Stream constriction as measured by the bridge opening ratio, M.

(b) Type of bridge abutment: wingwall, spill through, etc.

(c) Number, size, shape, and orientation of piers in the constriction.

(d) Eccentricity or asymmetric position of bridge with respect to the floodplain.

(e) Skew (bridge crosses floodplain at other than 90-degree angle).

The overall backwater coefficient K* consists of a base curve coefficient, K_b, to which are added incremental coefficients to account for the effect of piers, eccentricity, and skew. The value of K* is primarily dependent on the degree of constriction of the flow but also changes to a limited degree with the other factors.

(Res. 40-08 (§ 1205.3), 3-19-08)

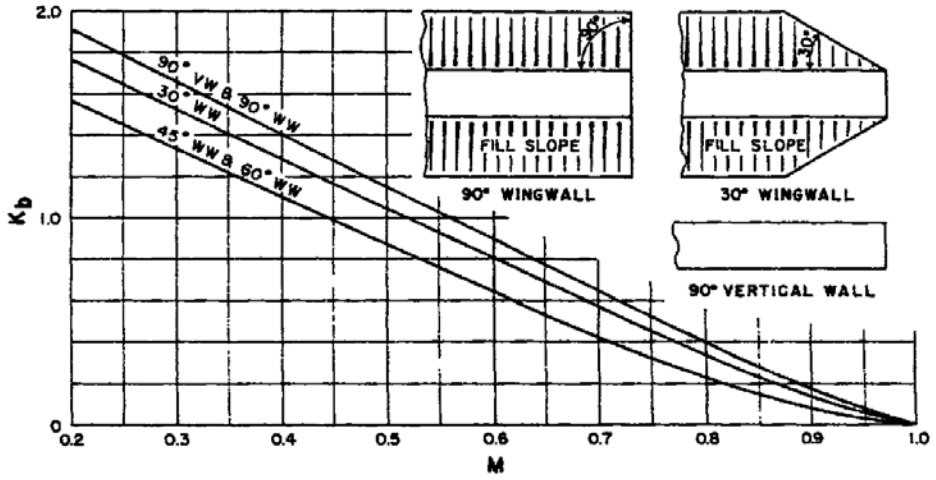
28.48.250 Effect of M and abutment shape (base curves).

Figure 28.48.250(a) shows the base curves for backwater coefficient, K_b, plotted with respect to the opening ratio, *M*, for several wingwall abutments and vertical wall type. Note how the coefficient K_b increases with channel constriction. The several curves represent different angles of wingwalls as can be identified by the accompanying sketches. The lower curves represent the better hydraulic shapes.

Figure 28.48.250(b) shows the relation between the backwater coefficient, K_b, and *M* for spill-through abutments for three embankment slopes. A comparison of the three curves indicates that the coefficient is little affected by embankment slope. **Figures 28.48.250(a)** and **28.48.250(b)** are "base curves" and K_b is referred to as the "base curve coefficient." The base curve coefficients apply to normal crossings for specific abutment shapes but do not include the effect of piers, eccentricity, or skew.

STORMWATER MANAGEMENT MANUAL

BASE CURVES FOR WINGWALL ABUTMENTS



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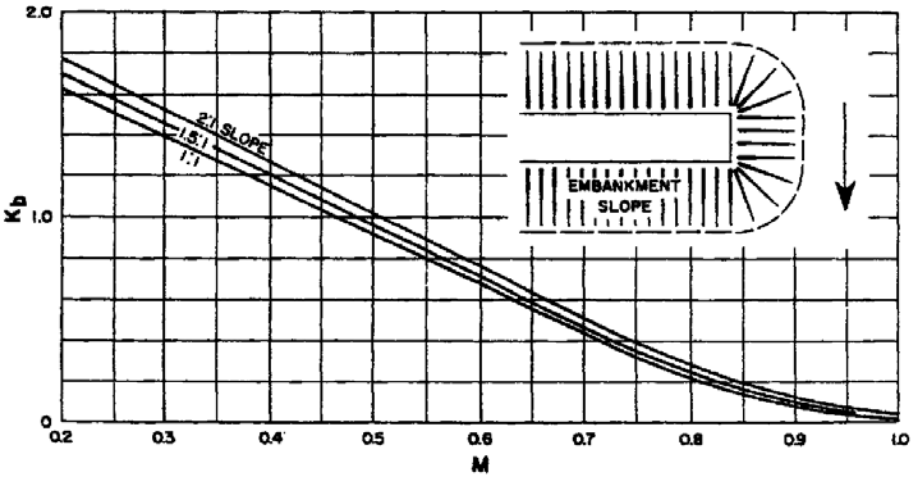
REFERENCE: HDS-1, FHWA

FIGURE 28.48.250(a)

STORMWATER MANAGEMENT MANUAL

BASE CURVES FOR SPILLTHROUGH ABUTMENTS



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REFERENCE: HDS-1, FHWA

FIGURE 28.48.250(b)

(Res. 40-08 (§ 1205.4), 3-19-08)

28.48.260 Effect of piers (normal crossings).

The effect on the backwater from introduction of piers in a bridge constriction has been treated as an incremental backwater coefficient designated ΔK_p, which is added to the base curve coefficient when piers are a factor. The value of the incremental backwater coefficient, ΔK_p, is dependent on the ratio that the area of the piers bears to the gross area of the bridge opening; the type of piers (or pilings in the case of pile bents); the value of the bridge opening ratio, M; and the angularity of the piers with the direction of flood flow. The ratio of the water area occupied by piers, A_p, to the gross water area of the constriction, A_{n2}, both based on the normal water surface, has been assigned the letter J. In computing the gross water area, A_{n2}, the presence of piers in the constriction is ignored. The incremental backwater coefficient for the more common types of piers and pile bents can be obtained from **Figure 28.48.260**. The procedure is to enter Chart A, **Figure 28.48.260**, with the proper value of J and read ΔK and obtain the correction factor σ from Chart B, **Figure 28.48.260**, for opening ratios other than unity. The incremental backwater coefficient is then:

$$\Delta K_p = \Delta K \sigma \qquad (28.48\text{-}15)$$

The incremental backwater coefficients for piers can, for all practical purposes, be considered independent of diameter, width, or spacing but shall be increased if there are more than five piles in a bent. A bent with 10 piles shall be given a value of ΔK_p about 20 percent higher than those shown for bents with five piles. If there is a good possibility of trash collecting on the piers, it is advisable to use a value greater than the pier width to include the trash. For a normal crossing with piers, the total backwater coefficient becomes:

K^* = K_b (**Figures 28.48.250(a)** or **28.58.250(b)** + ΔK_p (**Figure 28.48.260**) (28.48-16)

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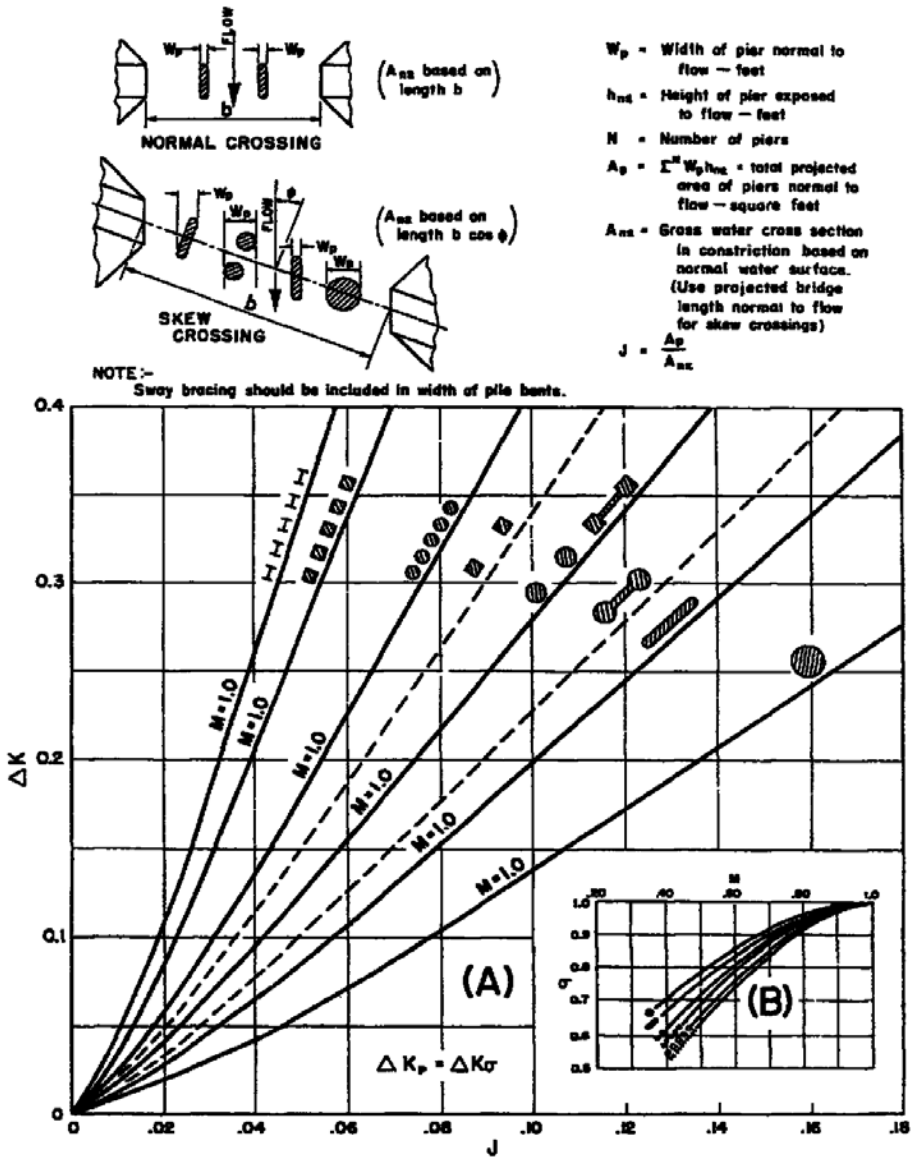
INCREMENTAL BACKWATER COEFFICIENT FOR PIER



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REFERENCE: HDS-1, FHWA

FIGURE 28.48.260

(Res. 40-08 (§ 1205.5), 3-19-08)

28.48.270 Bridge sizing and design.

The method of planning for bridge openings must include water surface profiles and hydraulic gradient analyses of the channel for the 100-year event. Once this hydraulic gradient is established without the bridge, the maximum reasonable effect on the channel flow by the bridge shall be determined.

(a) Bridge Design Standards. All bridges shall be designed to pass the 100-year design flow and meet all applicable floodplain regulations. The 100-year water surface elevation within the bridge shall be a minimum of 1.0 foot below the bridge low chord.

Where bridge abutments and foundations are located below the 100-year water surface elevation, concrete wingwalls at angles of 40 degrees to 60 degrees shall be tied to the existing side slopes to prevent erosion behind the abutments.

Where supercritical flow exists in a lined channel, the bridge shall have no influence on the flow. There shall be no encroachment into the 100-year water surface elevation.

The design and supporting calculations for both private bridges and low water crossings shall be prepared and certified by a Colorado Registered Professional Engineer.

(b) Design Procedure. The following is a brief step-by-step outline for determination of backwater produced by a bridge constriction:

(1) Determine the magnitude and frequency of the discharge for which the bridge is to be designed.

(2) Determine the stage of the stream at the bridge site for the design discharge.

(3) Plot representative cross-section of stream for design discharge at Section 1. If the stream is essentially straight and the cross-section substantially uniform in the vicinity of the bridge, the natural cross-section of the stream at the bridge site may be used for this purpose.

(4) Subdivide the above cross-section according to marked changes in depth of flow and roughness. Assign values of Manning's roughness coefficient, *n*, to each subsection. Typical roughness coefficients can be found in **Table 28.32.040(d)** of Chapter 28.32, Open Channels. Careful judgment is necessary in selecting these values.

(5) Compute conveyance and then discharge in each subsection.

(6) Determine the value of the kinetic energy coefficient.

(7) Plot the natural cross-section under the proposed bridge based on normal water for design discharge and compute the gross water area, including area occupied by piers.

(8) Compute the bridge opening ratio, *M*, observing modified procedure for skewed crossings.

(9) Obtain the value of K_b from the appropriate base curve.

(10) If piers are involved, compute the value of J and obtain the incremental coefficient, ΔK_p.

(11) If eccentricity is severe, compute the value of eccentricity and obtain the incremental coefficient, ΔK_e.

(12) If a skewed crossing is involved, observe proper procedure in previous steps, then obtain the incremental coefficient, ΔK_s, for proper abutment type.

(13) Determine the total backwater coefficient, K*, by adding incremental coefficients to the base curve coefficient, K_b.

(14) Compute the backwater by Equation 28.48-13.

(15) Determine the distance upstream to where the backwater effect is negligible.

Detailed steps illustrated by examples are presented in FHWA *Hydraulics of Bridge Waterways*.

(Res. 40-08 (§ 1206), 3-19-08)

28.48.280 Example application – Culvert sizing.

(a) Problem. Determine the culvert size necessary to convey the 100-year discharge in Doe Creek beneath John Boulevard. The results of the analysis are shown in the Culvert Design Form of **Figure 28.48.280(a)**.

Top of road elevation = 4,928 ft.

Culvert inlet elevation = 4,920 ft.

Culvert outlet elevation = 4,918 ft.

Culvert length = 200 ft.

Inlet – Groove end with headwall and wingwalls at 45 degrees

Outlet – Groove end with headwall and wingwalls at 45 degrees

Flow = 191 cfs

Tailwater depth = 4 ft.

(b) Solution.

(1) Step 1. Assume a reinforced concrete pipe diameter and determine the headwater to depth ratio for inlet control from **Figure 28.48.100(b)**. Assume a reinforced concrete pipe diameter of five feet. Given are a 100-year design flow of 191 cfs and a grooved end with headwall inlet configuration.

HW/D = 1.28 See **Figure 28.48.280(b)**

(2) Step 2. Calculate the required headwater depth assuming inlet control conditions. Multiply the pipe diameter times the headwater to depth ratio.

Headwater = HW_i = D*(HW/D) = 5.0*1.28 = 6.4 ft.

(3) Step 3. Calculate the required headwater elevation assuming inlet control conditions.

FALL = 0, since the culvert invert is at grade

$HW_i = HW_d$

$EL_i = EL_{sf}$

$EL_{hd} = EL_i + HW_i = 4{,}920 + 6.4 = 4{,}926.4$ ft.

(4) Step 4. Estimate the critical depth, d_c, in the culvert from **Figure 28.48.110(a)**.

d_c = 3.9 ft. (see **Figure 28.48.280(c)**)

(5) Step 5. Since the tailwater depth is less than the culvert diameter, compute the estimated water depth at the culvert outlet assuming the tailwater does not control the outlet conditions.

Outlet Depth = $(d_c + D)/2 = (3.9+5.0)/2 = 4.5$ ft.

(6) Step 6. Determine the flow depth at the culvert outlet, h_o. The estimated depth is the maximum value of the tailwater depth and the water depth assuming no tailwater.

4.5 ft. > 4.0 ft., therefore h_o = 4.5 ft.

(7) Step 7. Estimate the head, H, for outlet control conditions from **Figure 28.48.110(d)**.

H = 2.6 ft. (see **Figure 28.48.280(d)**)

(8) Step 8. Calculate the required outlet control headwater elevation, EL_{ho}.

$EL_{ho} = EL_o + H + h_o = 4{,}918 + 2.6 + 4.5 = 4{,}925.1$ ft.

(9) Step 9. Determine if the culvert is under inlet control or outlet control and provide the resulting control headwater elevation and depth.

$EL_{hd} > EL_{ho}$ (4,926.4 > 4,925.1), the culvert is under inlet control

Control Headwater Elevation = 4,926.4

HW = 6.4 ft.

(10) Step 10. Calculate the outlet velocity by an appropriate method and determine the amount of outlet protection needed, see GJMC 28.48.150.

v = 10.0 ft./s

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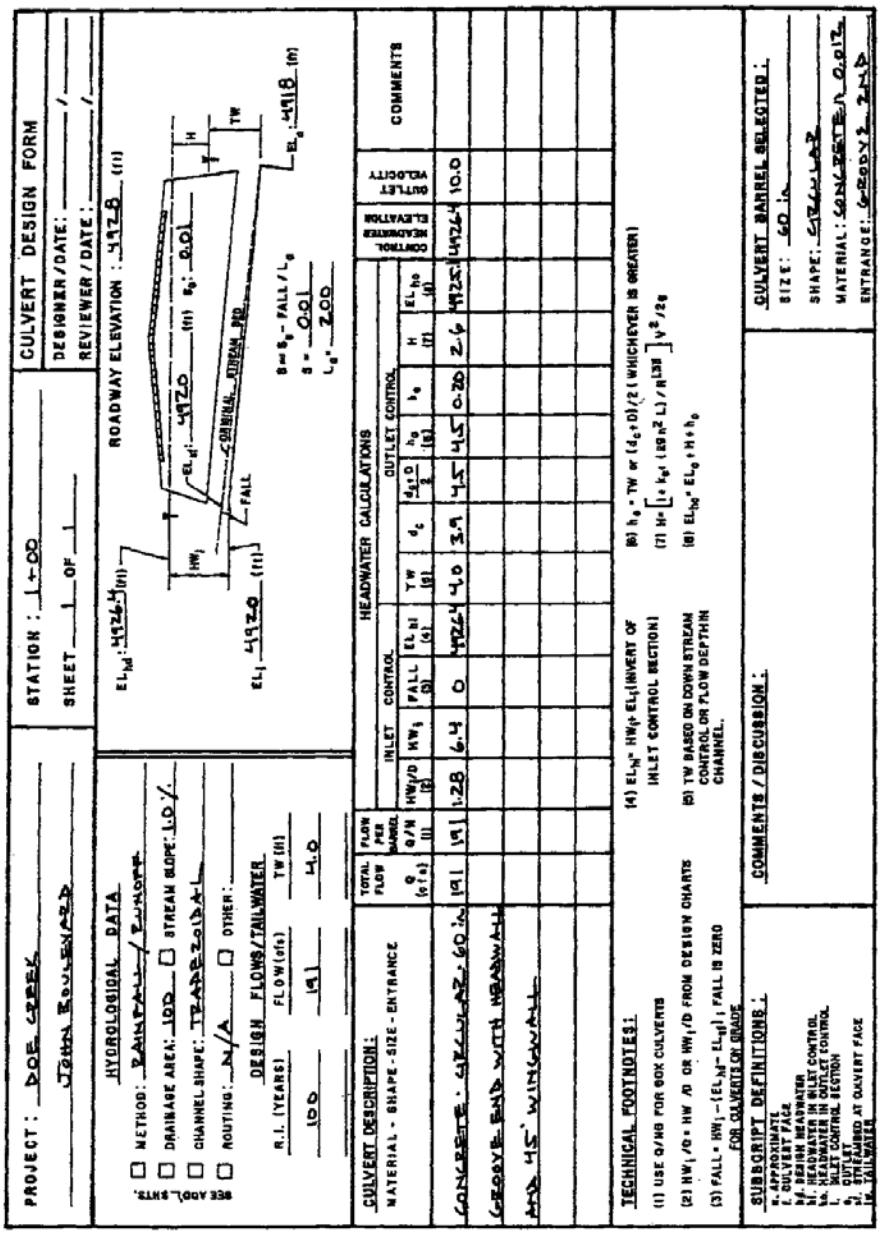
EXAMPLE - CULVERT DESIGN FORM



PROJECT: DOE CREEK
JOHN ROULENCE
STATION: 1+00
SHEET 1 OF 1
CULVERT DESIGN FORM
DESIGNER/DATE: /
REVIEWER/DATE: /

HYDROLOGICAL DATA
☐ METHOD: RAINFALL / RUNOFF
☐ DRAINAGE AREA: 100 ☐ STREAM SLOPE: 10 %
☐ CHANNEL SHAPE: TRAPEZOIDAL
☐ ROUTING: N/A ☐ OTHER:
DESIGN FLOWS/TAILWATER
R.I. (YEARS) FLOW(cfs) TW (ft)
100 191 4.0
SEE ADDL. SHTS.

ROADWAY ELEVATION: 4928 (ft)
EL_{hd}: 4926.4 (ft)
EL_i: 4920 (ft)
EL_d: 4920 (ft) S_o: 0.01
FALL
CONCRETE PIPE
TW
H
EL_o: 4918 (ft)
$S = S_o$ - FALL / L_o
S = 0.01
L_o = 200

CULVERT DESCRIPTION: MATERIAL - SHAPE - SIZE - ENTRANCE	TOTAL FLOW Q (cfs)	FLOW PER BARREL Q/N (ft)	HEADWATER CALCULATIONS: INLET CONTROL HW/D (ft)	INLET CONTROL HW (ft)	OUTLET CONTROL FALL (ft)	OUTLET CONTROL EL hd (ft)	OUTLET CONTROL TW (ft)	OUTLET CONTROL d_c	OUTLET CONTROL $\frac{d_c+D}{2}$	OUTLET CONTROL h_o (ft)	OUTLET CONTROL L_e	OUTLET CONTROL H (ft)	OUTLET CONTROL EL_{ho} (ft)	OUTLET VELOCITY (fps)	COMMENTS
CONCRETE - CIRCULAR - 60 in.	191	191	1.28	6.4	0	4926.4	4.0	3.9	4.5	4.5	0.20	2.6	4932.4	10.0	
GROOVE END WITH HEADWALL															
AND 45° WINGWALLS															

TECHNICAL FOOTNOTES:
(1) USE Q/N0 FOR BOX CULVERTS
(2) $HW_i/D = HW/D$ OR HW_i/D FROM DESIGN CHARTS
(3) FALL = $HW_i - (EL_{hd} - EL_{di})$; FALL IS ZERO FOR CULVERTS ON GRADE
(4) $EL_{hd} = HW_i$ or EL_i (INVERT OF INLET CONTROL SECTION)
(5) TW BASED ON DOWN STREAM CONTROL OR FLOW DEPTHIN CHANNEL.
(6) $h_o = TW$ or $(d_c + D)/2$ (WHICHEVER IS GREATER)
(7) $H = \left[1 + k_e\left(\frac{29n^2 L}{R^{1.33}}\right)\right] V^2/2g$
(8) $EL_{ho} = EL_o + H + h_o$

SUBSCRIPT DEFINITIONS:
a. APPROXIMATE
f. CULVERT FACE
hf. REGIN HEADWATER
hi. HEADWATER IN INLET CONTROL
ho. HEADWATER IN OUTLET CONTROL
I. INLET CONTROL SECTION
o. OUTLET
s. STREAMBED AT CULVERT FACE
tw. TAILWATER

COMMENTS / DISCUSSION:

CULVERT BARREL SELECTED:
SIZE: 60 in
SHAPE: CIRCULAR
MATERIAL: CONCRETE n 0.012
ENTRANCE: GROOVE END 2:1

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REFERENCE:

FIGURE 28.48.280(a)

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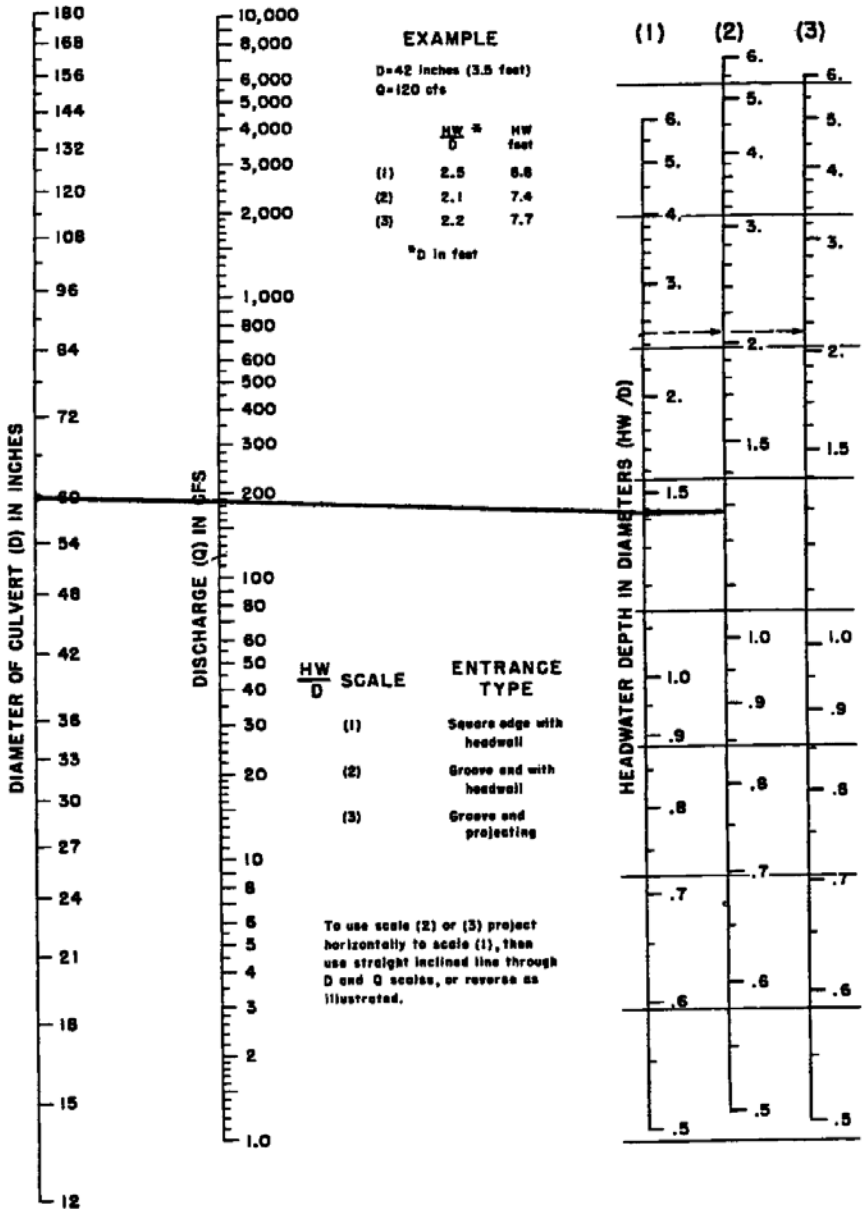
EXAMPLE - INLET CONTROL NOMOGRAPH



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REFERENCE:

FIGURE 28.48.280(b)

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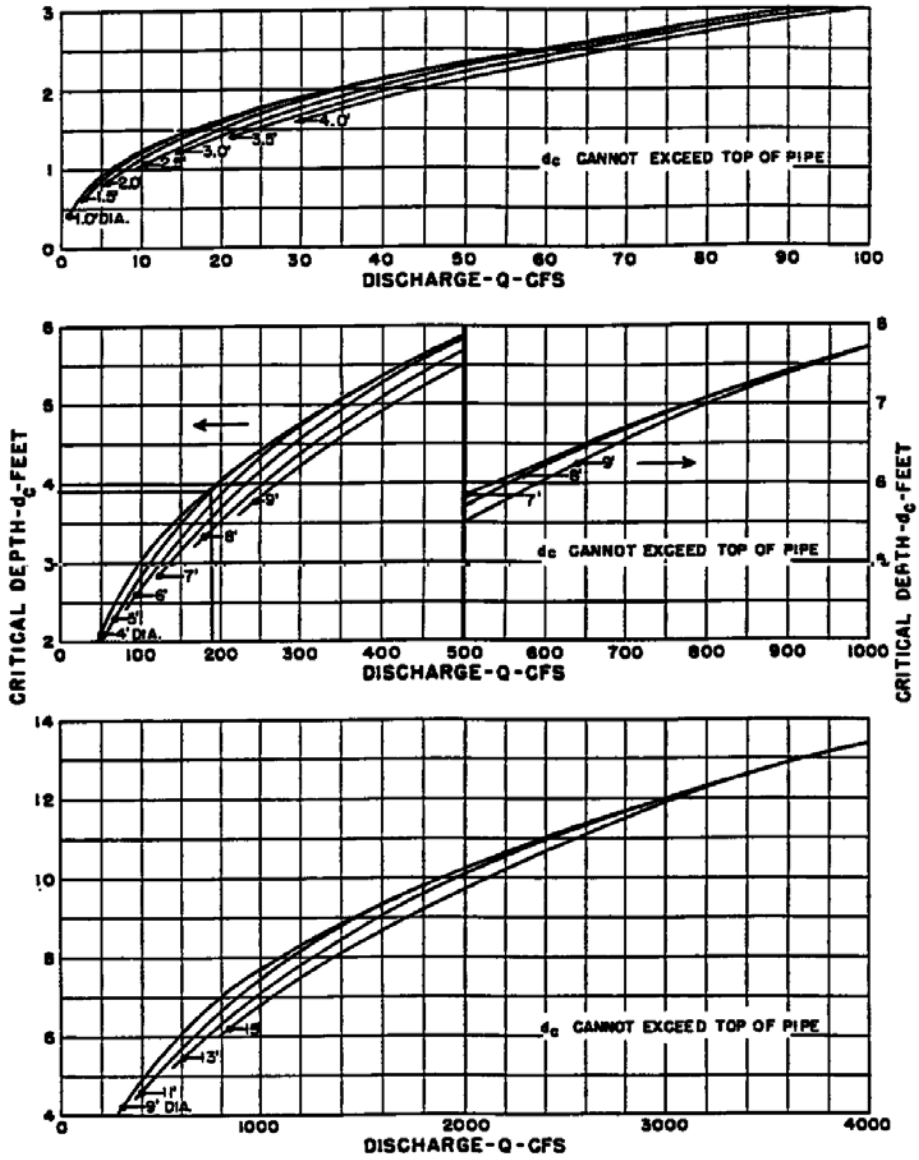
EXAMPLE - CRITICAL DEPTH

CHART 4



BUREAU OF PUBLIC ROADS
JAN. 1964

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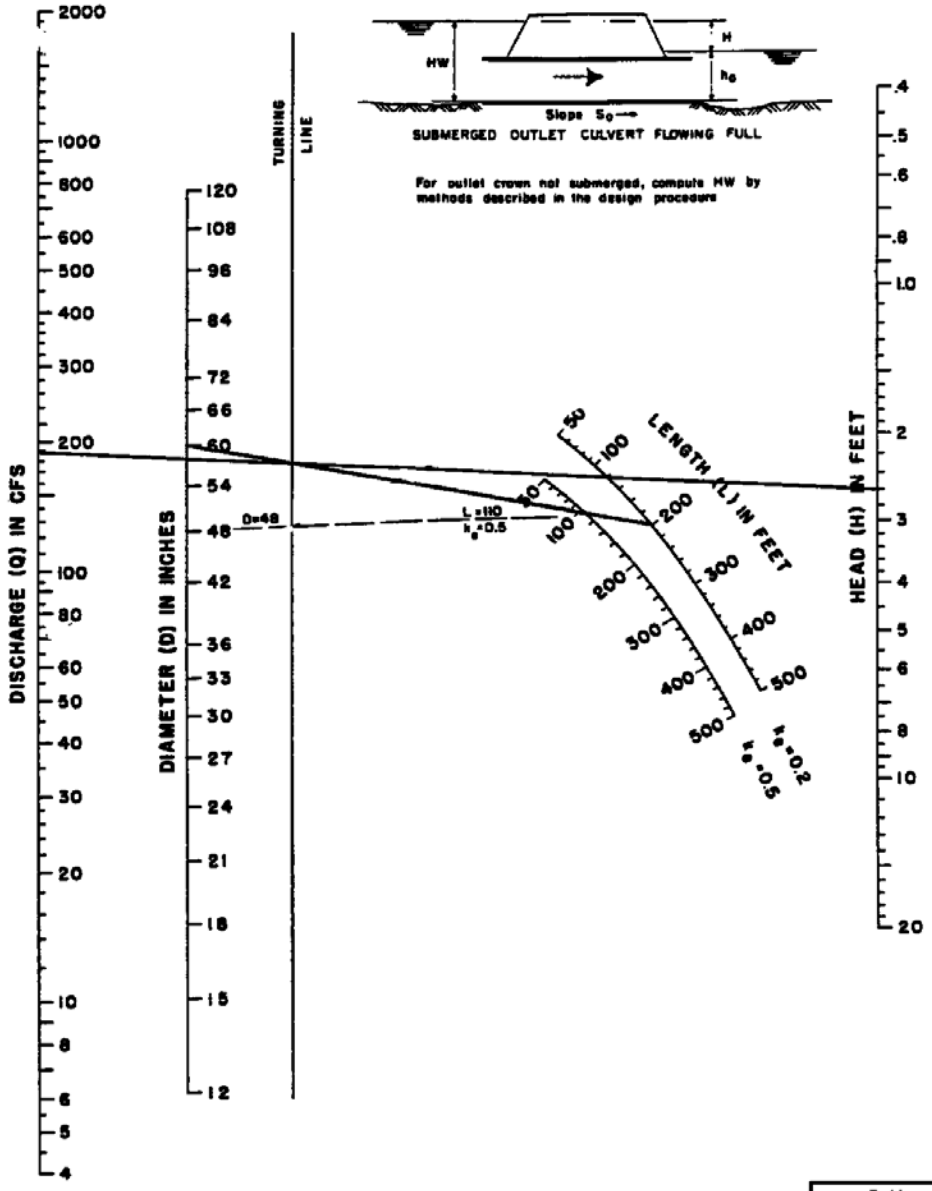
REFERENCE:

FIGURE 28.48.280(c)

STORMWATER MANAGEMENT MANUAL

EXAMPLE - OUTLET CONTROL NOMOGRAPH



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WRC ENGINEERING INC.

REFERENCE:

FIGURE 28.48.280(d)

(Res. 40-08 (§ 1207), 3-19-08)

Chapter 28.52

IRRIGATION/DRAINAGE STRUCTURES

Sections:
28.52.010 Introduction.
28.52.020 Irrigation ditch crossings (cross-drainage structures).
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28.52.040 Overchutes (flumes and pipe overchutes).

28.52.010 Introduction.

A large number of agricultural irrigation facilities exist in Mesa County, and many have historically intercepted runoff from rural and agricultural areas with little consequence. However, the development (urbanization) of these areas results in storm runoff of much higher peak flows and larger total volumes. In addition, water quality of the runoff is often adversely impacted by this urbanization. As a result, the traditional practice of utilizing irrigation ditches, drains, and reservoirs for stormwater control must be reexamined on a case-by-case basis.

It is recommended that the designer/engineer, when faced with a specific irrigation/drainage structures interface, to review in detail GJMC 28.16.200 through 28.16.230. Only after a thorough review and understanding of this chapter, and with coordination with the parties involved, shall the user proceed with the specific tasks that need to be performed. Further, the designer/engineer is cautioned to verify that damage to downstream properties will not occur by bypassing of storm runoff.

(Res. 40-08 (§ 1301), 3-19-08)

28.52.020 Irrigation ditch crossings (cross-drainage structures).

It is common for a storm drainage system to encounter irrigation ditches, canals, or even conduits, especially in agricultural areas. Mesa County contains a large percentage of agricultural lands, thus the interaction of storm runoff systems and agricultural irrigation structures is common, especially for new developments. Storm drains are often buried with sufficient cover to completely avoid an interaction with existing irrigation structures. However, it may occasionally be necessary to install storm drain pipe by boring or jacking to avoid disruption of the irrigation flow. Where the invert of a drainage channel is low enough in relation to the irrigation structure, it may be possible to utilize a standard culvert design for the crossing (see Chapter 28.48 GJMC).

In locations where stormwater flow is in an open channel or relatively shallow pipe at an intersection with an irrigation structure, other options must be considered. In certain (rare) cases, it is allowable for stormwater flow to enter an irrigation canal and then be removed (see side-channel spillways in GJMC 28.36.120) at another location. Otherwise, stormwater flow shall be kept separate from irrigation conveyances as reasonably possible. Two methods for completing this task are presented in GJMC 28.52.030 and 28.52.040: inverted siphons and overchutes. Overchutes include both flumes and pipe overchutes for the conveyance of stormwater over another channel.

(Res. 40-08 (§ 1302), 3-19-08)

28.52.030 Inverted siphons.

(a) An inverted siphon consists of a closed conduit used to convey water under an obstruction such as an irrigation structure or roadway where the use of a continuous-slope conduit would interfere with said obstruction. Sometimes called “sag pipes,” the conduit drops to an invert low enough to pass under the obstruction then rises to the channel invert at the downstream end. This infers pressure pipe flow, with successful operation being dependent on sufficient head at the upstream end to overcome the rise as well as pipe losses in the siphon section.

(b) Transitions are recommended for the upstream and downstream ends of all siphons to reduce head losses and to prevent excessive erosion. Entrance head losses reduce the effective head on the inverted siphon, thereby requiring larger upstream depths to achieve the same flow through the conduit. Concrete inlet and outlet transitions are required for siphons which:

(1) Cross railroads or State/federal highways.

(2) Are 36 inches in diameter or larger and cross a road.

(3) Are used with an unlined channel and the pipe velocity exceeds 3.5 feet per second.

(c) In locations where the siphon may be affected by groundwater flow, it may be necessary to include pipe collars to reduce piping effects. Cutoff walls may also be necessary depending on site conditions.

(d) It is recommended that the design of long inverted siphons include a blowoff structure at the low point of the alignment to allow for draining of the system (see GJMC 28.36.170(a)). These can be designed for operation by pumping or gravity draining. Shorter siphons can usually be easily drained by pumping from either end of the structure.

(e) Pipe used for inverted siphons shall be pressure-rated as required per design, shall utilize rubber gaskets (may use other joint connection devices in addition), and shall comply with the applicable pipe selection criteria set forth in GJMC 28.40.120.

(f) It is good design practice to include features in the design of an inverted siphon to minimize the risk of flooding due to the failure of the siphon to properly convey the channel flow. These features may include, but are not limited to:

(1) Increased freeboard in the upstream channel in the vicinity of the siphon.

(2) The use of multiple barrels to allow for at least partial operation if one barrel fails.

(3) The installation of a wasteway (and associated side-channel spillway) to limit the depth of water in the upstream channel.

(g) Inverted siphons pose a significant risk to human and animal safety. Specific features must be included in the design of these structures to help alleviate these risks. It is recommended that the location and safety features of any proposed inverted siphon be discussed with Mesa County and any local jurisdictions early in the design process. At some locations, a jurisdiction may disallow the use of these structures where they pose excessive or unwarranted risk to the public.

(h) The design procedure for an inverted siphon is as follows (USBR 1974):

(1) Determine an initial system layout with all known elevations and lengths. Pipe slopes between the inlet/outlet transitions and the main section of the siphon are limited to a maximum slope of 2:1. All siphon pipes shall have a slope of at least 0.005.

(2) Determine the type of inlet and outlet structures required (transitions, headwalls, etc.).

(3) Determine the type of pipe to be used. This is typically pressure-rated reinforced concrete pipe.

(4) Select initial pipe size based on the table in **Figure 28.52.030(a)**. This is based on design flow, transitions used, and the subjective length of the siphon. Presented with the table are maximum permissible pipe velocities for different siphon lengths and transition types. Siphons are considered to be relatively short if they are crossing under a road or a canal. Only flows of up to 99 cfs are included in **Figure 28.52.030(a)** since it is typically more economical to consider a bridge at flows of 100 cfs or higher. However, multiple barrels may be utilized to convey larger flows.

(5) Using the design flow rate and the properties of the initially selected pipe, determine the velocity head in the pipe (H_{vp}) and the friction slope (S_f). Using the normal depth in the upstream channel, find the velocity head (H_{v1}).

(6) Determine the additional freeboard required (FB_{add}) for the 50 feet of channel upstream of the structure:

$$FB_{add} = 0.5\,(\text{Normal Canal Bank Freeboard}) \tag{28.52-1}$$

(7) Invert elevations of the transitions are set to allow for an adequate hydraulic seal at the inlet (to minimize hydraulic loss) and to avoid submergence at the outlet. Due to the sloping pipe inlet, the effective diameter is larger than the pipe diameter:

$$D_i = \frac{D}{\cos\alpha} \tag{28.52-2}$$

Where:

D_1	=	Effective Inlet Diameter (feet)
D	=	Siphon Pipe Diameter (feet)
α	=	Slope of Inlet (α_1) or Outlet (α_2) Pipe (degrees)

Required hydraulic seal is based on the difference in velocity heads between the upstream channel and the pipe:

$$H_{seal} = 1.5 \cdot \Delta H_v = 1.5\left(H_{vp} - H_{v1}\right) \tag{28.52-3}$$

Where:

H_{seal}	=	Hydraulic Seal Required at Inlet, Min. 0.25' (feet)
H_{vp}	=	Velocity Head in the Pipe ($V^2/2g$) (feet)
H_{v1}	=	Velocity Head in the Upstream Channel (feet)

Throughout the remainder of this process, the designer is referred to **Figure 28.52.030(a)** for the locations of Stations A through H and J. Note that the siphon in **Figure 28.52.030(a)** is crossing under a roadway. In this section, the focus is on irrigation canal crossings, so the cover requirements may differ from those in the figure. Siphons crossing under a channel with flexible lining shall have a minimum of 2.0 feet of cover, and those crossing under a canal with concrete or other nonflexible lining shall have a minimum cover of six inches.

Table 28.52.030 presents equations for finding invert elevations at Stations A through H:

Table 28.52.030: Inverted Siphon Invert Elevation Equations

Station (see Figure 28.52.030(a))	Invert Elevation
A	Channel IE @ 10' U/S from the U/S transition
C	NWS Elev. @ Sta. A – H_{seal} + D_i
B	Minimum: Channel IE @ U/S end of transition Maximum: IE Sta. C + p_{inlet}
G	Channel IE @ 10' D/S from the D/S transition
H	Channel IE @ 10' D/S from the D/S transition
F	IE @ Sta. G – p_{outlet}

Where:

IE	=	Invert Elevation (feet)
NWS	=	Normal Water Surface (Design Flow) (feet)
p	=	Difference in invert elevations between the ends of the transitions (Sta. B and C or F and G) (feet)
p_{inlet}	≤	3/4D (feet)
p_{outlet}	≤	1/2D (feet)

The invert elevations of Stations D, J, and E are determined by cover requirements and pipe slope.

(8) Determine the total amount of hydraulic head available ($H_{profile}$) across the siphon profile:

$$H_{profile} = NWS@Sta.\ A - NWS@Sta.\ H \quad (28.52\text{-}4)$$

(9) Determine the approximate head loss across the preliminary profile, as well as a 10 percent factor of safety as included in Equation 28.52-5:

$$H_L = 1.1(h_i + h_f + h_b + h_o) \quad (28.52\text{-}5)$$

Where:

H_L	=	Head loss across siphon profile (with 10% F.S.) (feet)
h_i	=	Inlet transition head loss = $0.4\Delta H_v$ (feet)
h_f	=	Pipe friction losses = Pipe Length × S_f (feet)
h_b	=	Bend losses (See Equation 28.40-26) (feet)
h_o	=	Outlet transition head loss = $0.7\Delta H_v$ (feet)
ΔH_v	=	(H_{vp} – H_{v1})

For the siphon to function properly, the total head loss H_L must not exceed the available head across the profile, $H_{profile}$.

(10) Headwall height above the transition invert is dependent on backfill height and required freeboard. In many cases, the top elevation of the headwall is equal to the top of wall elevation at the cutoff, Station B. (The wall height there is determined by adding standard channel freeboard to the additional freeboard calculated in Equation 28.52-1.)

(11) Transition dimensions C, B, and cutoff depth e, and wall thickness tw are defined by **Figure 28.52.030(b)** (USBR 1974). Transition length L shall be at least three times the pipe diameter D.

(12) For most siphons, forces exerted on the pipe bends are not great enough to warrant additional structural considerations. However, for large pipes, high heads, poor foundation conditions, and large deflection angles, thrust blocks and other appurtenances shall be considered. (USBR 1974)

(13) The locations of Stations C and F are determined by the width of the obstruction and the siphon pipe slope requirements. Using the new locations for Stations C and F, determine new locations for Stations A, B, G, and H, and recompute invert elevations as applicable.

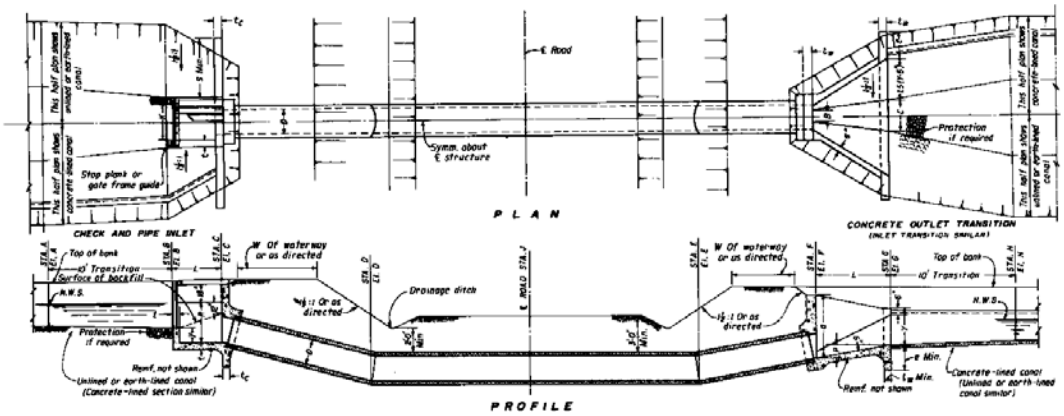
(14) Recompute total head loss (Equation 28.52-5) and verify that the final siphon profile is viable.

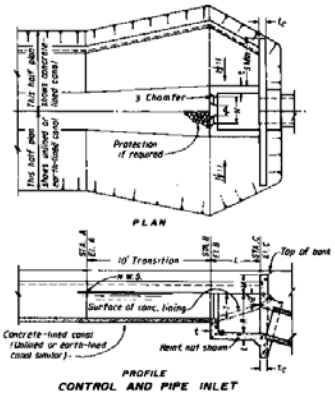
(15) Erosion protection may be required upstream and/or downstream from the siphon transitions. See Chapter 28.32 GJMC. Pipe collars may be necessary to reduce the effects of piping due to percolation along the outer wall of the pipe. A blowoff (drain) valve may be warranted for longer pipes. See Section 906 for criteria regarding these appurtenances.

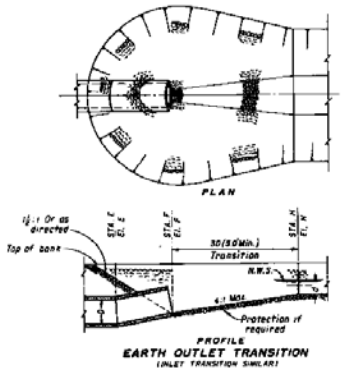
(16) Air vents, pressure-release valves, or air jumper pipes may be necessary to relieve air pressure in the siphon pipe, especially under less-than-capacity flows. A hydraulic jump can occur in the pipe, causing blowback and significantly reducing the capacity of the siphon. The aforementioned appurtenances allow for the release of trapped air from the pipe. See GJMC 28.36.170 for criteria regarding these appurtenances.

STORMWATER MANAGEMENT MANUAL

INVERTED SIPHON







PIPE DIAMETER SELECTION DATA

MAX. V=5.5 fps (EARTH TRANSITION) Q (cfs)		MAX. V=5.0 fps (CONC. TRANSITION) Q (cfs)		MAX. V=10.0 fps (CONC. TRANSITION) Q (cfs)		PIPE	
FROM	INCLUDING	FROM	INCLUDING	FROM	INCLUDING	DIA. (INCHES)	AREA (SQ. FT.)
0	3.7	0	3.9	0	7.9	12	0.785
3.7	4.3	3.9	6.1	7.9	12.3	15	1.227
4.3	6.2	6.1	8.8	12.3	17.7	18	1.767
6.2	8.4	8.8	12.0	17.7	24.1	21	2.405
8.4	11.0	12.0	15.7	24.1	31.4	24	3.142
11.0	13.9	15.7	19.9	31.4	39.8	27	3.976
13.9	17.2	19.9	24.5	39.8	49.1	30	4.909
17.2	20.8	24.5	29.7	49.1	59.4	33"	5.940
20.8	24.7	29.7	35.3	59.4	70.7	36	7.069
24.7	29.0	35.3	41.5	70.7	83.0	39	8.296
29.0	33.7	41.5	48.1	83.0	96.2	42	9.621
33.7	38.7	48.1	55.2			45	11.045
38.7	44.0	55.2	62.8			48	12.566
44.0	49.7	62.8	70.9			51	14.186
49.7	55.7	70.9	79.5			54	15.904
55.7	62.0	79.5	88.6			57	17.721
62.0	68.7	88.6	98.2			60	19.635
68.7	75.8					63	21.648
75.8	83.2					66	23.758
83.2	90.9					69	25.967
90.9	99.0					72	28.274

NOTES

Locations of vertical P.I.'s at Q and ℄ are to be considered approximate only and may be adjusted to fit actual laying length of pipe.
Siphons and elevations refer to invert unless otherwise shown.

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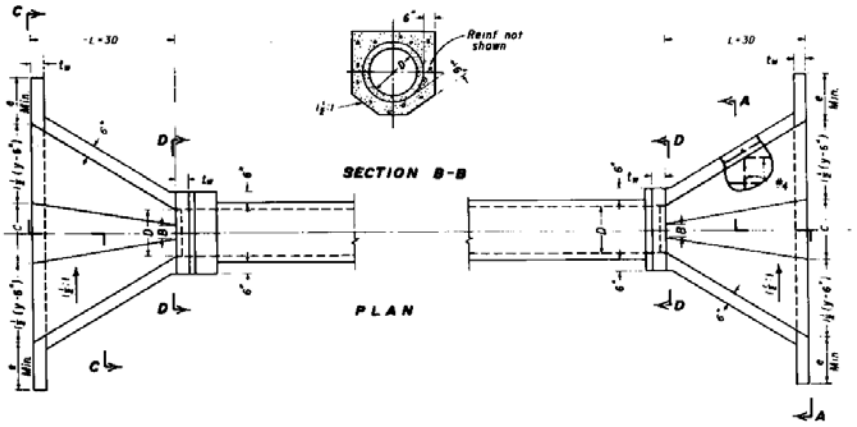
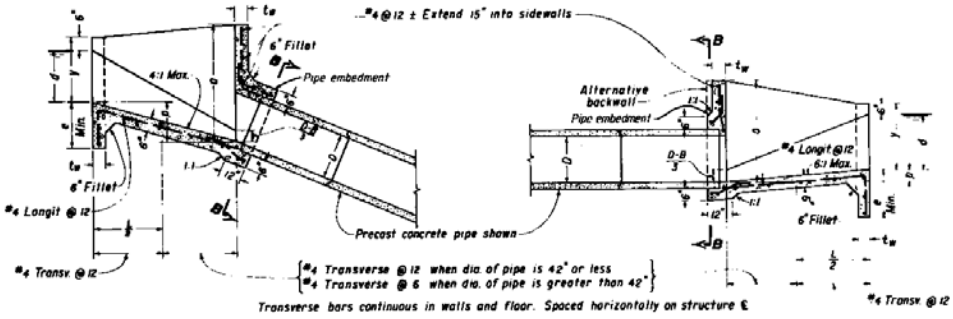
REFERENCE: DESIGN OF SMALL CANAL STRUCTURES (USBR, 1974)

FIGURE 28.52.030(a)

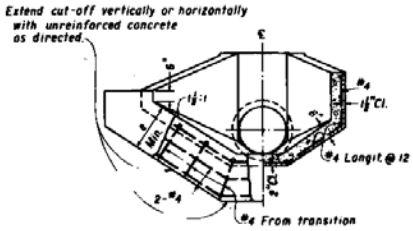
STORMWATER MANAGEMENT MANUAL

INVERTED SIPHON (TRANSITION DETAILS)

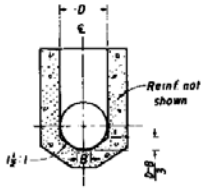




LONGITUDINAL SECTION



SECTION A-A
(SECTION C-C SIMILAR)



SECTION D-D

DIMENSIONS e AND t_w

DEPTH (d) OF WATER IN CANAL	e	t_w
0' to 3'	24"	6"
3' to 6'	2'-6"	8"
Greater than 6'	3'-0"	8"

DIMENSION C

RELATIONSHIP OF PIPE DIAMETER (D) TO DEPTH (d) IN CANAL	C WITH WATER SURFACE ANGLE OF 22 ½°	C WITH WATER SURFACE ANGLE OF 25°	C WITH WATER SURFACE ANGLE OF 27 ½°
D=d	.50	.80	1.10
D=1.25d	1.10	1.40	1.70
D=1.5d	1.50	1.80	2.10
D=2d	2.00	2.30	2.60

NOTES

The minimum freeboard at the transition cutoff of structures in earth lined or unlined canals should be 6 inches for depths of water at the cutoff of 0 to 1.25 feet, 9 inches for depths 1.26 to 2.00 feet, and 12 inches for depths 2.00 to 5.00 feet.
The freeboard at the transition cutoff of structures in hard surface lined canals should be the same as the freeboard of the lining.
The freeboard at transition headwalls should be equal to or greater than the freeboard at the cutoff for 24 inch pipe and smaller and the freeboard should increase as the size of the structure increases.
B=.3D3D
y=Depth (d) at cutoff plus freeboard at cutoff.
The elevation of the invert at the headwall is determined from the required submergence at the headwall opening.

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REFERENCE: DESIGN OF SMALL CANAL STRUCTURES (USBR, 1974)

FIGURE 28.52.030(b)

(Res. 40-08 (§ 1302.1), 3-19-08)

28.52.040 Overchutes (flumes and pipe overchutes).

The term "overchutes" refers to cross-drainage structures that pass over the normal water surface elevation of the drainage being crossed. While typically used to convey stormwater (or other) across an irrigation canal or natural drainageway, other obstructions such as roads and railroad tracks occasionally require these structures. Where the obstruction being crossed conveys anything other than water (such as vehicles), clearance to the overchute must be considered. The designer shall ensure that an overchute installed at a waterway will not adversely impact the design capacity of that waterway. This includes a minimum clearance of 1.0 foot over the normal water surface of the waterway.

Overchutes can be open-channel structures (flumes) or pipes, depending on site conditions. Rectangular concrete flume sections are typically used for larger cross-drainage (e.g., stormwater) flows and for areas where debris is expected to prohibit the use of pipes. **Figure 28.52.040(a)** presents a typical plan and profile for a rectangular concrete flume overchute. For smaller cross-drainage flows, pipe overchutes are typically employed for economic reasons. See **Figure 28.52.040(b)** for typical plans and profiles for two pipe overchute types. Note that welded steel pipe is specified for the suspended section of each due to the additional forces and exposure to which those sections are subjected. Both Figures assume that the obstruction being crossed is an existing trapezoidal canal.

(a) Flume Overchutes. The design of a flume overchute ("chute") is as follows (USBR 1974):

(1) The chute invert slope is dependent upon the selected method of energy dissipation at the chute outlet. Some, such as a stilling basin, best function with supercritical influent. Others, such as a baffled apron drop (GJMC 28.36.060), require subcritical flow at the entrance. Also, a wider, shallower flume section will require a smaller depth at the inlet pool and will more easily satisfy freeboard requirements. Therefore, the most economical flume section may not be the most efficient overall.

Where supercritical flow is desired, the following equations are used to determine critical slope:

$$d_c = \frac{q^{2/3}}{g^{1/3}} \qquad (28.52\text{-}6)$$

$$A_c = b \cdot d_c \qquad (28.52\text{-}7)$$

$$V_c = \frac{Q}{A_c} \qquad (28.52\text{-}8)$$

$$H_{v_c} = \frac{V_c^2}{2g} \qquad (28.52\text{-}9)$$

$$E_{s_c} = d_c + H_{v_c} \qquad (28.52\text{-}10)$$

$$S_c = \left[\frac{nV_c}{1.49 \cdot R^{2/3}}\right]^2 \qquad (28.52\text{-}11)$$

Where:

d_c	=	Critical depth (feet)
q	=	Flow per unit width (cfs/ft.)
A_c	=	Critical area (sf)
V_c	=	Critical velocity (fps)
H_{v_c}	=	Velocity head (critical flow) (feet)
E_{s_c}	=	Specific energy (critical flow) (feet)
S_c	=	Critical slope (ft./ft.)
n	=	Manning's roughness = 0.015
R	=	Hydraulic radius (feet)

The chute invert slope shall be at least 20 percent greater than critical slope (S_c) for the selected cross-section to avoid unstable flow that occurs around critical flow.

Where subcritical flow is desired, the slope shall be set appreciably less than critical slope as defined by Equation 28.52-11.

Normal depth at design flow in the flume shall be a minimum of 1.0 foot below the top of the flume wall for all nonpiped overchutes. Normal depth shall be based upon a Manning's roughness coefficient of 0.015 for the purpose of this criterion.

(2) Determine the required pool depth at the inlet transition, d_o. Equation 28.52-12 assumes that velocity in the inlet pool is zero:

$$d_o = d_c + H_{v_c} + 0.3 \cdot H_{v_c} \qquad (28.52\text{-}12)$$

Provide 2.0 feet of freeboard above the pool depth in the channel upstream from the overchute, and 1.0 foot of freeboard above the pool depth in the flume from the inlet pool to the suspended portion.

(3) The chute wall height across the suspended portion of the flume shall be equal to the maximum depth in the chute plus 1.0 foot of freeboard.

(4) Determine the flow depth at the downstream end of the chute using the Bernoulli Equation iteratively on d_2:

$$E_{s_2} + h_f = E_{s_1} + S_o L \qquad (28.52\text{-}13)$$

Where:

E_{s2}	=	D/S Specific Energy = $d_2 + H_{v2}$ (feet)
h_f	=	Friction Loss (feet)
E_{s1}	=	U/S Specific Energy = $d_1 + H_{v1}$ (feet)
S_oL	=	Vertical Drop across Chute (feet)

(5) A stilling basin or other energy dissipation structure shall be included as necessary per GJMC 28.36.020 through 28.36.060 and 28.36.070 through 28.36.100.

(b) Pipe Overchutes. The design of a pipe overchute is as follows (USBR 1974):

(1) The invert of the inlet transition is limited by the following:

(i) At least 1.0 foot of clearance shall be provided between the irrigation canal water surface and the pipe, where applicable. Larger clearances may be required for other types of obstructions.

(ii) 2.0 feet of bank freeboard shall be provided above the maximum water surface in the upstream channel.

(iii) Inlet losses reduce the effective capacity of the pipe. Therefore, it is recommended that the inlet opening be submerged by a minimum of $1.5H_{v(pipe)}$ to offset this loss and maintain one full velocity head in the pipe.

(2) Determine inlet/outlet control:

For inlet control, the required depth at the inlet (d_i) for a discharge of Q through the pipe is determined using Equation 28.52-14:

$$d_i = \frac{Q^2}{2gC^2A^2} \qquad (28.52\text{-}14)$$

Where:

C	=	Orifice discharge coefficient = 0.6
d_i	=	Depth (feet)
Q	=	Flow rate (cfs)
A	=	Cross-sectional area of pipe (sf)
q	=	Gravitational constant, 32.2 ft./s^2

Under outlet control, the required head for discharge Q is equal to the head losses through the pipe:

$$d_i = \sum H_L = h_i + h_f + h_o \qquad (28.52\text{-}15)$$

Where:

H_L	=	Head loss across pipe (feet)
h_i	=	Inlet head loss (feet)
h_f	=	Pipe friction losses = Pipe length × S_f (feet)
h_o	=	Outlet transition head loss (feet)

(3) Pipe overchutes shall be designed with a maximum full pipe velocity of 10 feet per second for concrete transition outlets or 12 feet per second for baffled outlets.

(4) Pipe diameter is determined by:

$$D = 1.13\sqrt{\frac{Q}{V}} \qquad (28.52\text{-}16)$$

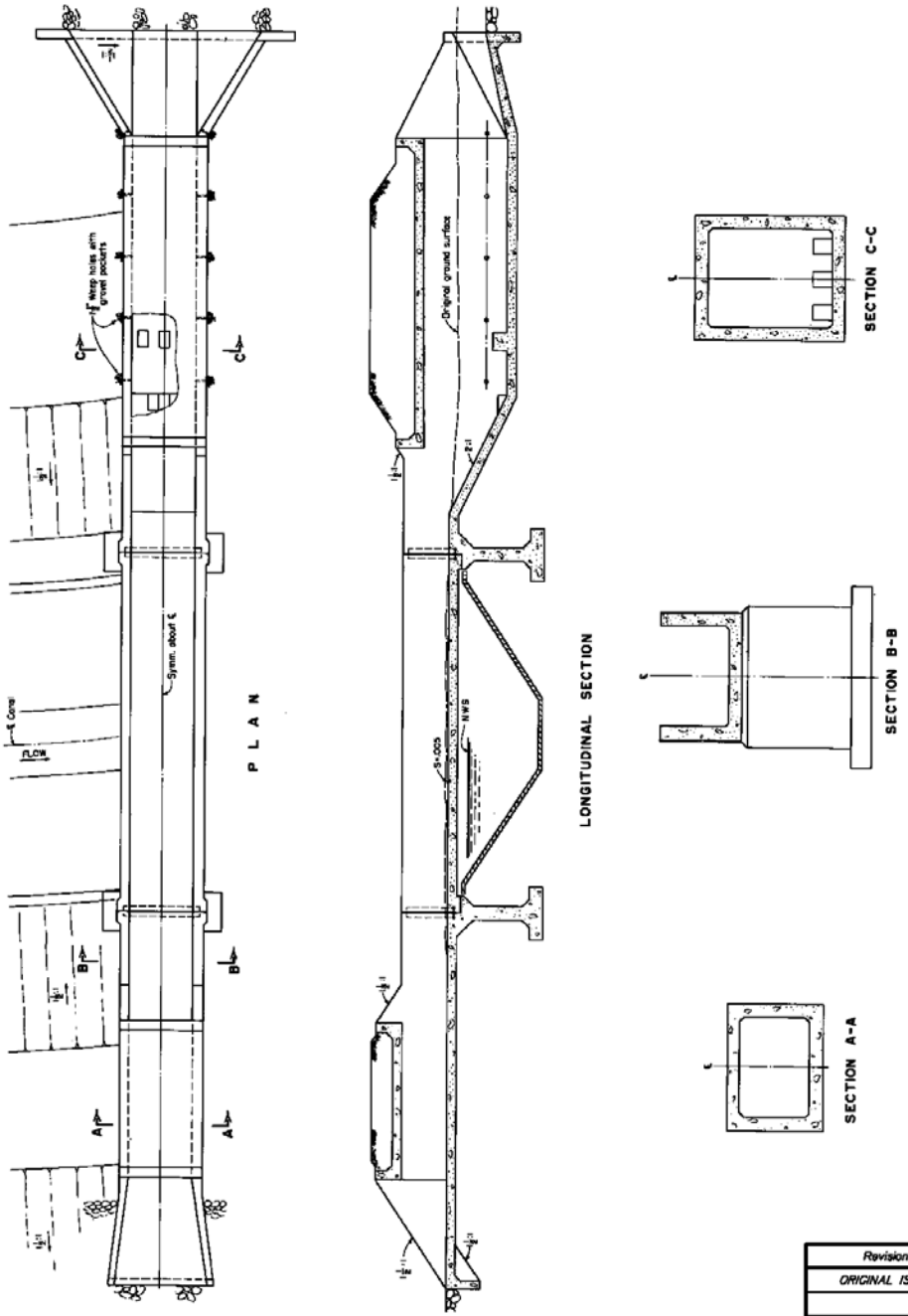
The minimum recommended diameter for an overchute pipe for the purpose of conveying stormwater is 24 inches. Depending on expected sediment and debris loads, some sites may necessitate larger minimum diameters.

(5) Structural and reinforcement requirements are not specified herein as they are outside the scope of this manual. Support piers shall be located so as to minimize potential adverse effects on the operation of the obstruction being crossed.

(6) An energy dissipation structure and/or other erosion protection shall be installed downstream of the overchute as applicable per Chapter 28.32 GJMC, GJMC 28.36.020 through 28.36.060 and 28.36.070 through 28.36.100, and Chapter 28.48 GJMC.

STORMWATER MANAGEMENT MANUAL

RECTANGULAR CONCRETE FLUME OVERCHUTE



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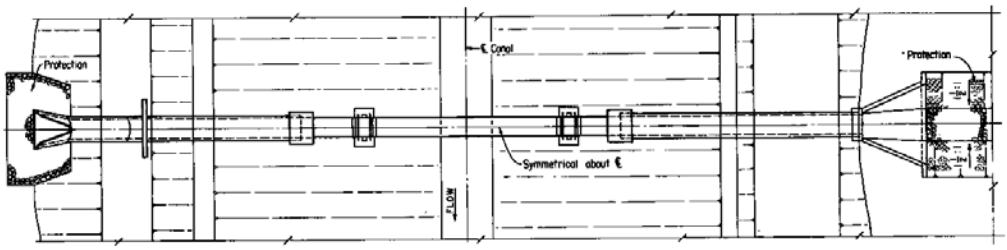
REFERENCE: DESIGN OF SMALL CANAL STRUCTURES (USBR, 1974)

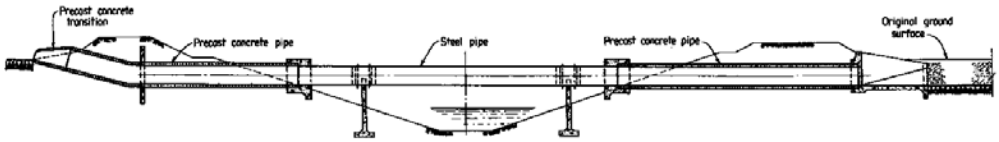
FIGURE 28.52.040(a)

STORMWATER MANAGEMENT MANUAL

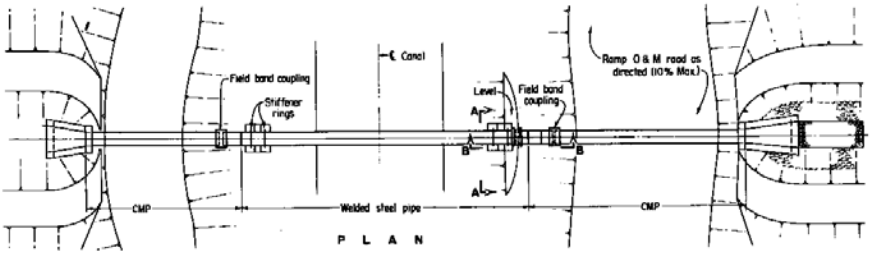
PIPE OVERCHUTES



P L A N



P R O F I L E
WELDED STEEL PIPE AND PRECAST CONCRETE PIPE



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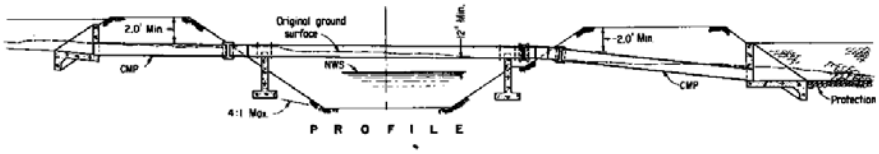
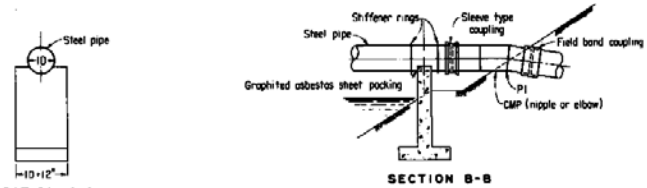


P R O F I L E



SECTION A-A
SECTION B-B

WELDED STEEL PIPE AND CORRUGATED METAL PIPE

Revision	Date
ORIGINAL ISSUE	3/27/08

WRC ENGINEERING, INC.

REFERENCE: DESIGN OF SMALL CANAL STRUCTURES (USBR, 1974)

FIGURE 28.52.040(b)

(Res. 40-08 (§ 1302.2), 3-19-08)

Chapter 28.56

DETENTION AND RETENTION

Sections:

28.56.010 Introduction.
28.56.020 Detention versus retention.
28.56.030 Local detention facilities.
28.56.040 Regional detention facilities.
28.56.050 Drainage fee in lieu of detention.
28.56.060 Drainage fee basis.
28.56.070 Drainage fee calculation.
28.56.080 Detention for management of stormwater quality.
28.56.090 Design storm criteria.
28.56.100 Geometric requirements.
28.56.110 Dry basin bottom drainage.
28.56.120 Accessibility and maintenance.
28.56.130 Calculating storage volume available.
28.56.140 Groundcover and landscaping.
28.56.150 Freeboard requirements.
28.56.160 State Engineer's Office.
28.56.170 Embankment protection.
28.56.180 Inlet and outlet design.
28.56.190 Off-site flows.
28.56.200 Retention.
28.56.210 Hydrologic design methods and criteria.
28.56.220 HEC-1 method.
28.56.230 Rational method.
28.56.240 Compensating detention analysis.
28.56.250 Over-detention analysis.
28.56.260 Hydraulic design of outlet works.

28.56.010 Introduction.

The main purpose of a detention basin is to store runoff and reduce peak discharge by allowing flow to be discharged later at a controlled rate, and within a reasonable time. This controlled discharge rate is based on either limited downstream capacity (regional and local facilities) or on a limit on the increase in flows over predevelopment conditions (local facilities only). Detention has been shown to be very beneficial in controlling flood peaks in an urbanized area. Use of detention includes local detention such as in-channel or within a parking lot, and regional detention, such as a large recreational lake or reservoir and off-line detention facilities. Regional and local detention facilities are more fully discussed below. Policy regarding detention and extended detention (retention) is found in GJMC 28.16.090 and 28.16.100.

It is important that any extended detention (retention) be supported by valid water rights that allows for retention without impacting any vested water rights on the stream system.

(Res. 40-08 (§ 1401), 3-19-08)

28.56.020 Detention versus retention.

Stormwater storage reservoir types are numerous, but they essentially fit into one of two categories: detention or retention. The words "pond" and "basin" are used interchangeably when used in connection with both detention and retention reservoirs. A detention basin or pond detains water temporarily, releasing water through a pipe or channel by means of a weir, orifice, or pump. Because of its ability to release flow during inflow, the overall volume of storage required for a given storm event is reduced. Another

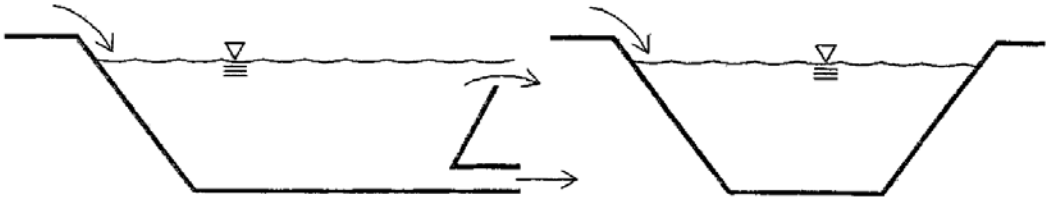
advantage of the detention basin is the positive means of outflow, resulting in fewer problems with long-term ponding. A retention basin or pond retains water without any initial release during inflow. Once the storm event is over, pond drainage may occur due to evaporation and percolation into the soil. In some instances, retention basins may also involve a gated pipe or pump which is closed or inoperative during the storm event. However, if a gated pipe or pump is an available or desirable option, it would normally be advantageous to release water during stormwater inflow, which would change the basin from a retention basin to a detention basin. The difference in detention and retention basins is depicted in **Figure 28.56.020**.

The words “pond” and “basin” may be used to refer to reservoirs that remain dry outside of storm events, or store water for other purposes, e.g., irrigation, recreation, aesthetics, etc., in addition to receiving stormwater during storm events. Words “wet” and “dry” are used as prefixes to describe the condition of ponds and basins. However, a wet pond and dry basin each have a specific meaning.

Wet ponds may be desirable compared to dry basins in some circumstances. It may be that ample storage volume exists to provide an aesthetic, recreational, or irrigation pond below the required reservoir volume. Use of irrigation storage facilities for stormwater detention purposes must be reviewed by the appropriate jurisdiction(s) on a case-by-case basis. It is required that the stormwater reservoir volume provided must be in addition to the maximum expected base storage (irrigation or wet pond) volume. This is depicted in **Figure 28.56.020**.

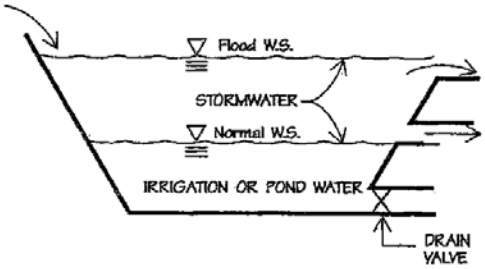
STORMWATER MANAGEMENT MANUAL

DETENTION AND RETENTION BASIN

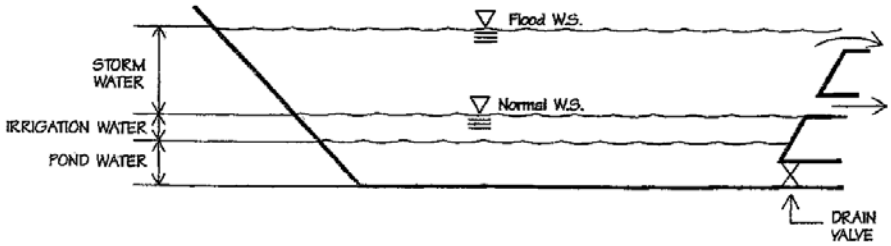


DETENTION BASIN RETENTION BASIN

WET POND COMBINATIONS



IRRIGATION OR POND AND STORMWATER DETENTION



POND, IRRIGATION, AND STORM WATER DETENTION POND

NOTE: Although the irrigation water will cycle between the pond normal surface and the maximum depth shown, all hydraulic analysis shall be based upon the full amount of irrigation water being present.

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WRC ENGINEERING INC.	REFERENCE: MESA COUNTY SWMM DATED MAY 1996	FIGURE 28.56.020

(Res. 40-08 (§ 1402), 3-19-08)

28.56.030 Local detention facilities.

Local detention facilities are usually designed by and financed by developers or local property owners. The facilities are intended to allow development by protecting a site from existing flooding conditions or to protect downstream property from increased runoff caused by development. Two classes of local facilities are defined below.

(a) Local Minor Facilities. Local minor detention facilities are defined as serving a single development with a hydrologic basin smaller than or equal to 20 acres and are designed to mitigate the impact of increased runoff due to development. The outlet capacity is generally based on predevelopment hydrology, and the detention structures are generally small (0.01 to one acre-foot). Detention storage volume may be provided as small landscaped or turfed basins, parking lot storage, or a suitable combination of all.

(b) Local Major Facilities. Local major detention facilities are defined as serving more than a single development or serving hydrologic basins greater than 20 acres in size. These facilities may serve dual functions. They typically reduce existing flooding problems to allow more development and/or control increased runoff caused by additional development. These facilities may store significant flood volumes and will generally be funded by the developer. They may handle both off-site and on-site flows. Due to their larger size, these basins are designed much the same as regional detention facilities.

(Res. 40-08 (§ 1403.1), 3-19-08)

28.56.040 Regional detention facilities.

Regional detention facilities are those identified in the current Grand Valley Stormwater Master Management plan or as designated by local jurisdiction. Generally, these facilities control flow on major drainageways, are large in size, and are owned and maintained by public agencies. The purpose of these facilities is to significantly reduce downstream flows in order to maximize the capacity of existing systems and maintain flows at or below historic rates.

(Res. 40-08 (§ 1403.2), 3-19-08)

28.56.050 Drainage fee in lieu of detention.

The developer may be given the option of paying a drainage fee in lieu of providing adequate detention facilities. Such an option may be considered only if the developer completes an engineering analysis to show that all downstream facilities have adequate capacity to handle the undetained flows from the proposed development. If such option is allowed, this does not waive the requirements for drainage planning submittal requirements as outlined in Chapter 28.12 GJMC.

(Res. 40-08 (§ 1404), 3-19-08)

28.56.060 Drainage fee basis.

(a) For stormwater management purposes, charges assessed to existing and new development to offset cost of providing drainage facilities and services are typically categorized as an impact fee or a utility fee.

(b) An impact fee is based on the cost of upgrading drainage services within a watershed, shared among all new developments within the watershed. The basis for sharing costs can be as simple as the size of the water tap and as complex as calculating imperviousness of the property then making adjustments for various best management practices, such as detention. An impact fee is a one-time charge against new development.

(c) A utility fee is based on the cost of upgrading and maintaining drainage services within a watershed to meet current standards or level-of-service. A utility fee is often assessed to all properties, devel-

oped or not, and often is limited to providing maintenance of the system and minor capital improvements. Utility fees are normally charged on a monthly basis.

(d) Since the local jurisdiction charge is a fee in lieu of detention for new development, it is considered a limited impact fee. Reasonableness tests applied to impact fees include:

(1) The system impact fee shall be related to the amount of drainage improvements needed to meet local standards.

(2) The impact fee shall only cover capital and related (i.e., engineering, construction administration, etc.) costs for improvements.

(Res. 40-08 (§ 1404.1), 3-19-08)

28.56.070 Drainage fee calculation.

(a) The formula used by local jurisdictions to calculate drainage fee is of the form:

$$\text{Drainage Fee (\$)} = B(C_D - C_H)A^{0.7} \qquad (28.56\text{-}1)$$

Where:

B	=	Fee constant (established annually by City Council of local jurisdiction)
C_D	=	100-year runoff coefficient (expressed as a decimal) based on developed land use conditions
C_H	=	100-year runoff coefficient (expressed as a decimal) based on pre-developed land use conditions
A	=	Area of development (acres)

Assigning B = $14,000, A = 1 acre, C_D = 0.60 and C_H = 0.51, based on SCS Type C soils, and an imperviousness of two percent pre-developed and 50 percent developed, the fee in lieu of detention would be $1,260.

(b) The equation used in Mesa County and the other local jurisdictions takes into account key factors for a fee in lieu of detention, such as:

(1) The fee is based on area.

(2) The fee takes into account imperviousness by using the rational method C values.

(3) The fee takes into account the difference between pre- and post-development runoff rates, which is the main function of on-site detention.

(c) The constant B needs to closely reflect the actual cost of providing detention, and must be changed with time as the need arises. Local jurisdictions will review this figure annually and make appropriate recommendations for its adjustment.

(Res. 40-08 (§ 1404.2), 3-19-08)

28.56.080 Detention for management of stormwater quality.

In addition to the primary purpose of detention and retention facilities to reduce peak flows, they can be adapted to enhance stormwater quality.

The outlet for a detention basin can be designed to allow for a slower rate of release and thus provide time for particulate pollutants to settle out of the stormwater. Such basins are called extended detention basins (EDB). It is recommended that an EDB outlet be designed to completely drain a full basin in 48 hours,

allowing for the removal of a significant portion of insoluble pollutants with proper operation and maintenance.

A retention pond (RP) is a sedimentation facility designed to have a permanent water pool. This pool of water is mixed with stormwater during storm runoff events from frequently occurring storms and allows for sedimentation and thus water quality enhancement to occur.

For frequently occurring storms, both EDBs and RPs capture the total runoff as a surcharge. However, in the case of RPs, the stormwater is allowed to mix with the permanent pool water as it rises above the permanent pool level. All surcharged water above the permanent pool level is to be released over 48 hours. Details related to the design of EDBs and RPs can be found in Chapter 28.60 GJMC, Construction Site Stormwater Runoff Control, and Chapter 28.64 GJMC, Post-Construction Stormwater Management.

For the 100-year detention, the water quality volume is considered to be a part of the volume required for detention purposes.

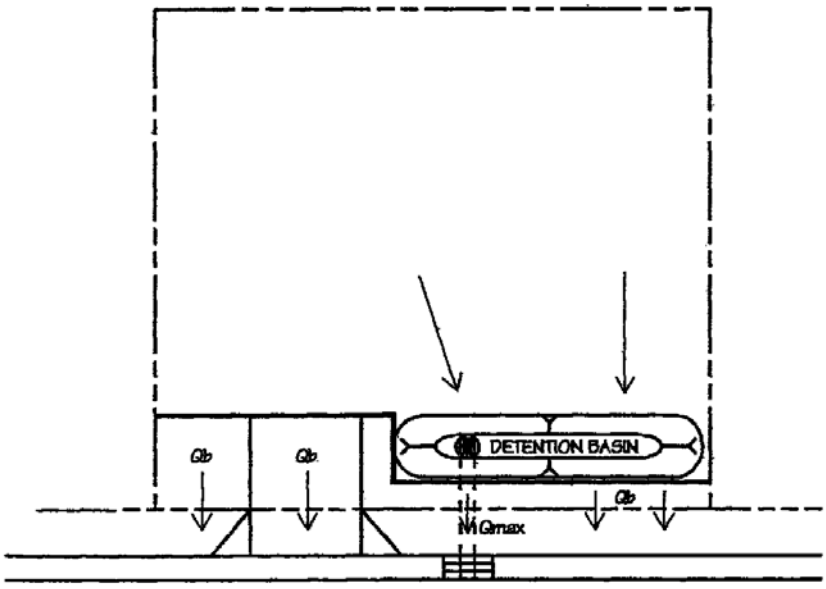
(Res. 40-08 (§ 1405), 3-19-08)

28.56.090 Design storm criteria.

Peak runoff from a site may not be increased in the 10- and 100-year storms due to development. The site runoff may be a composite of detention/retention basin release/overflow and direct runoff, both of which must be considered. If direct runoff is allowed from the site, the sum of the direct runoff plus the release from the detention basin must not exceed the historic rate. This is depicted in **Figure 28.56.090** and discussed further in GJMC 28.56.240.

STORMWATER MANAGEMENT MANUAL

TOTAL SITE RUNOFF



Maximum release from detention pond Qmax ≤ Historic peak Q_h minus direct bypass runoff Qb

$Q_{max} \leq Q_h - Qb$

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WRC ENGINEERING, INC.

REFERENCE: MESA COUNTY SWMM DATED MAY 1996

FIGURE 28.56.090

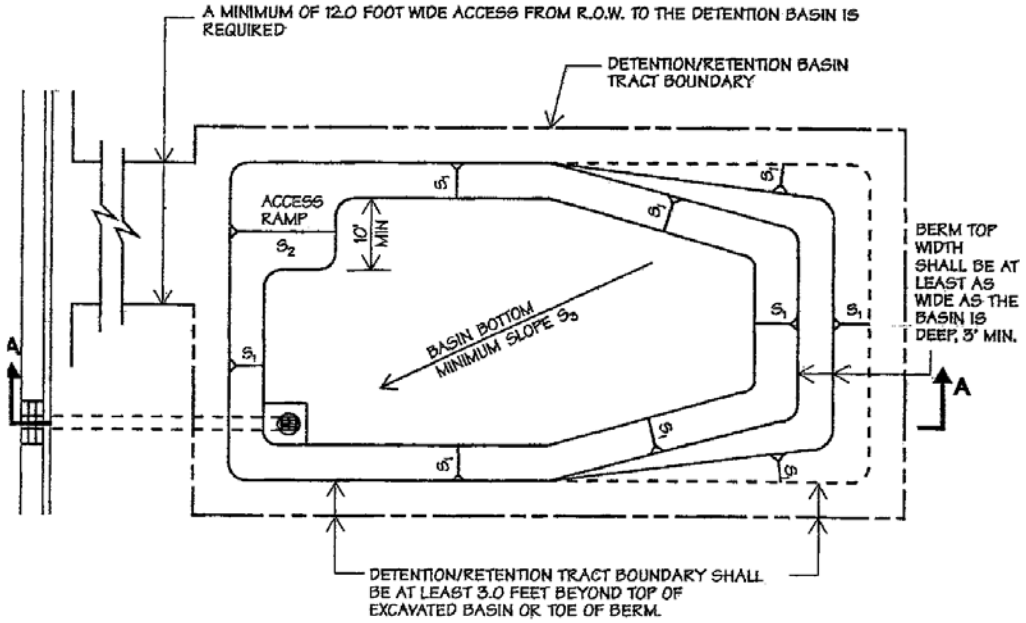
(Res. 40-08 (§ 1406.1), 3-19-08)

28.56.100 Geometric requirements.

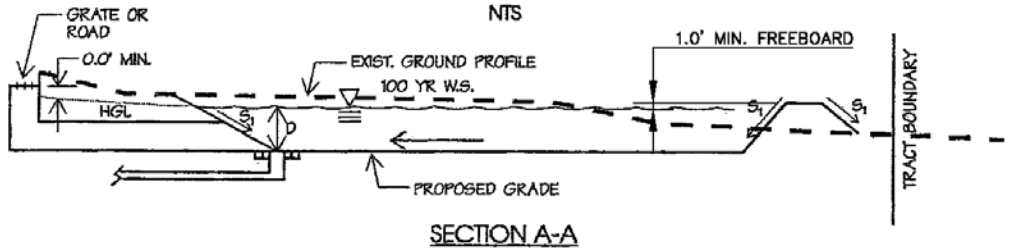
For proper function and safety considerations, geometric requirements shall be as shown on **Figure 28.56.100**.

STORMWATER MANAGEMENT MANUAL

DETENTION/RETENTION BASIN GEOMETRIC REQUIREMENTS



PLAN VIEW
NTS



SECTION A-A
NTS

STEEPEST S_1: 4H:1V FOR BASINS ON PUBLIC LANDS AND PARKS
3H:1V FOR SEEDED OR SODDED SLOPES
2H:1V FOR RIPRAP OR OTHER APPROVED SLOPE PROTECTION
VERTICAL WALLS WITH SAFETY RAILING LIMITED TO ONE SIDE ONLY WHERE APPROVED BY THE CITY ENGINEER OR COUNTY DEVELOPMENT ENGINEER.

STEEPEST S_2: 6H:1V FOR ACCESS RAMP, ALL SURFACES

MINIMUM S_3: 0.5% FOR CONCRETE CHANNEL
1.0% FOR ASPHALT (PARKING LOT)
2.0% FOR ALL OTHER SURFACES

MAXIMUM D: 4' RETENTION BASIN
8' WET OR DRY DETENTION FACILITY
>8' SPECIAL APPROVAL REQUIRED, BUT MAY BE ALLOWED FOR MULTIPLE USE PONDS OR FOR STEEP TERRAINS

MINIMUM D: 4' WET PONDS (SEE PAGE VIII-1)

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ORIGINAL ISSUE	3/27/06

WRC ENGINEERING, INC.	REFERENCE: MESA COUNTY SWMM DATED MAY 1996	FIGURE 28.56.100

(Res. 40-08 (§ 1406.2), 3-19-08)

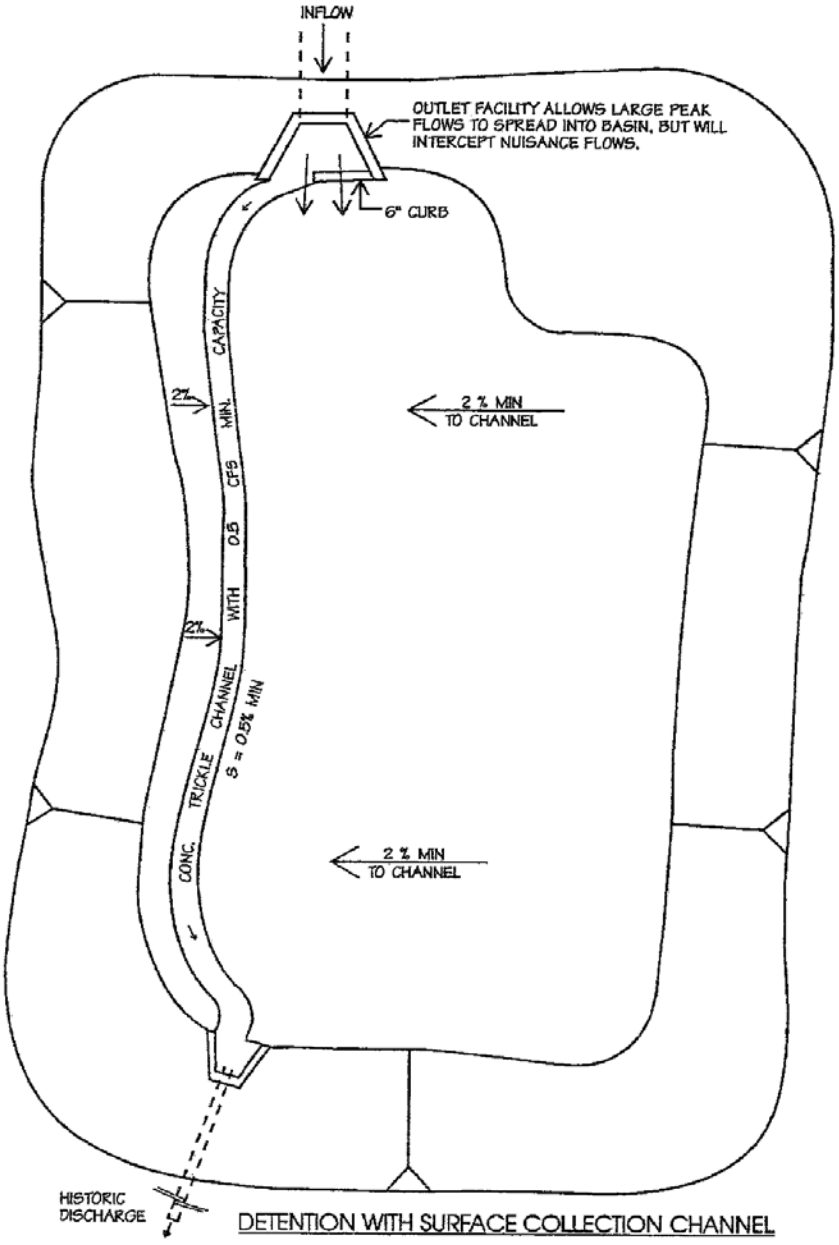
28.56.110 Dry basin bottom drainage.

Most drainage conveyance systems are designed to divert even minor nuisance flows to stormwater storage facilities. For dry basins, this can present an aesthetic and maintenance problem. Conveyance facilities to a dry basin shall be capable of transporting flow to the outlet facility rather than causing a soggy bog condition that cannot be properly maintained. Facilities conveying trickle or nuisance flows, such as from irrigation sprinklers, shall be adequate to convey at least 0.5 cfs. Reference is made to **Figures 28.56.110(a)** and **28.56.110(b)**.

The outlet facility for a retention basin would be a dry well or riprap filled dissipation pit. For a detention basin, the nuisance flows shall be conveyed to the basin outlet.

STORMWATER MANAGEMENT MANUAL

DRY BASIN TRICKLE FLOW CONVEYANCE



DETENTION WITH SURFACE COLLECTION CHANNEL

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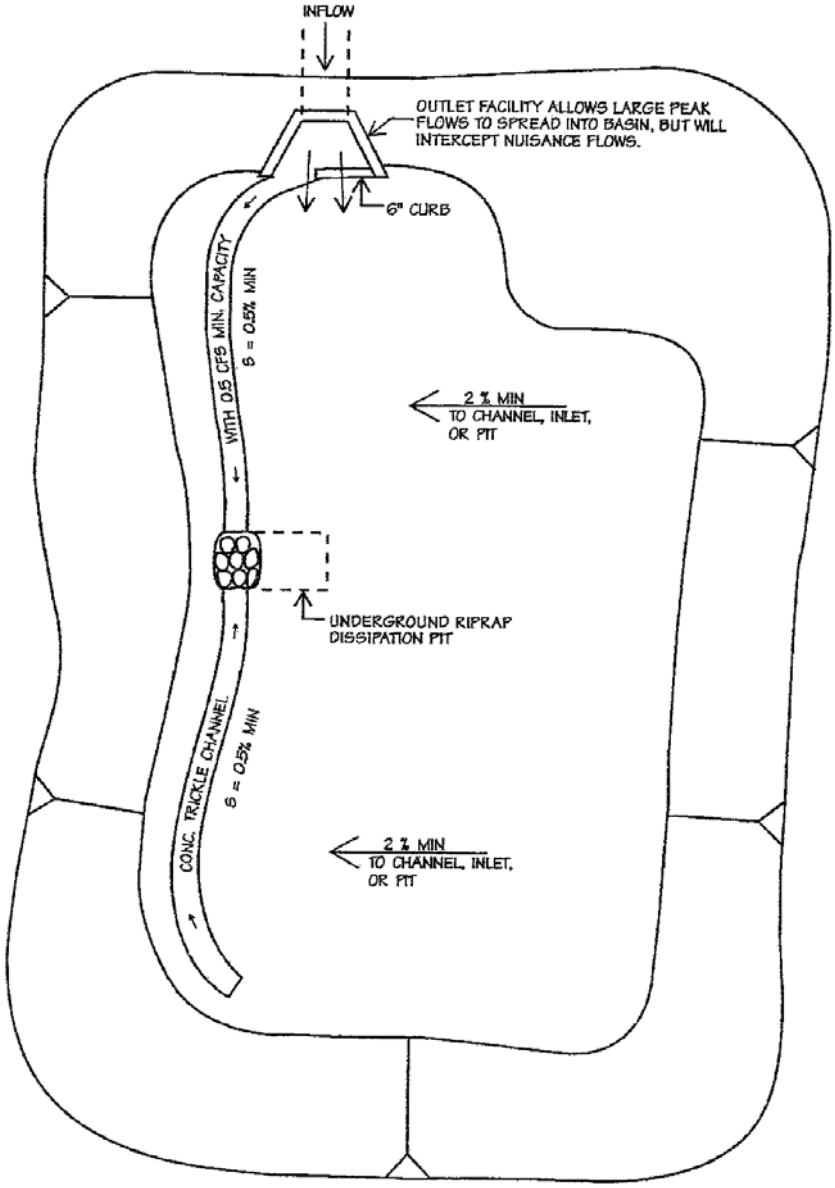
WRC ENGINEERING, INC.

REFERENCE: MESA COUNTY SWMM DATED MAY 1996

FIGURE 28.56.110(a)

STORMWATER MANAGEMENT MANUAL

DRY BASIN TRICKLE FLOW CONVEYANCE



RETENTION WITH SURFACE COLLECTION CHANNEL
(THE SAME CONCEPT APPLIES TO AN UNDERGROUND SYSTEM)

Revision	Date
ORIGINAL ISSUE	3/27/06

WRC ENGINEERING, INC.	REFERENCE: MESA COUNTY SWMM DATED MAY 1996	FIGURE 28.56.110(b)

(Res. 40-08 (§ 1406.3), 3-19-08)

28.56.120 Accessibility and maintenance.

All reservoirs or ponds which serve more than a single lot or site must be provided with a detention/retention tract dedicated for maintenance access. Maintenance of required volume and inflow and outflow works is necessary for the facility to function as required. Dedicated rights-of-way and/or easements must be provided as required in GJMC 28.16.020(b).

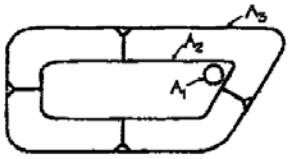
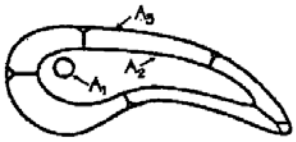
(Res. 40-08 (§ 1406.4), 3-19-08)

28.56.130 Calculating storage volume available.

Storage volume shall be calculated by the methods shown prescribed in **Figure 28.56.130**.

STORMWATER MANAGEMENT MANUAL

CALCULATING STORAGE VOLUME

BASIN SHAPE			
BASIN TYPE	VERTICAL WALLS AND/OR PRISMATIC BASINS	FAIRLY UNIFORM SHAPE AND SIDE SLOPES OR	HIGHLY IRREGULAR SHAPE AND SIDE SLOPES
VOLUME CALCULATION METHOD	AVERAGE END AREA METHOD	CONIC METHOD	
EQUATION	$V = \left(\frac{A_n + A_{n+1}}{2}\right)L$	$V = \Sigma V_{n \text{ to } n+1}$ $V_{n \text{ to } n+1} = \left[A_n + A_{n+1} + (A_n A_{n+1})^5\right]\frac{h}{3}$	

WHERE: V = VOLUME (ft)
A_n = HORIZONTAL AREA (ft^2) AT ELEVATION "n"
A_{n+1} = HORIZONTAL AREA (ft^2) AT ELEVATION "n+1"
h = VERTICAL HEIGHT (ft) BETWEEN ELEVATION "n" AND "n+1"
$V_{n \text{ to } n+1}$ = VOLUME BETWEEN ELEVATION "n" AND "n+1"
L = LENGTH (ft) BETWEEN TWO ENDS

NOTE: THE ABOVE EQUATIONS MAY BE USED IN SUCCESSION FOR INCREMENTAL HEIGHTS WITHIN A BASIN. AN AREA SHOULD BE SELECTED AT ALL SIGNIFICANT CHANGES IN SHAPE OR SIDE SLOPE.

Revision	Date
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WRC ENGINEERING, INC.

REFERENCE: MESA COUNTY SWMM DATED MAY 1996

FIGURE 28.56.130

(Res. 40-08 (§ 1406.5), 3-19-08)

28.56.140 Groundcover and landscaping.

After final grading, the slopes and bottom of each detention and retention basin shall be protected from erosion by seeding and mulching, sodding or other approved groundcover and shall be in accordance with jurisdictional specifications.

The planting of trees and shrubs on the slopes of stormwater basins is also encouraged. Temporary and/or permanent irrigation systems shall be provided as required for the type of groundcover and landscape installed and approved.

(Res. 40-08 (§ 1406.6), 3-19-08)

28.56.150 Freeboard requirements.

The minimum required freeboard for open space detention/retention facilities is 1.0 foot above the computed 100-year water surface elevation.

(Res. 40-08 (§ 1406.7), 3-19-08)

28.56.160 State Engineer's Office.

Any dam constructed for the purpose of storing water, with a surface area, volume, or dam height as specified in § 37-87-105, C.R.S., as amended, shall require the approval of the plans by the State Engineer's Office. All detention and retention storage areas shall be designed and constructed in accordance with these criteria. Those facilities subject to State statutes shall be designed and constructed in accordance with the criteria of the State.

(Res. 40-08 (§ 1406.8), 3-19-08)

28.56.170 Embankment protection.

Whenever a detention pond uses an embankment to contain water, the embankment shall be protected from catastrophic failure due to overtopping. Overtopping can occur when the pond outlets become obstructed or when a larger than 100-year storm occurs. Failure protection for the embankment may be provided in the form of a buried heavy riprap layer on the entire downstream face of the embankment or a separate emergency spillway having a minimum capacity of twice the maximum release rate for the 100-year storm. Structures shall not be permitted in the path of the emergency spillway or overflow. The invert of the emergency spillway shall be set equal to or above the 100-year water surface elevation.

(Res. 40-08 (§ 1406.9), 3-19-08)

28.56.180 Inlet and outlet design.

The outlet from the detention basin shall consist of a short (maximum 25 feet) length(s) of CAP or RCP with an 18-inch minimum diameter. Multiple pipe outlets may be required to control different design frequencies. The invert of the lowest outlet pipe shall be set at the lowest point in the detention pond or at the top of the minimum pool, if present. The outlet pipe(s) shall discharge into a standard manhole or into a drainageway with proper erosion protection for the proposed structure. If an orifice plate is required to control the release rates, the plate(s) shall be hinged to open into the detention pipes to facilitate back flushing of the outlet pipe(s).

Inlet to the detention pipes can be by way of surface inlets and/or by a local private storm sewer system.

(Res. 40-08 (§ 1406.10), 3-19-08)

28.56.190 Off-site flows.

It is rarely the case that a new development comprises an entire drainage basin. Instead, developments are most often located within a larger drainage basin. This means that unless the new development is located at the very upstream edge of a drainage basin, it will most likely receive sheet flow, if not con-

centrated flow, from off-site areas. Developers must look not only at the new development but also at the surrounding topography to determine just how much off-site area drains to the new development site.

For drainage design of new developments, there are two considerations for accommodating off-site storm runoff. These are peak runoff rates from off-site areas and routing of off-site storm runoff relative to the new development.

(a) Peak Storm Runoff Rates.

(1) Undeveloped Off-Site Areas. Runoff rates from off-site areas that are undeveloped but have a comprehensive development plan (comp plan) in place will be calculated using imperviousness values in **Table 28.28.020** for the land use or surface characteristic specified by the comp plan. Runoff rates from off-site areas that are undeveloped and do not have a comp plan in place will be calculated using an imperviousness of 45 percent as specified in **Table 28.28.020** (or as specified by the local jurisdiction).

(2) Developed Off-Site Areas. Runoff rates from off-site areas that are developed should be determined by calculating the actual imperviousness of the area using approved drainage reports, aerial photography, and field investigations. If this information is not available, imperviousness shall be determined based on general land use or surface characteristic as shown in **Table 28.28.020**.

The reduction of peak runoff rates from detention shall only be assumed for developments that are confirmed to have detention facilities and shall be subject to approval by the local jurisdiction. The discharge rates from these detention facilities shall be assumed to be those rates approved in the final drainage report for each off-site upstream area having detention facilities.

(b) Routing of Off-Site Storm Runoff. There are two methods by which off-site flows can be routed relative to the new development. These are routing around the new development and routing through the new development.

(1) Routing Around the New Development. Ideally the new development will be graded so off-site storm runoff is routed around the development based on peak rates determined in subsection (a) of this section. If this method is chosen, off-site flows must be routed to their historic path immediately downstream of the new development. Concentrated flows draining to the development should be maintained as concentrated flows downstream of the development and sheet flows should be maintained as sheet flow.

(2) Routing Through the New Development. If the site cannot be graded to accommodate rerouting off-site flows, the development's detention pond must be sized to account for any off-site flow that comes into the new development and drains to the new detention pond. It is possible that routing off-site runoff through the new detention pond will significantly alter the volume and outlet requirements of the new detention pond.

The effects of routing storm runoff from off-site areas through the new detention pond shall be determined by hydrograph routing methods. A hydrograph of the off-site area, assuming ultimate development conditions without detention, shall be generated to achieve a total volume of runoff. The developed condition hydrograph shall then be truncated at the allowable release rate and extended in time such that the total runoff volume is the same. This modified hydrograph is a reasonable representation of the ultimate development runoff that is routed through a detention pond within the off-site development.

The modified off-site hydrograph is then added to the developed conditions hydrograph for the new development (assuming no on-site detention). This composite hydrograph shall then be routed through the new detention pond to verify that the release rates from the new detention pond meet allowable release rates. In this instance, the allowable release rate is the sum of the allowable release rates from both the off-site area and the new development. The design

of the detention pond may require iteration on the detention volume and outlet configuration to achieve the required results.

(Res. 40-08 (§ 1406.11), 3-19-08)

28.56.200 Retention.

Retention will only be considered on a case-by-case basis with the following minimum requirements:

(a) Retention basins must drain within 48 hours of all storm events up to the 100-year storm event, beginning either at the start of the storm or when runoff first reaches the basin. Total runoff volume shall be determined by calculating imperviousness then converting this to a curve number (CN) following the procedures in Chapter 28.28 GJMC. Using the CN, excess precipitation for the design storm is determined using procedures described in GJMC 28.28.070. The design storm shall be the 24-hour precipitation amount of 2.01 inches multiplied by a factor of 1.5.

(b) The design of the retention basin must be supported by vertical hydraulic conductivity data for subsurface soil and/or rock obtained via an appropriate engineering test such as a tri-axial cell test, a permeameter test, or a vertical conductivity aquifer test conducted by a qualified geotechnical engineer familiar with the Mesa County soils and geology. Test data shall then be used in an appropriate calculation to determine the required size of the retention basin and the time required for complete infiltration of the 100-year storm event. One of the following models shall be used to demonstrate the design meets all criteria:

(1) Hydrus-2D (U.S. Dept. of Agriculture, Agricultural Research Service).

(2) SEEP/W (GeoSlope International, Inc.).

(3) Equivalent model (upon approval of local jurisdiction).

(c) When using vertical hydraulic conductivity data in these calculations, a saturated K-value shall only be used when it has been demonstrated that the infiltration media over the entire length of the infiltration path are saturated. If the infiltration path is characterized by unsaturated conditions, a partially saturated K-value shall be used for infiltration calculations.

(d) Measures that minimize sediment from entering and clogging the pond surface shall be implemented. These include pre-sediment basins and/or frequent sediment removal. Depth of storage shall be minimized and surface area shall be maximized for infiltration purposes. The wetted sides of the pond shall not be included in the area used to calculate infiltration releases.

(e) An emergency overflow from the retention area shall be provided with a minimum capacity of the 100-year peak inflow rate. The overflow path shall be carefully selected and analyzed for capacity and downstream impact. The overflow shall be located at the maximum retention volume water surface. A minimum of 1.0 foot of freeboard shall be provided above the maximum retention volume water surface.

(f) An operation maintenance plan shall be developed and be part of the development agreement that includes monitoring and reporting requirements and penalties for noncompliance. This plan may include pumping to meet the drain time requirements and should consider that there may be power outages during a major storm.

(Res. 40-08 (§ 1406.12), 3-19-08)

28.56.210 Hydrologic design methods and criteria.

The hydrologic design of detention facilities is based on the type of facility (regional vs. local) and the method used to estimate the runoff (HEC-1 vs. the rational method). If HEC-1 is used, a full hydrograph is available for traditional storage routing. If the rational method is used, only a peak flow rate is avail-

able. GJMC 28.52.220 through 28.56.250 discuss the procedures for these two methods. Note that the procedures used to calculate storm runoff are described in Chapter 28.28 GJMC.

(Res. 40-08 (§ 1407), 3-19-08)

28.56.220 HEC-1 method.

The HEC-1 method may be used to develop inflow hydrographs for hydrologic basins of any size, and may be used for both local and regional facilities. The inflow hydrographs shall be based on ultimate development conditions.

This program can calculate a hydrograph for any location in the hydrologic basin. The data input file must be structured so that the proposed detention basin site is a hydrograph-routing or hydrograph-combining point.

(a) Detention Basin Outflow Limitations. The controlled outlet capacity has direct influence on the required size of the basin. The outflow limitation can be based on either the existing undeveloped peak flow from the hydrologic basin or on limitations in the capacity of the downstream conveyance system (based on a hydrologic analysis of local conditions). The outflow limitation for local facilities is stated in GJMC 28.16.090. The design maximum outlet capacity of a regional facility must be coordinated with the local jurisdiction.

(b) Hydrologic Calculation Method. After the inflow hydrograph has been calculated and the outflow limits have been determined, the required storage volume can be estimated. Separate methods for calculating required storage are used depending on the method used to estimate the inflow hydrograph.

In order to calculate the required storage volume at a particular detention basin site, the following information must be available or prepared:

(1) Inflow hydrograph;

(2) Outlet capacity limitation;

(3) Proposed outlet discharge versus elevation data for the proposed basin site;

(4) Proposed storage vs. elevation data for the proposed basin site;

(5) Proposed drain time for the proposed basin site.

(c) The HEC-1 computer program can be used to determine the required storage volume and outflow limitation based on a reservoir routing procedure. Initial estimates of outlet size are made and the program is run. The output is reviewed and changes are made to the outlet configuration as needed until the desired degree of flood peak attenuation and acceptable drain time is achieved.

(Res. 40-08 (§ 1407.1), 3-19-08)

28.56.230 Rational method.

The minimum required volume shall be determined using the HEC-1 method or the following equations. These empirical equations were developed as part of the UDFCD hydrology research program and modified to reflect rainfall conditions in Mesa County. The equations are based on a computer modeling study and represent average conditions.

One of the most difficult aspects of storm drainage is obtaining consistent results between various methods for estimating detention requirements. These equations provide consistent and more effective approaches to the sizing of on-site detention ponds. The equations presented in this section may be used for hydrologic basins with a total area of less than 160 acres, per the rational method restrictions set forth in GJMC 28.28.100(c). The use of these equations in the design of regional detention facilities must be approved by Mesa County or the applicable local jurisdiction.

(a) Minimum Detention Volumes.

$$V = KA \quad (28.56\text{-}2)$$

For the 100-year,

$$K_{100} = (1.78P - 0.002P^2 - 3.56)(X_{100}/900) \quad (28.56\text{-}3)$$

For the 10-year,

$$K_{10} = (0.95P - 1.90)(X_{10}/1{,}000) \quad (28.56\text{-}4)$$

Where:

V = required volume for the 100- or 10-year storm (acre-feet)

P = Developed basin imperviousness (percent)

A = Tributary area (acres)

X = Mesa County and the other local jurisdictions adjustment factor per **Table 28.56.230(a)**

Table 28.56.230(a): Detention – Volume Adjustment Factor

Ultimate Development Percent Imperviousness	X_{100}	X_{10}
< 50%	0.42	0.26
≥ 50%	0.48	0.38

(b) Allowable Release Rates. The maximum release rates at the ponding depths corresponding to the 10- and 100-year volumes are as follows:

Table 28.56.230(b): Allowable Release Rates for Detention Ponds (cfs/acre)

Control Frequency	Soil Group		
	A	B	C
10-year	0.05	0.09	0.12
100-year	0.25	0.43	0.50

The predominant soil group for the total basin area tributary to the detention pond shall be used for determining the allowable release rate. Information on the soils in Mesa County can be found in published SCS soil surveys.

(Res. 40-08 (§ 1407.2), 3-19-08)

28.56.240 Compensating detention analysis.

(a) If any storm runoff will be discharged from the property without first being routed through a detention pond, on-site detention facilities are to be designed using the compensating detention procedure. The total of all undetained area shall not exceed five percent or 5,000 square feet, whichever is less.

(b) Compensating detention is based on the following assumptions:

(1) The 10- and 100-year peak discharge from the property from detained and undetained area when added together will be no greater than allowable discharge. Therefore, the more unde-

tained release of storm runoff from the site, the less the detention pond is permitted to release, which requires proportionally larger detention volume.

(2) Regardless of the method used, the volume of the detention pond must be adjusted to result in reduced discharge rates. For the HEC-1 method, the detention volume is determined using actual runoff hydrographs and storage routing based on the outlet configuration. For the rational method, the increase in volume is accomplished by simply computing the volume based on the entire property area, not just the area tributary to the detention pond. This is a reasonable assumption given the five percent area or 5,000 square feet size limitation on undetained area.

(c) The compensating detention procedure is given in six steps below. The following procedure applies to both the HEC-1 and rational method methods for determining detention volumes, except as specifically noted otherwise.

(1) Step 1. If the undetained area is less than five percent of the total project area or 5,000 square feet, whichever is less, continue. If not, then the undetained area must either be reduced in size or the site layout revised to be in compliance with the SWMM.

(2) Step 2. Determine the allowable release rate for the 10- and 100-year flood events based on the pre-project site conditions using the entire site area. See **Table 28.56.230(b)**.

(3) Step 3. Determine the post-project runoff rates for the 10- and 100-year floods for the undetained area only.

(4) Step 4. Determine the adjusted allowable release rates by subtracting the runoff rates from the post-project, undetained area from the allowable release rates in Step 2.

(5) Step 5. Determine minimum required 100-year and 10-year storage volumes for the area tributary to the detention pond. If using the rational method, the storage volume is determined using the equations in GJMC 28.56.230 based on the entire project area, not just the area tributary to the detention pond.

(6) Step 6. Determine the final outlet configuration that results in the adjusted allowable release rates at the computed detention volumes for the entire site.

(Res. 40-08 (§ 1407.3), 3-19-08)

28.56.250 Over-detention analysis.

Over-detention is defined as detaining developed conditions peak flows to the point that release rates are lower than pre-developed conditions. Over-detention is sometimes required to meet capacity limitations of downstream drainage facilities. Specific over-detention requirements are identified in basin-wide or watershed master plans or by the local jurisdiction within which the detention pond is proposed.

Over-detention requirements are unique for each basin or watershed and are often based on a detailed hydrologic investigation using hydrograph methods to generate peak flows and route the flows through the drainage system. Simplified detention volume and release rate methods are not appropriate, and over-detention volume and release rate requirements shall be determined using a hydrograph analysis in accordance with the SWMM requirements.

(Res. 40-08 (§ 1407.4), 3-19-08)

28.56.260 Hydraulic design of outlet works.

Hydraulic design data for sizing of detention facilities outlet works is as follows:

(a) Weir Flow. The general form of the equation for horizontal crested weirs is:

$$Q = CL(H)^{3/2} \quad (28.56\text{-}5)$$

Where:

Q = discharge (cfs)
C = weir coefficient (see **Table 28.56.260**)
L = horizontal length (feet)
H = total energy head (feet)

Another common weir is the v-notch, whose equation is as follows:

$$Q = 2.5 \tan(\Theta/2)H5/2 \quad (28.56\text{-}6)$$

Where:

θ = angle of the notch at the apex (degrees)

When designing or evaluating weir flow, the effects of submergence must be considered. A single check on submergence can be made by comparing the tailwater to the headwater depth. The example calculation for a weir design on **Figure 28.56.100** illustrates the submergence check.

(b) Orifice Flow. The equation governing the orifice opening and plate is the orifice flow equation:

$$Q = C_d A (2gh)^{1/2} \quad (28.56\text{-}7)$$

Where:

Q = Flow (cfs)
C_d = Orifice coefficient
A = Area ($ft.^2$)
g = Gravitational constant = 32.2 $ft./sec^2$
h = Head on orifice measured from center of the opening (ft.)

An orifice coefficient (C_d) value of 0.65 shall be used for sizing of squared edged orifice openings and plates.

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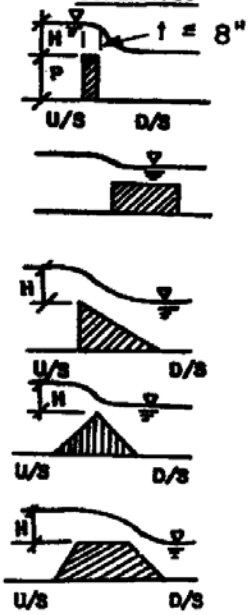
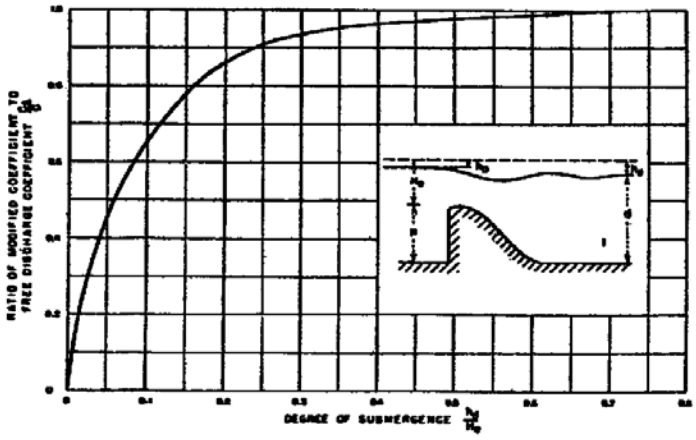
WEIR FLOW COEFFICIENTS

SHAPE	COEFFICIENT	COMMENTS
Sharp Crested	-	
Projection Ratio (H/P = 0.4)	3.4	H< 1.0
Projection Ratio (H/P = 2.0)	4.0	H> 1.0
Broad Crested		
W/Sharp U/S Corner	2.6	Minimum Value
W/Rounded U/S Corner	3.1	Critical Depth
Triangular Section	-	
A) Vertical U/S Slope	-	
1:1 D/S Slope	3.8	H>0.7
4:1 D/S Slope	3.2	H>0.7
10:1 D/S Slope	2.9	H>0.7
B) 1:1 U/S Slope	-	
1:1 D/S Slope	3.8	H>0.5
3:1 D/S Slope	3.5	H>0.5
Trapezoidal Section		
1:1 U/S Slope, 2:1 D/S Slope	3.4	H>1.0
2:1 U/S Slope, 2:1 D/S Slope	3.4	H>1.0
Road Crossings		
Gravel	3.0	H>1.0
Paved	3.1	H>1.0

SCHEMATIC



ADJUSTMENTS FOR TAILWATER



Revision	Date
ORIGINAL ISSUE	3/27/08

WRC ENGINEERING INC.

REFERENCE: KING & BRATER, HANDBOOK OF HYDRAULICS, 1963
DESIGN OF SMALL DAMS, USBR, 1977

TABLE 28.56.260

(Res. 40-08 (§ 1408), 3-19-08)

Chapter 28.60

CONSTRUCTION SITE STORMWATER RUNOFF CONTROL

Sections:

28.60.010 Introduction.
28.60.020 Colorado discharge permit.
28.60.030 Standards and requirements – Stormwater discharge limitations.
28.60.040 Standards and requirements – Minimum BMP requirements.
28.60.050 Standards and requirements – Acceptable BMPs.
28.60.060 Stormwater permit.
28.60.070 Stormwater permit variance/exception.
28.60.080 Inspection and enforcement – Mesa County.
28.60.090 Inspection and enforcement – City of Grand Junction.
28.60.100 Inspection and enforcement – Other municipalities.
28.60.110 Construction SWMP.
28.60.120 Site description.
28.60.130 Site map.
28.60.140 Stormwater management controls.
28.60.150 Final stabilization and long-term stormwater management.
28.60.160 Inspection and maintenance.
28.60.170 Certification.
28.60.180 Estimated BMP costs.
28.60.190 Permit transfer requirements.
28.60.200 Checklist.

28.60.010 Introduction.

All persons engaged in land disturbance for new development, disturbing 1.0 acres or more, or development disturbing less than 1.0 acres that is part of a larger common plan of development or sale, shall implement the following measures to prevent the discharge of pollutants to the stormwater system to the maximum extent practicable:

(a) Obtain a permit from the Water Quality Control Division (WQCD) for Stormwater Discharges Associated with Construction Activity, called "stormwater construction permit." A condition of the permit requires the preparation and implementation of a stormwater management plan (SWMP) to control the discharge of pollutants resulting from construction activity.

Information required by the WQCD for a stormwater management plan is included in this chapter and shall be referred to as the "construction SWMP." The construction SWMP must include appendices with the WQCD permit application, text and graphics identifying erosion control measures to be implemented during construction, and be certified by a qualified erosion control specialist.

Exemptions to the requirement for a SWMP for projects that disturb less than five acres may be granted by the WQCD when the rainfall erosivity factor (R-factor) is less than a value of five. See website at:

http://www.cdphe.state.co.us/wq/PermitsUnit/wqcdpmt.html

However, the exemptions do not relieve the owner/operator from meeting discharge limitations described in GJMC 28.60.030(a).

(b) For development within the designated urbanized area of unincorporated Mesa County (see **Figure 28.16.110**), obtain a Mesa County stormwater construction permit. Application for the Mesa County stormwater construction permit may be submitted concurrent with the application for the WQCD stormwater construction permit, but the WQCD permit must be received by the County

before approval of the County permit. Within the City of Fruita and the Town of Palisade, contact the Engineering or Planning Department for requirements.

(c) For development within the City of Grand Junction, obtain a Grand Junction stormwater construction permit. Application for the Grand Junction stormwater construction permit may be submitted concurrent with the application for the WQCD stormwater construction permit, but the WQCD permit must be received by the City of Grand Junction before approval of the Grand Junction permit. Development within the City of Grand Junction does not need a Mesa County permit.

(d) Provide measures to control erosion and sedimentation within the on-site major drainageway(s), in accordance with Chapter 28.32 GJMC, Open Channels.

(e) Implement post-construction BMPs to control the discharge of pollutants after construction is completed, in accordance with Chapter 28.64 GJMC, Post-Construction Stormwater Management.

(Res. 40-08 (§ 1501), 3-19-08)

28.60.020 Colorado discharge permit.

(a) Stormwater Discharge Permit. The Water Quality Control Division (WQCD) of the Colorado Department of Public Health and Environment (CDPHE) has direction and authority to administer the Federal stormwater permit program (i.e., NPDES Phase I and Phase II) as part of the Colorado Water Quality Control Act (§ 25-8-101, C.R.S. et seq.). The terms and conditions of the permit have set forth minimum requirements for stormwater management programs for municipalities that address water quality from significant development or redevelopment, from construction sites and from other activities. Programs include:

(1) Public Education and Outreach on Stormwater Impacts. Prepare and distribute education materials to the community or conduct outreach activities about impacts of stormwater discharges on water bodies.

(2) Public Involvement/Participation. Conduct and document public meetings related to implementation of the stormwater management programs.

(3) Illicit Discharge Detection and Elimination. Detect and prohibit illicit discharges through regulatory measures.

(4) Construction Sites Stormwater Runoff Control. Develop, implement, and enforce a program to reduce pollutants in any stormwater runoff to the MS4 from construction activities that result in a land disturbance of greater than or equal to 1.0 acres. This permit condition is the basis for requirements identified in this chapter of the manual.

(5) Post-Construction Stormwater Management in New Development and Redevelopment. Develop, implement, and enforce a program to reduce pollutants in any stormwater runoff to the MS4 from all new development and significant redevelopment. This permit condition is the basis for requirements identified in Chapter 28.64 GJMC.

(6) Pollution Prevention/Good Housekeeping for Municipal Operations. Develop and implement an operation and maintenance program that includes an employee training component and has the ultimate goal of preventing or reducing pollutant runoff from municipal operations.

Additional information can be found at the CDPHE website address:

http://www.cdphe.state.co.us/cdphehom.asp

(b) Mesa County Permittees. Mesa County, the City of Grand Junction, the Grand Junction Drainage District, and the Town of Palisade, who are members of the 5-2-1 Drainage Authority, each have obtained a permit to discharge stormwater under the Colorado Discharge Permit System (CDPS, COR-090031, COR-090077, COR-090006, and COR-090005, respectively). Other jurisdictions

within Mesa County may be subject to these regulations in the future and the manual user is encouraged to contact their local jurisdiction for more information.

(c) Stormwater Management Manual. Information presented in this manual meets, in part, requirements for the following programs: Illicit Discharge Detection and Elimination, Construction Sites Stormwater Runoff Control, and Post-Construction Stormwater Management in New Development and Redevelopment. The CDPS Phase II Stormwater Discharge Permit includes requirements for MS4s to control erosion and sedimentation from construction activities and has identified:

(1) Procedures for site planning.

(2) Requirements for selection, implementation, installation and maintenance of best management practices (BMPs).

(3) Procedures for site inspection and enforcement.

Requirements and procedures for these items are addressed by this manual.

(Res. 40-08 (§ 1502), 3-19-08)

28.60.030 Standards and requirements – Stormwater discharge limitations.

All stormwater discharges from construction sites disturbing 1.0 acres or more shall meet the following standards:

(a) Stormwater discharges from construction activities shall not cause, have the reasonable potential to cause, or measurably contribute to an exceedance of any water quality standard, including narrative standards for water quality.

(b) Concrete wash water shall not be discharged to State waters or to storm sewer systems. On-site permanent disposal of concrete washout waste is not authorized. Discharge to the ground of concrete washout waste that will subsequently be disposed of off-site is authorized.

Discharges to the ground of concrete washout water from washing of tools and concrete mixer chutes may be authorized; provided, that:

(1) The source is identified in the construction SWMP;

(2) BMPs are included in the construction SWMP to prevent pollution of groundwater; and

(3) These discharges do not leave the site as surface runoff or to surface waters.

(c) Bulk storage structures for petroleum products and other chemicals shall have adequate protection so as to contain all spills and prevent any spilled material from entering State waters.

(d) All site wastes must be removed from the site for disposal in licensed disposal facilities. No building material wastes or unused building materials shall be buried, dumped, or discharged at the site. All site wastes must be properly managed to prevent potential pollution of State waters.

(e) Off-site vehicle tracking of sediments shall be minimized.

(f) Land disturbances shall be conducted in a manner to effectively reduce accelerated soil erosion and sedimentation.

(g) Discharges to the ground of water from construction dewatering activities may be authorized; provided, that:

(1) The source is groundwater and/or groundwater combined with stormwater that does not contain pollutants in concentrations exceeding the State groundwater standards in Regulations 5 CCR 1002-41 and 42;

(2) The source is identified in the construction SWMP;

(3) BMPs are included in the construction SWMP; and

(4) These discharges do not leave the site as surface runoff or to surface waters.

(Res. 40-08 (§ 1503.1), 3-19-08)

28.60.040 Standards and requirements – Minimum BMP requirements.

The stormwater management plan (SWMP) prepared for the WQCD as a condition of the stormwater construction permit shall include as a minimum both structural and nonstructural measures. Facilities must select, install, implement, and maintain appropriate BMPs following good engineering, hydrologic and pollution control practices. BMPs implemented at the site must be adequately designed to provide control for all potential pollutant sources associated with construction activity to prevent pollution or degradation of State waters. The primary goal of the construction SWMP is to reduce erosion at the source, followed by trapping eroded materials before they leave the site. The construction SWMP shall include, as a minimum, the following (see GJMC 28.60.110 for detailed construction SWMP requirements):

(a) BMPs are required to control erosion at the source, such as those that stabilize earth disturbances with vegetation or mulch after grading is substantially complete on any portion of the site not otherwise permanently stabilized. Typical examples include surface roughening (Symbol SR, **Figure 28.60.040(a)**), mulching (Symbol MU, **Figure 28.60.040(b)**) and vehicle tracking control (Symbol VTC, **Figure 28.60.040(c)**). Other control methods not shown include installation of blankets, straw wattles, tackifiers, netting, and matting.

(b) BMPs are required to trap sediment before it leaves the site or enters the municipal storm sewer system, whichever comes first. Such BMPs shall be installed prior to initiating earth disturbances. Typical examples include check dams (Symbol CD, **Figure 28.60.040(d)**), inlet protection (Symbol IP, **Figure 28.60.040(e)**), sediment basin (Symbol SB, **Figure 28.60.040(f)**), and silt fence (Symbol SF, **Figure 28.60.040(g)**).

(c) BMPs are required to prevent spills of petroleum products and other chemicals and contain storm runoff from construction wastes to a designated area, if applicable. See GJMC 28.64.140, BMPs for industrial and commercial activities, for examples.

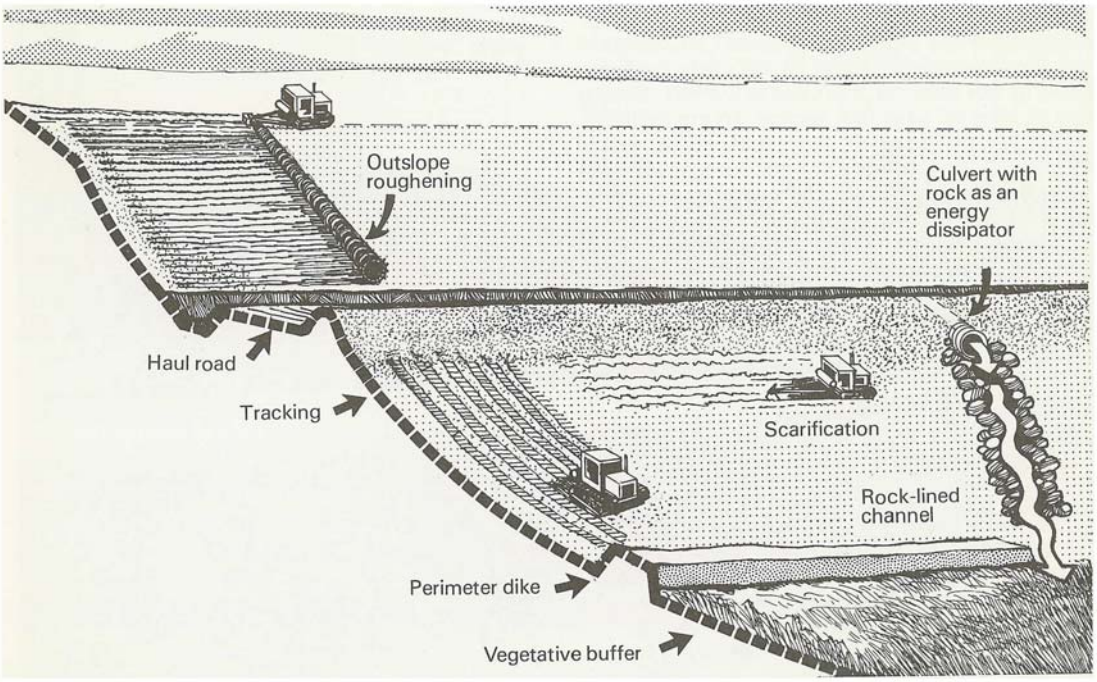
(d) Construction sequencing for all BMPs is required to reduce the duration a disturbed area is exposed. Temporary disturbed areas shall be exposed no longer than 30 days. Disturbed areas that are to be permanently stabilized shall be exposed no longer than seven days.

(e) BMPs are required to capture and retain runoff from equipment washing operations, such as cleaning of concrete trucks. See GJMC 28.46.140, BMPs for industrial and commercial activities, for examples.

(f) Program and schedule for regular inspection and maintenance of BMPs.

STORMWATER MANAGEMENT MANUAL

SURFACE ROUGHENING



Notes:
1. Roughen soil surface with depressions from 2- to 4-inches deep and spaced 4- to 6-inches apart' using chisel or ripping equipment. For slopes 2:1 or greater, use track dozer working perpendicular to slope.
2. Roughen slope after final grading. Roughening of ridges and depressions shall follow along slope contours.
3. Additional treatments may be necessary.

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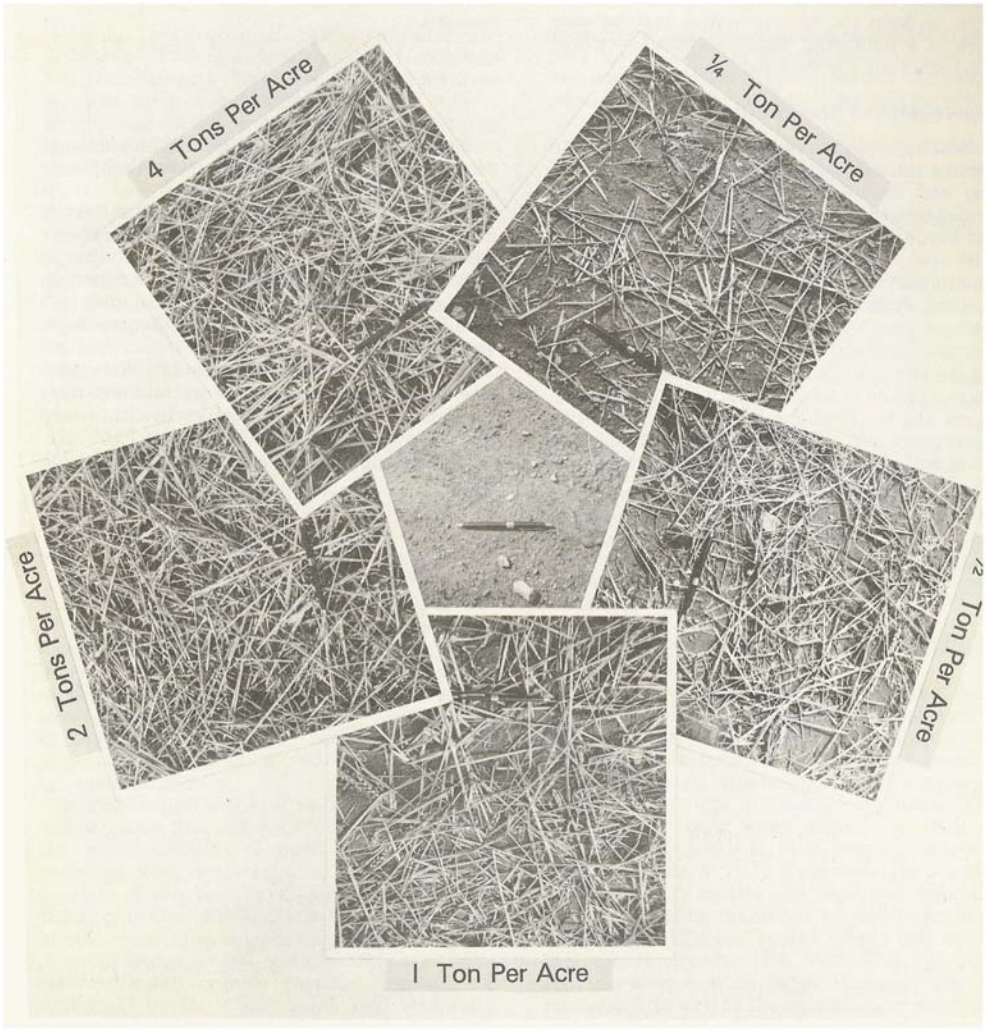
WRC ENGINEERING, INC.

REFERENCE: *EPA 1976. EROSION AND SEDIMENT CONTROL SURFACE MINING IN THE EASTERN U.S. PLANNING*

FIGURE 28.60.040(a)

STORMWATER MANAGEMENT MANUAL

MULCHING



1. All disturbed areas must be mulched or seeded and mulched within 14–days after final grade is reached on any portion of the site not otherwise permanently stabilized. All mulching and seeding must meet local jurisdiction requirements.
2. Mulch shall be clean, weed– and seed–free, long stemmed grass hay or cereal grain straw with 50% or more by weight being ten inches or greater.
3. Mulch shall be anchored by mechanical crimping, with tackifier, or with nets.
4. Hydraulic mulching limited to areas where slopes are steeper than 3:1 or access is too difficult.
5. Mulch shall be applied at a 1–ton per acre or greater rate.

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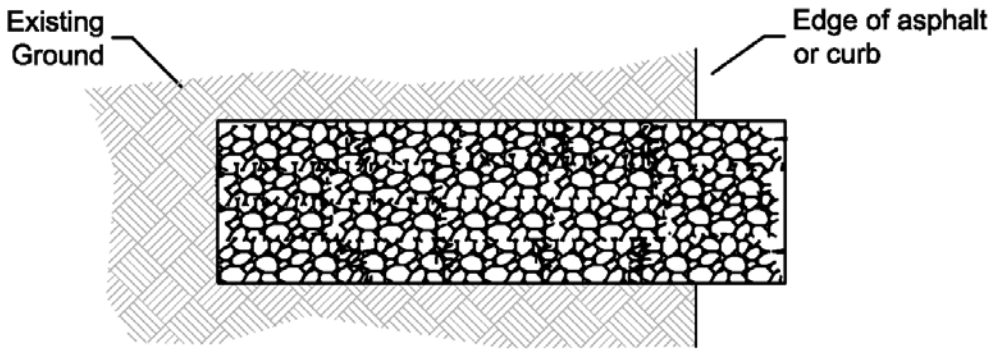
WRC ENGINEERING INC.

REFERENCE: *EPA 1976. EROSION AND SEDIMENT CONTROL SURFACE MINING IN THE EASTERN U.S. PLANNING*

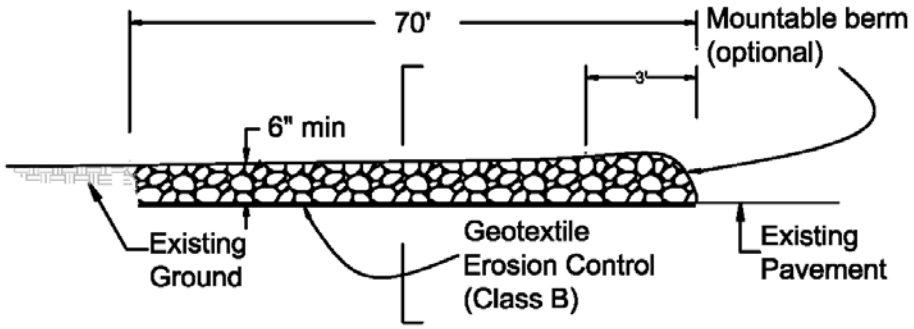
FIGURE 28.60.040(b)

STORMWATER MANAGEMENT MANUAL

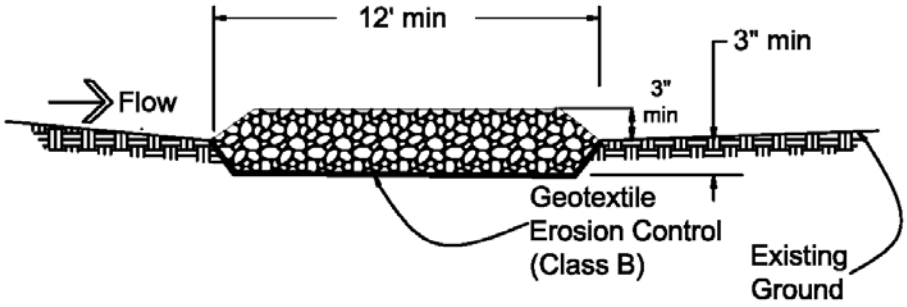
VEHICLE TRACKING CONTROL



PLAN



SIDE ELEVATION



SECTION

NOTES:

1. VEHICLE TRACKING REQUIRED WHEN LAND DISTURBANCE 2–ACRES ORE GREATER.
2. USE 2– TO 3–INCH COARSE AGGREGATE MATERIAL.
3. GEOTEXTILE SHALL CONFORM TO CDOT 712.08, CLASS B.
4. SEDIMENT, DIRT OR MUD TRACKED ONTO PUBLIC STREETS SHALL BE REMOVED MECHANICALLY BY SWEEPING, SCOOPING AND SHOVELING.

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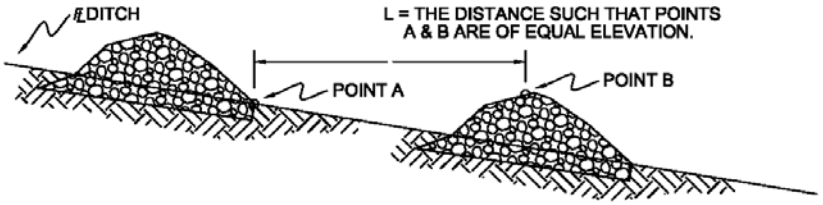
WRC ENGINEERING, INC.

REFERENCE: *CDOT 2000. STANDARD PLANS M & S STANDARDS M-208-1, SHEET 5 OF 7*

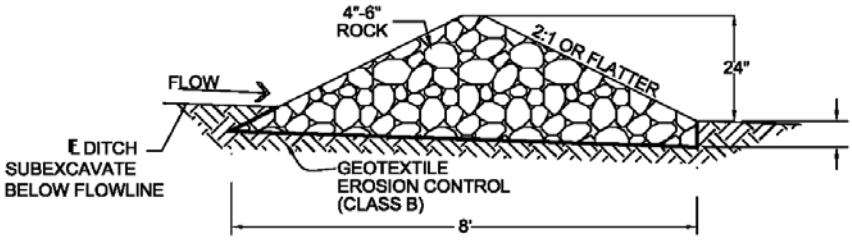
FIGURE 28.60.040(c)

STORMWATER MANAGEMENT MANUAL

CHECK DAM (RIPRAP)



PROFILE VIEW ALONG DITCH FLOWLINE



PROFILE

RIPRAP CHECK DAM

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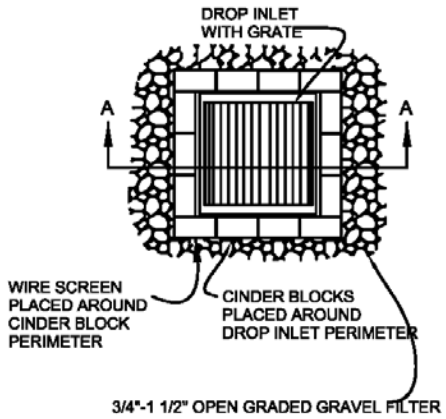
REFERENCE: *CDOT 2000. STANDARD PLANS M & S STANDARDS M-208-1, SHEET 4 OF 7*

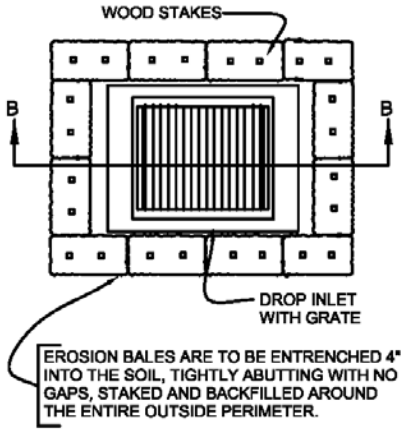
FIGURE 28.60.040(d)

STORMWATER MANAGEMENT MANUAL

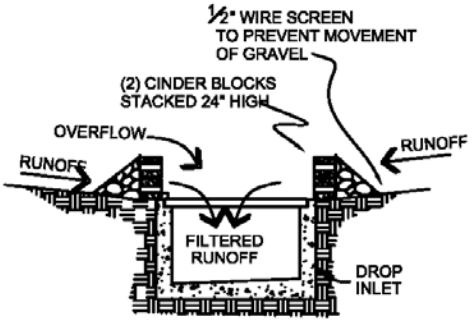
INLET PROTECTION



PLAN VIEW

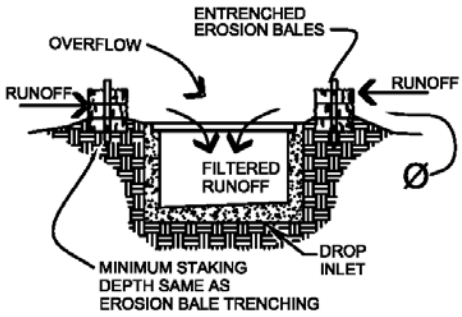


PLAN VIEW



CROSS SECTION A-A

DROP INLET BLOCK AND GRAVEL FILTER



CROSS SECTION B-B

DROP INLET EROSION BALE FILTER

Ø Sediment removal shall be performed continuously for proper function

NOTE:
VISUAL WARNING SHALL BE PROVIDED WHERE INLET IS OBSTRUCTING TRAFFIC (VEHICLE, PEDESTRIAN, BICYCLE, ETC.)

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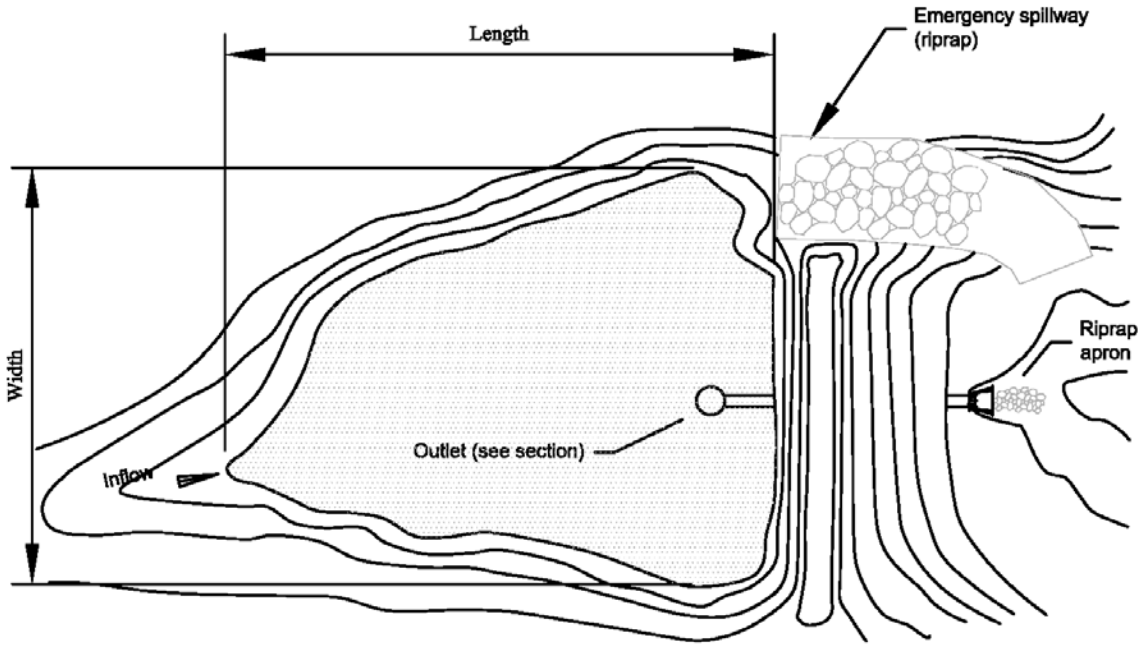
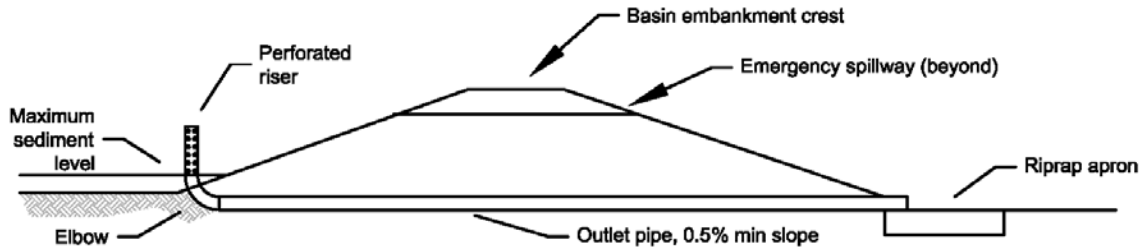
FIGURE 28.60.040(e)

STORMWATER MANAGEMENT MANUAL

SEDIMENT BASIN



PLAN



SECTION THROUGH OUTLET

Notes:
1. Required volume to crest of emergency spillway is 1,800 cubic feet per acre of drainage area.
2. Emergency spillway to pass 100-year or greater flood peak.
3. Emergency spillway must not be constructed over fill material. Protect spillway with riprap.
4. Basin length to width ratio, L/W to be greater than 2.0
5. Remove sediment when level reaches the invert of the lowest orifice at 50% of the storage volume
6. Outlet to be minimum 8" diameter PVC. Riser to include perforations to drain volume below emergency spillway in 40-hours.

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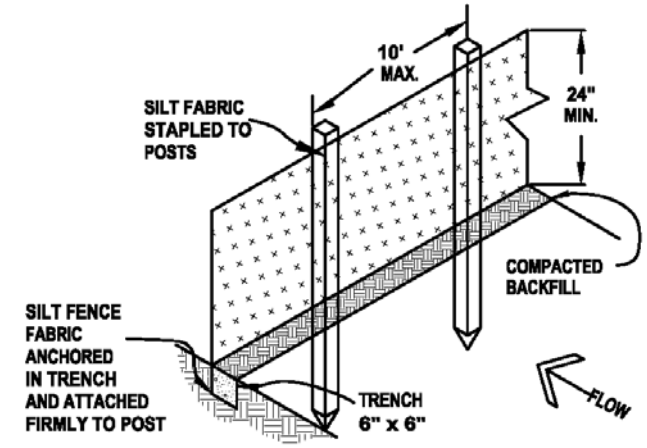
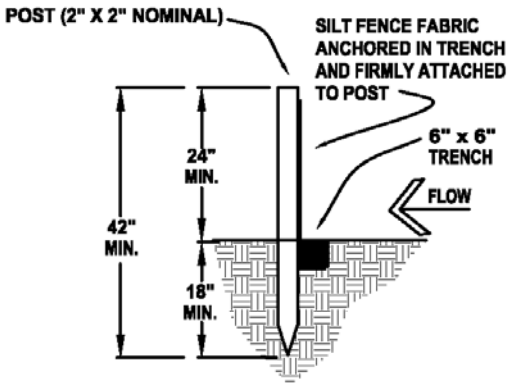
REFERENCE:
UDFCD. URBAN STORM DRAINAGE CRITERIA MANUAL
VOLUME 3 BEST MANAGEMENT PRACTICES

FIGURE 28.60.040(f)

STORMWATER MANAGEMENT MANUAL

SILT FENCE





Ø SEDIMENT REMOVAL SHALL BE PERFORMED CONTINUOUSLY FOR PROPER FUNCTION.

Notes:
1. Silt fence should not be used in areas of concentrated flow.
2. Where stormwater is within a swale and a silt fence is used to trap sediment, the silt fence is to be reinforced such as with straw bales, or a double silt fence arrangement.

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FIGURE 28.60.040(g)

(Res. 40-08 (§ 1503.2), 3-19-08)

28.60.050 Standards and requirements – Acceptable BMPs.

Criteria for selection and design of BMPs can be found in the following documents:

(a) Colorado Department of Transportation 2002. Erosion Control and Stormwater Quality Guide. This document is available in .pdf format at:

http://www.dot.state.co.us/environmental/envWaterQual/wqms4.asp

CAD drawings for BMPs are also available at CDOT website.

(b) Urban Drainage and Flood Control District (UDFCD) 1999. Urban Storm Drainage Criteria Manual, Volume 3 – Best Management Practices. This can be found at:

http://www.udfcd.org/downloads/down_critmanual.htm

(c) EPA 2002. Consideration in the Design of Treatment Best Management Practices (BMP) to Improve Water Quality. EPA 600 R-03/103. This document is available in .pdf form at the following website:

http://www.epa.gov/ORD/NRMRL/pubs/600r03103/600r03103chp5.pdf

(d) City of Grand Junction August 2005. Standard Contract Documents for Capital Improvement Projects. This document is available in .pdf form at:

http://www.gjcity.org/citydeptwebpages/publicworksandutilities/engineering/standard-contractdocuments.htm.

(e) The BMPs presented in the documents referenced above shall be used in the preparation of the construction SWMP (See GJMC 28.60.110), except as modified as follows. Use of alternate BMPs not specified above is subject to approval by the local jurisdiction.

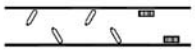
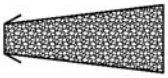
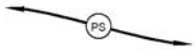
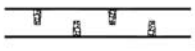
(1) Where stormwater is within a swale and a silt fence is used to trap sediment, the silt fence is to be reinforced such as with straw bales, or a double silt fence arrangement.

(2) Straw bales to trap sediment shall not be used when stormwater is concentrated in a swale, or a channel (see Chapter 28.32 GJMC).

See **Figures 28.60.050(a)** and **28.60.050(b**) for list of construction BMPs and map symbols for the erosion control plan.

STORMWATER MANAGEMENT MANUAL

EROSION CONTROL PLAN SYMBOLS

TITLE	KEY	SYMBOL
CHECK DAM	CD	
CONSTRUCTION ROAD STABILIZATION	CRS	
CURB SOCK INLET PROTECTION	CS	
TEMPORARY DIVERSION DIKE	DD	
TEMPORARY CHANNEL DIVERSION	DV	
STORM DRAIN INLET PROTECTION	IP	
MULCHING	MU	
OUTLET PROTECTION	OP	
PAVED FLUME	PF	
PERMANENT SEEDING	PS	
ROUGH CUT STREET CONTROL	RCS	

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REFERENCE:
UDFCD. URBAN STORM DRAINAGE CRITERIA MANUAL
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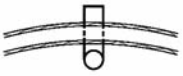
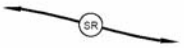
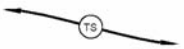
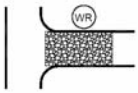
FIGURE 28.60.050(a)

STORMWATER MANAGEMENT MANUAL

EROSION CONTROL PLAN SYMBOLS (cont'd)

TITLE	KEY	SYMBOL
SEDIMENT BASIN	SB	
TEMPORARY STREAM CROSSING	SC	
SILT FENCE	SF	
SURFACE ROUGHENING	SR	
SEDIMENT TRAP	ST	
STRAW BALE BARRIER	STB	
TEMPORARY SEEDING	TS	
TEMPORARY SLOPE DRAIN	TSD	
VEHICLE TRACKING CONTROL	VTC	
VEHICLE TRACKING CONTROL WITH WASH RACK	WR	

Revision	Date
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WRC ENGINEERING, INC

REFERENCE:
UDFCD. URBAN STORM DRAINAGE CRITERIA MANUAL
VOLUME 3 BEST MANAGEMENT PRACTICES

FIGURE 28.60.050(b)

(Res. 40-08 (§ 1503.3), 3-19-08)

28.60.060 Stormwater permit.

(a) Mesa County. The construction SWMP shall be reviewed in accordance with this chapter of the manual and a stormwater construction permit will be issued after:

(1) The WQCD issues a permit for stormwater discharges associated with construction activity. Note that the application to the WQCD may occur before the application to the County, but the WQCD permit must be received by the County before the County will approve the construction SWMP and issue a construction stormwater permit. The County permit is not needed within the City of Grand Junction limits.

(2) Approval of the construction stormwater management plan, which includes written and graphical descriptions of construction erosion control measures, and a certification (see GJMC 28.60.110).

(3) Submittal of proper collateral, if required.

(4) Written notice from construction stormwater permit holder that initial construction BMPs will be installed prior to any land disturbance.

(b) City of Grand Junction. The construction SWMP shall be reviewed in accordance with this chapter of the manual and a Grand Junction construction stormwater permit will be issued after:

(1) The WQCD issues a permit for stormwater discharges associated with construction activity. Note that the application to the WQCD may occur before the application to the City, but the WQCD permit must be received by the City before the City will approve the construction SWMP and issue a construction stormwater permit.

(2) Approval of the construction stormwater management plan, which includes written and graphical descriptions of construction erosion control measures, and a certification (see GJMC 28.60.110).

(3) Submittal of proper collateral, if required.

(4) Written notice from construction stormwater permit holder that initial construction BMPs will be installed prior to any land disturbance.

(5) In addition, the City may require a construction stormwater permit if the development disturbs less than 1.0 acres and if:

(i) The City determines that the development is on steep slopes, may contribute to a violation of water quality standards, or may be a significant source of pollutants; or

(ii) The development is in close proximity to a wetland, water body or waterway.

(c) Other Jurisdictions. The City of Fruita, the Town of Palisade, and the Grand Junction Drainage District do not require a separate construction related permit, but the owner/operator must obtain a stormwater construction permit from the WQCD, which requires preparation of a construction stormwater management plan. A copy of the WQCD stormwater permit shall be provided to the local jurisdiction.

(Res. 40-08 (§ 1504), 3-19-08)

28.60.070 Stormwater permit variance/exception.

Variances/exceptions from stormwater permitting may be granted for the following conditions (check with local jurisdictions). The variance/exception from permitting does not relieve the owner/operator from meeting discharge limitations described in GJMC 28.60.030, Standards and requirements – Stormwater discharge limitations, or from those in Chapter 13.28 GJMC within the City's jurisdiction.

(a) Land disturbance activities in areas where the topography would prohibit runoff from leaving the site or entering a waterway.

(b) Agricultural and silviculture activities such as home gardening and tilling a field for weed control.

(c) Maintenance activities, such as regrading a dirt road, relandscaping a lawn, cleaning out roadside ditches, and other land disturbances that do not alter original line and grade, hydraulic capacity or original purpose.

(d) Repaving a roadway, providing that underlying and/or surrounding soil is not cleared, graded, excavated or otherwise disturbed.

(e) For small construction activity (i.e., from one to five acres of earth disturbance) based on the rainfall erosivity factor (i.e., the R Factor) (see Colorado Discharge Permits System Regulation No. 61 @ 61.3(2)(f)(ii)(B)) and duration of the exposed disturbance. To obtain a waiver from the CDPS construction general permit, the applicant must submit calculations to the WQCD (see "Policy on the State Approved Method for Calculating the Rainfall Erosivity Factor") which can be obtained in .pdf form by searching for "erosivity factor" in the website:

http://www.cdphe.state.co.us/index.html

(f) The following activities provided the land disturbance is less than one acre and are not part of a larger common plan of development or sale:

(1) Grading or an excavation below finished grade for basements, footings, retaining walls, or other structures on plots unless otherwise required by the International Building Code.

(2) A sidewalk or driveway authorized by a valid permit.

(3) Gravel, sand, or soil removal as authorized.

(Res. 40-08 (§ 1505), 3-19-08)

28.60.080 Inspection and enforcement – Mesa County.

Upon approval of the construction SWMP (See GJMC 28.60.060, Stormwater permit), a stormwater permit will be issued to the applicant, which requires:

(a) Inspector. The owner/operator shall retain a qualified erosion control specialist to perform inspections of the BMPs in the construction SWMP and determine if the construction is in accordance with the construction SWMP.

(b) Inspections. The site perimeter, all disturbed areas, material and/or waste storage areas that are exposed to precipitation, discharge locations, and locations where vehicles access the site shall be inspected for evidence of, or the potential for, pollutants leaving the construction site boundaries, entering the stormwater drainage system, or discharging to State waters. All erosion and sediment control practices identified in the construction SWMP shall be evaluated to ensure that they were properly installed and are being maintained and operated correctly.

(c) Inspection Frequency. The inspector shall perform inspections at least once every 14 days and within 24 hours after the end of a precipitation or snowmelt event that causes surface erosion on the site.

(d) Inspection Reporting. The inspector shall prepare inspection reports and submit a copy of all inspection reports and any changes to the construction SWMP to Mesa County within five working days of the inspection. Inspection results shall be logged on forms provided, site conditions noted, and any changes to the construction SWMP shall be documented.

The permittee shall keep a record of inspections. Inspection reports must identify any incidents of noncompliance with the terms and conditions of this permit. Inspection records must be retained for three years from expiration or inactivation of permit coverage. At a minimum, the inspection report must include:

(1) The inspection date;

(2) Name(s) and title(s) of personnel making the inspection;

(3) Location(s) of discharges of sediment or other pollutants from the site;

(4) Location(s) of BMPs that need to be maintained;

(5) Location(s) of BMPs that failed to operate as designed or proved inadequate for a particular location;

(6) Location(s) where additional BMPs are needed that were not in place at the time of inspection;

(7) Deviations from the minimum inspection schedule as provided in subsection (c) of this section;

(8) Description of corrective action for subsections (d)(3) through (6) of this section, dates corrective action(s) taken, and measures taken to prevent future violations, including requisite changes to the construction SWMP, as necessary; and

(9) After adequate corrective action(s) has been taken, or where a report does not identify any incidents requiring corrective action, the report shall contain a signed statement indicating the site is in compliance with the permit to the best of the signer's knowledge and belief.

(e) Changes to Construction SWMP. The permittee shall amend the construction SWMP:

(1) When there is a change in design, construction, operation, or maintenance of the site, which would require the implementation of new or revised BMPs; or

(2) If the construction SWMP proves to be ineffective in achieving the general objectives of controlling pollutants in stormwater discharges associated with construction activity; or

(3) When BMPs are no longer necessary and are removed.

Construction SWMP changes shall be made prior to changes in the site conditions, except as allowed for in the paragraph below. Construction SWMP revisions may include, but are not limited to: potential pollutant source identification; selection of appropriate BMPs for site conditions; BMP maintenance procedures; and interim and final stabilization practices. The construction SWMP changes may include a schedule for further BMP design and implementation; provided, that if any interim BMPs are needed to comply with the permit, they are also included in the construction SWMP and implemented during the interim period.

Construction SWMP changes addressing BMP installation and/or implementation are often required to be made in response to changing conditions, or when current BMPs are determined ineffective. The majority of construction SWMP revisions to address these changes can be made immediately with quick in-the-field revisions to the construction SWMP. In the less common scenario where more complex development of materials to modify the construction SWMP is necessary, construction SWMP revisions shall be made in accordance with the following requirements:

(i) The construction SWMP shall be revised as soon as practicable, but in no case more than 72 hours after the change(s) in BMP installation and/or implementation occur at the site; and

(ii) A notation must be included in the construction SWMP prior to the site change(s) that includes the time and date of the change(s) in the field, an identification of the BMP(s) removed or added, and the location(s) of those BMP(s).

(f) Substantial Completion. For construction sites that are substantially complete but where final stabilization is not complete, additional inspections shall be conducted at no less than once a month until final stabilization is achieved. These inspections shall include the perimeter of the site, disturbed areas, and material storage areas exposed to precipitation for evidence of, or potential for, the discharge of pollutants to the drainage system.

(g) Final Completion. For construction sites where final stabilization has been achieved, the inspector shall:

(1) Provide certification from the engineer of record that the stormwater volume capacity of any detention site has been restored to the design condition prior to turning over maintenance responsibility to an owners' association.

(2) Submit to the County the final inspection report, final construction SWMP, and certification that the project is completed in accordance with the construction SWMP.

The construction stormwater permit will be released after final stabilization has taken place, as certified by the qualified erosion control specialist.

(h) Enforcement. Mesa County will audit 10 percent of all construction sites to verify that inspections have been conducted, that the construction SWMP is current and is addressing erosion and sedimentation concerns.

If Mesa County determines that inspections are not being conducted in accordance with this manual, they will notify the inspector and the permit holder by mail, and will require the deficiencies be corrected within the stated time frame. If deficiencies are not corrected within 30 days of the first notice of a deficiency, enforcement measures for the stormwater permit, such as required changes to the construction SWMP, stop work orders, and fines, will be implemented, in accordance with requirements of the Land Development Code.

(Res. 40-08 (§ 1506.1), 3-19-08)

28.60.090 Inspection and enforcement – City of Grand Junction.

Inspection and enforcement of construction BMPs will be performed by the City in accordance with Chapter 13.28 GJMC and as amended.

Upon approval of the construction SWMP (See GJMC 28.60.060, Stormwater permit), a stormwater permit will be issued to the applicant, which requires:

(a) Inspection Frequency. The owner/operator shall inspect all BMPs at least once every 14 days, and after any precipitation or snowmelt event that causes surface erosion. The owner/operator must provide consent to the City for the City to inspect any BMP without advance notice or permission from the owner/operator.

(b) Inspections. Inspections shall include proper installation and maintenance of all BMPs, the perimeter of the site, disturbed areas, and material storage areas exposed to precipitation and shall be conducted for evidence of, or potential for, the discharge of pollutants to the drainage system.

(c) Inspection Reporting. Inspection results shall be logged on forms provided, site conditions noted, and any changes to the construction SWMP shall be documented. Based upon inspections performed by the owner/operator or by authorized City personnel, modifications to the construction SWMP shall be necessary if at any time the specified BMPs do not meet the objectives of Chapter 13.28 GJMC.

The permittee shall keep a record of inspections. Inspection reports must identify any incidents of noncompliance with the terms and conditions of this permit. Inspection records must be retained for three years from expiration or inactivation of permit coverage. At a minimum, the inspection report must include:

(1) The inspection date;

(2) Name(s) and title(s) of personnel making the inspection;

(3) Location(s) of discharges of sediment or other pollutants from the site;

(4) Location(s) of BMPs that need to be maintained;

(5) Location(s) of BMPs that failed to operate as designed or proved inadequate for a particular location;

(6) Location(s) where additional BMPs are needed that were not in place at the time of inspection;

(7) Deviations from the minimum inspection schedule as provided in subsection (a) of this section;

(8) Description of corrective action for subsections (c)(3) through (6) of this section, dates corrective action(s) taken, and measures taken to prevent future violations, including requisite changes to the construction SWMP, as necessary; and

(9) After adequate corrective action(s) has been taken, or where a report does not identify any incidents requiring corrective action, the report shall contain a signed statement indicating the site is in compliance with the permit to the best of the signer's knowledge and belief.

(d) Changes to Construction SWMP. If major modification to the construction SWMP is required, such as addition or deletion of a sediment basin, the owner/operator shall meet and confer with authorized City personnel to determine the nature and extent of modification(s). Minor modifications necessary to meet the objectives of Chapter 13.28 GJMC and as amended may be performed without City authorization. All approved modification(s) shall be completed in a timely manner. All modification(s) shall be recorded on the owner/operator's copy of the construction SWMP. In the case of an emergency, the contractor shall implement conservative BMPs and follow up with City personnel the next working day.

The permittee shall amend the construction SWMP:

(1) When there is a change in design, construction, operation, or maintenance of the site, which would require the implementation of new or revised BMPs; or

(2) If the construction SWMP proves to be ineffective in achieving the general objectives of controlling pollutants in stormwater discharges associated with construction activity; or

(3) When BMPs are no longer necessary and are removed.

Construction SWMP changes shall be made prior to changes in the site conditions, except as allowed for in the paragraph below. Construction SWMP revisions may include, but are not limited to: potential pollutant source identification; selection of appropriate BMPs for site conditions; BMP maintenance procedures; and interim and final stabilization practices. The construction SWMP changes may include a schedule for further BMP design and implementation; provided, that if any interim BMPs are needed to comply with the permit, they are also included in the construction SWMP and implemented during the interim period.

Construction SWMP changes addressing BMP installation and/or implementation are often required to be made in response to changing conditions, or when current BMPs are determined ineffective. The majority of construction SWMP revisions to address these changes can be made immediately with quick in-the-field revisions to the construction SWMP. In the less common scenario where more complex development of materials to modify the construction SWMP is necessary, construction SWMP revisions shall be made in accordance with the following requirements:

(i) The construction SWMP shall be revised as soon as practicable, but in no case more than 72 hours after the change(s) in BMP installation and/or implementation occur at the site; and

(ii) A notation must be included in the construction SWMP prior to the site change(s) that includes the time and date of the change(s) in the field, an identification of the BMP(s) removed or added, and the location(s) of those BMP(s).

(e) Substantial Completion. For construction sites that are substantially complete but where final stabilization is not complete, additional inspections shall be conducted at no less than once a month until final stabilization is achieved. These inspections shall include the perimeter of the site, dis-

turbed areas, and material storage areas exposed to precipitation for evidence of, or potential for, the discharge of pollutants to the drainage system.

(f) Final Completion/Inactivation. For construction sites where final stabilization has been achieved, the inspector shall:

(1) Provide certification from the engineer of record that the stormwater volume capacity of any detention site has been restored to the design condition prior to turning over maintenance responsibility to an owners' association.

(2) Submit to the City the final inspection report, final construction SWMP, and certification that the project is completed in accordance with the construction SWMP.

(3) Provide a copy of the CDPHE inactivation notice for construction stormwater discharge general permit certification.

The construction stormwater permit will be released after final stabilization has taken place, as certified by the qualified erosion control specialist.

(g) Enforcement. The City of Grand Junction has the right to enter the premises at any time to investigate if the discharger is complying with all the requirements of the construction SWMP, in accordance with GJMC 13.28.040.

(h) Upset Condition. An upset condition determination constitutes an affirmative defense to an action brought for noncompliance when the terms of the construction SWMP are met. An owner/operator who wishes to establish the affirmative defense of upset must demonstrate, through properly signed, contemporaneous operating logs, or other relevant evidence that:

(1) An upset occurred and that the cause(s) of the upset can be identified;

(2) The facility or operation was at the time being properly operated;

(3) Notice of the upset was submitted as required in GJMC 13.28.020(d); and

(4) Remedial measures were complied with as required.

In any enforcement proceeding, the one seeking to establish the occurrence of an upset has the burden of proof.

(Res. 40-08 (§ 1506.2), 3-19-08)

28.60.100 Inspection and enforcement – Other municipalities.

Contact the City of Fruita, the Town of Palisade, and the Grand Junction Drainage District to determine inspection and enforcement requirements.

(Res. 40-08 (§ 1506.3), 3-19-08)

28.60.110 Construction SWMP.

The construction SWMP shall be prepared by a qualified erosion control specialist in accordance with good hydrologic and pollution control practices. A current copy of the construction SWMP must be on the site at all times.

The construction SWMP shall identify potential sources of pollution (including sediment) which may reasonably be expected to affect the quality of stormwater discharges associated with construction activity. The construction SWMP shall also describe and ensure the implementation of BMPs which will be used to reduce the pollutants in stormwater discharges associated with construction activity. Construction operations must implement the provisions of the construction SWMP.

A checklist of items required for the construction SWMP is provided in **Tables 28.60.110(a)** and **28.60.110(b)**. The construction SWMP shall include the items in GJMC 28.60.120 through 28.60.180, at a minimum.

STORMWATER MANAGEMENT MANUAL

CONSTRUCTION STORMWATER MANAGEMENT PLAN CHECKLIST

Instructions: Applicant to identify with a "check-mark" if information is provided. If applicant believes information is not required, indicate with "n/a" and provide a brief explanation. The local jurisdiction will determine if information labeled "n/a" is required and whether information must be submitted.

1) A site description including:
- ___ A description of the nature of the construction activity.
- ___ The proposed sequence for major activities.
- ___ Estimates of the total area of the site and the area of the site that is expected to undergo clearing, excavation or grading.
- ___ A summary of any existing data used in the development of the site construction plans or Construction SWMP that describe the soil or existing potential for soil erosion.
- ___ A description of the existing vegetation at the site and an estimate of the percent vegetative ground cover. Photos of the existing vegetation may be useful to determine if final stabilization has occurred.
- ___ The location and description of all potential pollution sources, including ground surface disturbing activities, vehicle fueling, storage of fertilizers or chemicals, etc.
- ___ The location and description of any anticipated non-stormwater components of the discharge, such as uncontaminated springs, landscape irrigation return flow, and construction dewatering.
- ___ The name of the receiving water(s) and the size, type and location of any outfall(s). If the discharge is to a municipal separate storm sewer, the name of that system, the location of the storm sewer discharge, and the ultimate receiving water(s).

2) A site map with:
- ___ Construction site boundaries
- ___ All areas of soil disturbance
- ___ Areas of cut and fill
- ___ Areas used for storage of building materials, soils or wastes
- ___ Location of any dedicated asphalt or concrete batch plants
- ___ Location of BMPs needed to address pollutant sources identified in Section 1507.3 (b)
- ___ Location of springs, streams, wetlands and other surface waters
- ___ Stormwater discharge locations

3) A description of all control measures that reflect the potential pollutants sources identified at the facility. The description of stormwater management controls shall address the following components, at a minimum:
- ___ Construction SWMP Administrator
- ___ Identification of Potential Pollutant Sources including:
  - ___ all disturbed and stored soils
  - ___ vehicle tracking of sediments
  - ___ management of contaminated soils
  - ___ loading and unloading operations
  - ___ outdoor storage activities (building materials, fertilizers, chemicals, etc.)
  - ___ vehicle and equipment maintenance and fueling
  - ___ significant dust or particulate generating processes
  - ___ routine maintenance activities involving fertilizers, pesticides, detergents, fuels, solvents, oils, etc.
  - ___ on-site waste management practices (waste piles, liquid wastes, dumpsters, etc.)
  - ___ concrete truck/equipment washing, including the concrete truck chute and associated fixtures and equipment
  - ___ dedicated asphalt and concrete batch plants
  - ___ non-industrial waste sources such as worker trash and portable toilets
  - ___ other areas or procedures where potential spills can occur

Revision	Date
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REVISED	2/20/08

WRC ENGINEERING, INC.	REFERENCE:	**TABLE 28.60.110(a)**

STORMWATER MANAGEMENT MANUAL

CONSTRUCTION STORMWATER MANAGEMENT PLAN CHECKLIST
(continued)

Instructions: Applicant to identify with a "check-mark" if information is provided. If applicant believes information is not required, indicate with "n/a" and provide a brief explanation. The local jurisdiction will determine if information labeled "n/a" is required and whether information must be submitted.

4) A description of all Best Management Practices (BMPs) for Stormwater Pollution Prevention including:

___ Structural Practices for Erosion and Sediment Control
___ Non-Structural Practices for Erosion and Sediment Control
___ Phased BMP Implementation
___ Materials Handling and Spill Prevention
___ Dedicated Concrete or Asphalt Batch Plants
___ Vehicle Tracking Control
___ Waste Management and Disposal, Including Concrete Washout
___ Groundwater and Stormwater Dewatering
___ Construction SWMP Administrator
___ Construction SWMP Administrator
___ Construction SWMP Administrator

5) The Construction SWMP shall clearly describe the practices used to achieve final stabilization of all disturbed areas at the site

6) The plan shall include a description of procedures to inspect and maintain in good and effective operating condition the vegetation, erosion and sediment control measures.

7) The Construction Stormwater Management Plan shall be certified.

8) The plan shall include the estimated total cost (purchase, installation and maintenance) of the required temporary soil erosion and sediment control measures to determine surety or bonding requirements for the proposed plan.

Revision	Date
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REVISED	2/20/08

WRC ENGINEERING, INC.	REFERENCE:	**TABLE 28.60.110(b)**

(Res. 40-08 (§ 1507), 3-19-08)

28.60.120 Site description.

Each plan shall provide a description of the following:

(a) A description of the nature of the construction activity.

(b) The proposed sequence for major activities.

(c) Estimates of the total area of the site, and the area of the site that is expected to undergo clearing, excavation or grading.

(d) A summary of any existing data used in the development of the site construction plans or construction SWMP that describe the soil or existing potential for soil erosion.

(e) A description of the existing vegetation at the site and an estimate of the percent vegetative ground cover. Photos of the existing vegetation may be useful to determine if final stabilization has occurred.

(f) The location and description of all potential pollution sources, including ground surface disturbing activities, vehicle fueling, storage of fertilizers or chemicals, etc.

(g) The location and description of any anticipated nonstormwater components of the discharge, such as uncontaminated springs, landscape irrigation return flow, and construction dewatering.

(h) The name of the receiving water(s) and the size, type and location of any outfall(s). If the discharge is to a municipal separate storm sewer, the name of that system, the location of the storm sewer discharge, and the ultimate receiving water(s).

(Res. 40-08 (§ 1507.1), 3-19-08)

28.60.130 Site map.

Each plan shall provide a generalized site map or maps which indicate:

(a) Construction site boundaries.

(b) All areas of soil disturbance.

(c) Areas of cut and fill.

(d) Areas used for storage of building materials, soils or wastes.

(e) Location of any dedicated asphalt or concrete batch plants.

(f) Location of BMPs needed to address pollutant sources identified in GJMC 28.60.140.

(g) Location of springs, streams, wetlands and other surface waters.

(h) Stormwater discharge locations.

(Res. 40-08 (§ 1507.2), 3-19-08)

28.60.140 Stormwater management controls.

The construction SWMP must include a description of all stormwater management controls that will be implemented as part of the construction activity to control pollutants in stormwater discharges. The appropriateness and priorities of stormwater management controls in the construction SWMP shall reflect the potential pollutants sources identified at the facility.

The description of stormwater management controls shall address the following components, at a minimum:

(a) Construction SWMP Administrator. The construction SWMP shall identify a specific individual(s), position or title responsible for developing, implementing, maintaining, and revising the construc-

tion SWMP. The activities and responsibilities of the administrator shall address all aspects of the facility's construction SWMP.

(b) Identification of Potential Pollutant Sources. All potential pollutant sources, including materials and activities, at a site must be evaluated for the potential to contribute pollutants to stormwater discharges. The construction SWMP shall identify and describe those sources determined to have the potential to contribute pollutants to stormwater discharges, and the sources must be controlled through BMP selection and implementation, as required in subsection (c) of this section.

At a minimum, each of the following sources and activities shall be addressed in the construction SWMP. If the source or activity does not have the potential to contribute pollutant, it must be indicated in the construction SWMP:

(1) All disturbed and stored soils;

(2) Vehicle tracking of sediments;

(3) Management of contaminated soils;

(4) Loading and unloading operations;

(5) Outdoor storage activities (building materials, fertilizers, chemicals, etc.);

(6) Vehicle and equipment maintenance and fueling;

(7) Significant dust or particulate generating processes;

(8) Routine maintenance activities involving fertilizers, pesticides, detergents, fuels, solvents, oils, etc.;

(9) On-site waste management practices (waste piles, liquid wastes, dumpsters, etc.);

(10) Concrete truck/equipment washing, including the concrete truck chute and associated fixtures and equipment;

(11) Dedicated asphalt and concrete batch plants;

(12) Nonindustrial waste sources such as worker trash and portable toilets; and

(13) Other areas or procedures where potential spills can occur.

(c) Best Management Practices (BMPs) for Stormwater Pollution Prevention. The construction SWMP shall identify and describe appropriate BMPs, including, but not limited to, those required by subsections (c)(1) through (8) of this section, that will be implemented at the facility to reduce the potential of the sources identified in subsection (b) of this section to contribute pollutants to stormwater discharges. The construction SWMP shall clearly describe the installation and implementation specifications for each BMP identified in the construction SWMP to ensure proper implementation, operation and maintenance of the BMP.

(1) Structural Practices for Erosion and Sediment Control. The construction SWMP shall clearly describe and locate all structural practices implemented at the site to minimize erosion and sediment transport. Practices may include, but are not limited to: straw bales, wattles/sediment control logs, silt fences, earth dikes, drainage swales, sediment traps, subsurface drains, pipe slope drains, inlet protection, outlet protection, gabions, and temporary or permanent sediment basins.

(2) Nonstructural Practices for Erosion and Sediment Control. The construction SWMP shall clearly describe and locate, as applicable, all nonstructural practices implemented at the site to minimize erosion and sediment transport. Description must include interim and permanent stabilization practices, and site-specific scheduling for implementation of the practices. The construction SWMP should include practices to ensure that existing vegetation is preserved where possible. Nonstructural practices may include, but are not limited to: temporary vege-

tation, permanent vegetation, mulching, geotextiles, sod stabilization, slope roughening, vegetative buffer strips, protection of trees, and preservation of mature vegetation.

(3) Phased BMP Implementation. The construction SWMP shall clearly describe the relationship between the phases of construction, and the implementation and maintenance of both structural and nonstructural stormwater management controls. The construction SWMP must identify the stormwater management controls to be implemented during the project phases, which can include, but are not limited to, clearing and grubbing; road construction; utility and infrastructure installation; vertical construction; final grading; and final stabilization.

(4) Materials Handling and Spill Prevention. The construction SWMP shall clearly describe and locate all practices implemented at the site to minimize impacts from procedures or significant materials that could contribute pollutants to runoff. Such procedures or significant materials could include: exposed storage of building materials; paints and solvents; fertilizers or chemicals; waste material; and equipment maintenance or fueling procedures. Areas or procedures where potential spills can occur must have spill prevention and response procedures identified in the construction SWMP.

(5) Dedicated Concrete or Asphalt Batch Plants. The construction SWMP shall clearly describe and locate all practices implemented at the site to control stormwater pollution from dedicated concrete batch plants or dedicated asphalt batch plants covered by this certification.

(6) Vehicle Tracking Control. The construction SWMP shall clearly describe and locate all practices implemented at the site to control potential sediment discharges from vehicle tracking. Practices must be implemented for all areas of potential vehicle tracking and can include: minimizing site access, street sweeping or scraping, tracking pads, graveled parking areas, requiring that vehicles stay on paved areas on site, wash racks, contractor education, and/or sediment control BMPs, etc.

(7) Waste Management and Disposal, Including Concrete Washout.

(i) The construction SWMP shall clearly describe and locate the practices implemented at the site to control stormwater pollution from all construction site wastes (liquid and solid), including concrete washout activities. Designated concrete washouts shall be identified in the field with signage.

(ii) The practices used for concrete washout must ensure that these activities do not result in the contribution of pollutants associated with the washing activity to stormwater runoff.

(iii) GJMC 28.60.030(b) authorizes the conditional discharge of concrete washout water to the ground. The construction SWMP shall clearly describe and locate the practices to be used that will ensure that no washout water from concrete washout activities is discharged from the site as surface runoff or to surface waters.

(iv) Because pH is a pollutant of concern for washout activities, the soil must have adequate buffering capacity to result in protection of the groundwater standard, or a liner/containment must be used. The following management practices are recommended to prevent an impact from unlined pits to groundwater:

(A) The use of the washout site should be temporary (less than one year); and

(B) The washout site should not be located in an area where shallow groundwater may be present, such as near natural drainages, springs, or wetlands.

(8) Groundwater and Stormwater Dewatering.

(i) The construction SWMP shall clearly describe and locate the practices implemented at the site to control stormwater pollution from the dewatering of groundwater or stormwater from excavations, wells, etc.

(ii) GJMC 28.60.030 authorizes the conditional discharge of construction dewatering to the ground. For any construction dewatering of groundwater not authorized under a separate CDPS discharge permit, the construction SWMP shall clearly describe and locate the practices to be used that will ensure that no groundwater from construction dewatering is discharged from the site as surface runoff or to surface waters.

(Res. 40-08 (§ 1507.3), 3-19-08)

28.60.150 Final stabilization and long-term stormwater management.

The construction SWMP shall clearly describe the practices used to achieve final stabilization of all disturbed areas at the site, and any planned practices to control pollutants in stormwater discharges that will occur after construction operations have been completed at the site. The designs of post-construction BMPs, which are described in Chapter 28.64 GJMC, Post-Construction Stormwater Management, are included with the final drainage report (see GJMC 28.12.060 through 28.12.100, final drainage report).

Final stabilization practices for obtaining a vegetative cover shall include, as appropriate: seed mix selection and application methods; soil preparation and amendments; soil stabilization practices (e.g., crimped straw, hydro mulch or rolled erosion control products); and appropriate sediment control BMPs as needed until final stabilization is achieved; etc.

Final stabilization is reached when all ground surface disturbing activities at the site have been completed, and uniform vegetative cover has been established on all remaining pervious soil surfaces with an individual plant density of at least 70 percent of pre-disturbance levels and equivalent permanent, physical erosion reduction methods (buildings, asphalt, concrete, etc.) have been employed. This does not mean that 70 percent of total surface area of the site has been converted to impervious surfaces.

(Res. 40-08 (§ 1507.4), 3-19-08)

28.60.160 Inspection and maintenance.

The plan shall include a description of procedures to inspect and maintain in good and effective operating condition the vegetation, erosion and sediment control measures and other protective measures identified in the construction SWMP. GJMC 28.60.080 through 28.60.100 describe inspection requirements.

(Res. 40-08 (§ 1507.5), 3-19-08)

28.60.170 Certification.

The construction stormwater management plan shall include the following certification:

> I hereby certify that the Construction Stormwater Management Plan for the construction of (name of Development) was prepared by me (or under my direct supervision) in accordance with the provisions of the *Stormwater Management Manual* for the owner/operators of (name of Development). I understand that the (Identify permitting agency) does not and will not assume liability for facilities designed by others.
>
> _____ _____
> Erosion Control Specialist Date

(Res. 40-08 (§ 1507.6), 3-19-08)

28.60.180 Estimated BMP costs.

The plan shall include the estimated total cost (purchase, installation and maintenance) of the required temporary soil erosion and sediment control measures to determine surety or bonding requirements for the proposed plan. Provide quantities and unit costs.

(Res. 40-08 (§ 1507.7), 3-19-08)

28.60.190 Permit transfer requirements.

When a portion of a permitted site is sold to a new owner or operator, a permit certification must be in place that is held by the new owner/operator of the sold area. This may be accomplished in one of the following ways:

(a) Coverage under the Existing Certification. Activities at the sold area may be covered under an existing permit for the project if the current permittee has contractual responsibility and operational control to address the impacts that construction activities at the sold area may have on stormwater runoff (including implementation of the construction SWMP for the sold area). Therefore, a legally binding agreement must exist assigning this responsibility to the permit holder on behalf of the new owner/operator for the sold area. It is necessary to notify the local jurisdiction in such case. Documentation of the agreement must be available upon request and the construction SWMP must be maintained to include all activities covered by the permit.

Example: Developer Dan sells a lot to Builder Bob. Developer Dan is currently covered under a permit that covers a larger area, which includes the sold lot. Developer Dan and Builder Bob may enter into a contract that assigns the responsibility for permit coverage and stormwater management to Developer Dan for Builder Bob's lot. Developer Dan is also responsible for making sure his construction SWMP includes the activities on the lot. Developer Dan's permit will continue to cover construction activities on Builder Bob's lot.

(b) New Certification Issued – Reassignment. A new permit may be issued to the new owner/operator of the sold area. The existing permittee and the new owner/operator must complete the reassignment form to remove the sold area from the existing permit and cover it under a new permit issued to the new owner/operator of the sold area. Both entities must have their construction SWMP in place that accurately reflects their current covered areas and activities.

Example: Developer Dan sells a lot to Builder Bob. Developer Dan is currently covered under a permit that covers a larger area, which includes the sold lot. For this example, Developer Dan and Builder Bob must jointly submit the reassignment form. Builder Bob will be issued a new permit for his lot and the lot will be removed from Developer Dan's permit coverage. Prior to submittal of the reassignment form, Developer Dan must revise his construction SWMP to reflect the changes in his covered area and activities, and Builder Bob must develop his own construction SWMP to cover the area and activities for which he will obtain coverage. The reassignment form and associated instructions can be found in Chapter 28.68 GJMC, Standard Forms. The form and instructions can also be found at the CDPHE website:

http://www.cdphe.state.co.us/wq/PermitsUnit/stormwater/construction.html

under the "construction reassignment form" link.

(c) Amend Existing Permit Certifications. In some cases, both parties (the original owner/operator and the new owner/operator of an area undergoing transfer of ownership) will already be permit holders for their portions of the overall project (i.e., at least two permits are issued for the project and cover both the party wishing to reassign coverage and the party wishing to accept coverage). When an additional area is transferred between the two parties, the permittees may amend their permits instead of completing the reassignment form. Both parties must separately provide a letter to the local jurisdiction that includes the revised information, removing the applicable area(s) from the original owner/operator's permit certification, and adding the area(s) to the new owner/operator's permit certification. The requests must cite both permit numbers. (Note: this request may be submitted jointly if it is signed by both entities.) This option will likely be used in cases where a developer and an owner/operator have already submitted a reassignment form, as discussed in subsection (b) of this section, where an initial transfer of lots has occurred, and then additional lots are transferred at a later date. Both entities must have a construction SWMP in place that accurately reflects their current covered areas and activities.

Example: Developer Dan sells a lot to Builder Bob. Developer Dan is currently covered under a permit that covers a larger area, which includes the sold lot. In addition, Builder Bob also holds a permit for other portions of the development which he already owns, and Builder Bob wishes to cover his new lot under this permit. Developer Dan submits a request to remove the lot from his permit and provides Builder Bob's permit number that the lot will now be under which that lot will be covered. Builder Bob also submits a request to modify his permit to add the lot, and provides Developer Dan's permit number under which the lot was previously covered. Developer Dan and Builder Bob must revise their construction SWMP to reflect the changes in their covered area and activities.

(d) Sale of Residence to Homeowner. For residential construction only, when a residential lot has been conveyed to a homeowner and all criteria in subsections (d)(1) through (d)(5) of this section are met, coverage under this permit is no longer required and the conveyed lot may be removed from coverage under the permittee's certification. At such time, the permittee is no longer responsible for meeting the terms and conditions of this permit for the conveyed lot, including the requirement to transfer or reassign permit coverage. The permittee remains responsible for inactivation of the original certification.

(1) The lot has been sold to the homeowner(s) for private residential use;

(2) The lot is less than 1.0 acres of disturbed area;

(3) All construction activity conducted by the permittee on the lot is completed;

(4) A certificate of occupancy (or equivalent) has been awarded to the home owner; and

(5) The construction SWMP has been amended to indicate the lot is no longer covered by permit.

Lots not meeting all of the above criteria require continued permit coverage. However, this permit coverage may be transferred or reassigned to a new owner or operator as described in subsections (a) through (c) of this section.

(Res. 40-08 (§ 1508), 3-19-08)

28.60.200 Checklist.

A checklist for the construction SWMP is provided in **Tables 28.60.110(a)** and **28.60.110(b)**. This checklist contains recommended report outline and contents for the construction SWMP. A copy of the completed checklist shall be bound with the construction SWMP.

Applicant is to identify with a check mark ("🗏") if information is provided with the appropriate submittal. If applicant believes information is not required, indicate with "n/a." The submittal will be reviewed to determine if information is required and whether information must be submitted.

(Res. 40-08 (§ 1509), 3-19-08)

Chapter 28.64

POST-CONSTRUCTION STORMWATER MANAGEMENT

Sections:

28.64.010 Introduction.
28.64.020 Standards for best management practices (BMPs) – Minimum structural BMPs requirements.
28.64.030 Standards for best management practices (BMPs) – Aesthetic requirements.
28.64.040 Standards for best management practices (BMPs) – Proprietary BMPs.
28.64.050 Standards for best management practices (BMPs) – Considerations in BMPs selection.
28.64.060 Standards for best management practices (BMPs) – Local modifications to minimum structural BMPs.
28.64.070 Final drainage report.
28.64.080 Water quality capture volume.
28.64.090 Directly connected impervious area.
28.64.100 Water quality capture volume.
28.64.110 Nonstructural BMPs – General information.
28.64.120 Nonstructural BMPs – Spill prevention and response.
28.64.130 Inspection and enforcement.
28.64.140 BMPs for industrial and commercial activities.
28.64.150 Industrial and commercial activities.
28.64.160 Best management practices.

28.64.010 Introduction.

All persons engaged in new development and redevelopment of property that disturbs 1.0 acres or more shall implement post-construction BMPs to control the discharge of pollutants after construction is completed, in accordance with the provisions of this manual. Post-construction BMPs, which includes both structural and nonstructural measures, shall be identified in the final drainage report (see GJMC 28.12.060 through 28.12.100, final drainage report). For requirements during construction, see Chapter 28.60 GJMC, Construction Site Stormwater Runoff Control.

(Res. 40-08 (§ 1601), 3-19-08)

28.64.020 Standards for best management practices (BMPs) – Minimum structural BMPs requirements.

BMPs for significant development and redevelopment capture and detain stormwater in best management practices, called volume capture devices. These BMPs are designed to capture and temporarily detain a large percentage of runoff events and runoff volumes then release the runoff over a six- to 40-hour period, which allows sufficient time for settling of pollutants. Volume capture BMPs are widely used by communities throughout the United States and are considered a standard of practice.

The following BMPs meet the minimum water quality capture volume (WQCV) requirements for on-site or regional stormwater quality facilities:

Figure 28.64.020(a), Porous Pavement Detention (with under-drain only);

Figure 28.64.020(b), Porous Landscape Detention (with under-drain only);

Figure 28.64.020(c), Extended Detention Basin;

Figure 28.64.020(d), Sand Filter Extended Detention Basin;

Figure 28.64.020(e), Constructed Wetland Basin;

Figure 28.64.020(f), Retention Basin;

Figure 28.64.020(g), Grass Swale.

Examples of these BMPs can be found in:

(a) *Urban Drainage and Flood Control District (UDFCD) 1999*. Urban Storm Drainage Criteria Manual (USDCM), Volume 3 – Best Management Practices. This document is available at:

http://www.udfcd.org/usdcm/vol3.htm.

(b) *Water Environment Federation (WEF) and American Society of Civil Engineers (ASCE) 1998*. Urban Runoff Quality Management. *WEF Manual No. 23, ASCE Manual No. 87*.

(c) *EPA 2002. Consideration in the Design of Treatment Best Management Practices (BMP) to Improve Water Quality. EPA 600 R-03/103*. This document is available in .pdf form at the following website:

http://www.epa.gov/ORD/NRMRL/pubs/600r03103/600r03103chp5.pdf

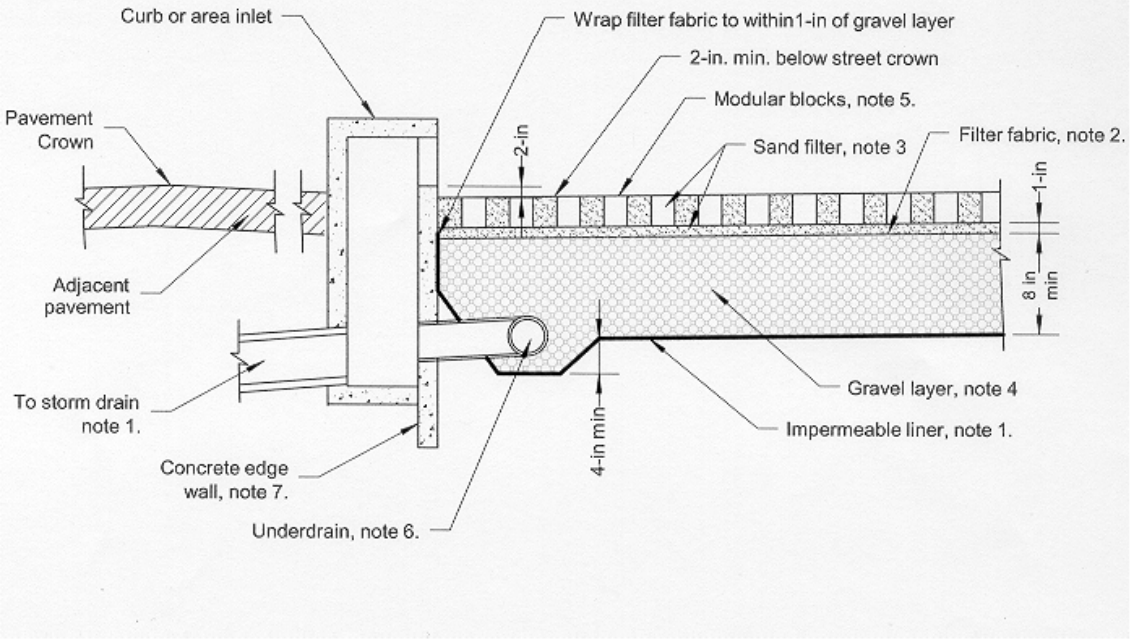
Portions of the USDCM Volume 3 that are required to design an extended detention basin to include water quality requirements are in Chapter 28.80 GJMC. Each designer should note that all UDFCD documents are updated continuously, and it is the designer's responsibility to check for these updates to ensure use of the most up-to-date data. Each designer should also note that some equations in this manual have been modified from those in Volume 3 to be specific to Mesa County. Equations in this manual shall govern.

Use of alternate BMPs not specified above is subject to approval by the local jurisdiction. **Figure 28.64.020(h)** offers a schematic for determining the best BMP options for individual sites.

When new development is served by a regional stormwater quality facility designed in accordance with this chapter and stormwater from the development is discharged to an open conveyance system before reaching the regional facility, on-site BMPs must also be provided. If the new development discharges to the regional stormwater quality facility through a storm drain, then this additional requirement does not apply.

STORMWATER MANAGEMENT MANUAL

POROUS PAVEMENT DETENTION (PPD)



NOTES:

1. PPD MUST INCLUDE AN UNDER-DRAIN SYSTEM THAT DISCHARGES TO A SURFACE DRAINAGE AND A 16 MIL IMPERMEABLE LINER. INFILTRATION NOT PERMITTED.
2. FILTER FABRIC(GEO-TEXTILE) SHALL MEET THE FOLLOWING: ASTM D-4751-AOS US STD SIEVE #50 TO #70; ASTM D-4632 - MIN. GRAB STRENGTH OF 100-LBS; ASTM D-4491 - MIN. PERMITTIVITY OF 1.8/SEC.
3. SAND FILTER TO BE ASTM C33 SAND.
4. GRAVEL LAYER TO BE AASHTO #4 WITH ALL FRACTURED FACES(CDOT SECTION 703, #4 COURSE AGGREGATE).
5. MODULAR BLOCK WITH OPEN SURFACE AREA OF 40% OR GREATER FOR VOID SPACE. SURFACE OF BLOCKS TO BE PLACED AT 0% GRADE IN ALL DIRECTIONS.
6. UNDER-DRAIN TO BE 4" MIN. DIAMETER, WITH 0.2% MIN. SLOPE, AT 20-FT MAXIMUM, ON CENTERS.
7. CONSTRUCT CONCRETE EDGE-WALL AROUND PERIMETER OF PPD, MIN. 6-IN THICK AND 18-IN DEEP.

Revision	Date
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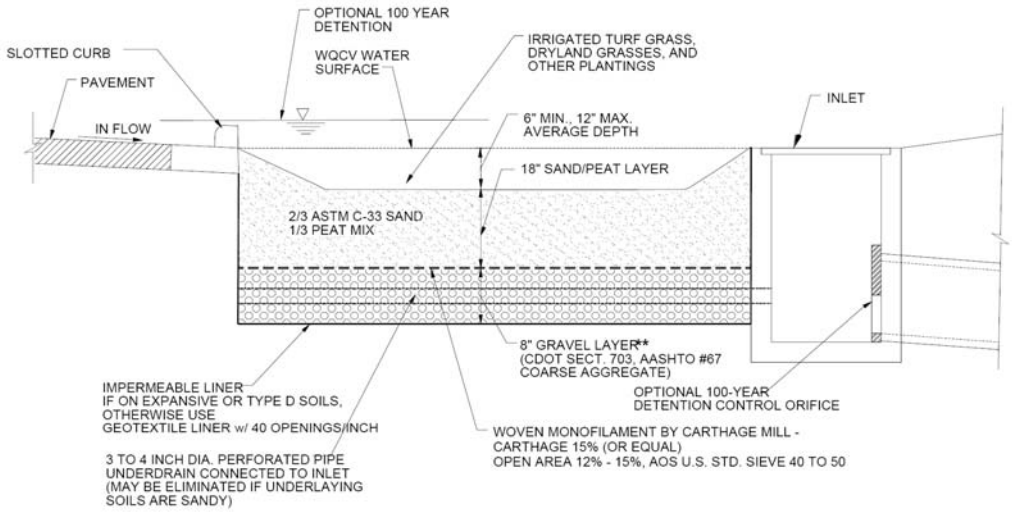
URS ENGINEERING, INC.

REFERENCE: *UDFCD. URBAN DRAINAGE CRITERIA MANUAL VOLUME 3 BEST MANAGEMENT PRACTICES*

FIGURE 28.64.020(a)

STORMWATER MANAGEMENT MANUAL

POROUS LANDSCAPE DETENTION (PLD)



** SUBSTITUTE AN 18" LAYER OF SAND/PEAT MIX FOR THE 8" GRAVEL LAYER WHEN NO UNDERDRAIN IS USED IN NRCS TYPE D SOILS OR IN EXPANSIVE SOILS. USE IMPERMEABLE LINER UNDER AND ON SIDES OF BASIN.

NOTES:

1. PLD MUST INCLUDE AN UNDERDRAIN SYSTEM THAT DISCHARGES TO A SUFACE DRAINAGE. NO INFILTRATION PERMITTED.

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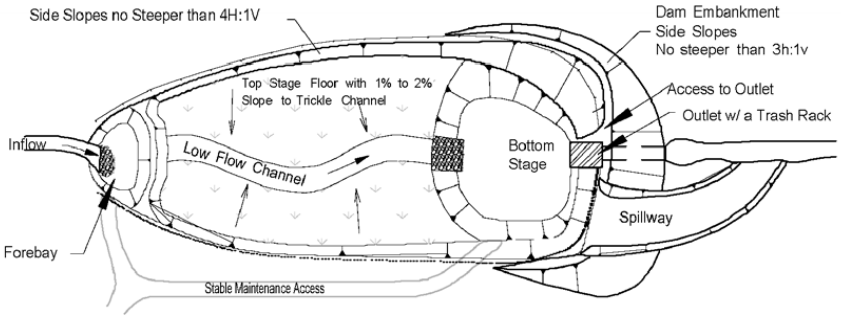
WRC ENGINEERING, INC.

REFERENCE: *UDFCD. URBAN DRAINAGE CRITERIA MANUAL VOLUME 3 BEST MANAGEMENT PRACTICES*

FIGURE 28.64.020(b)

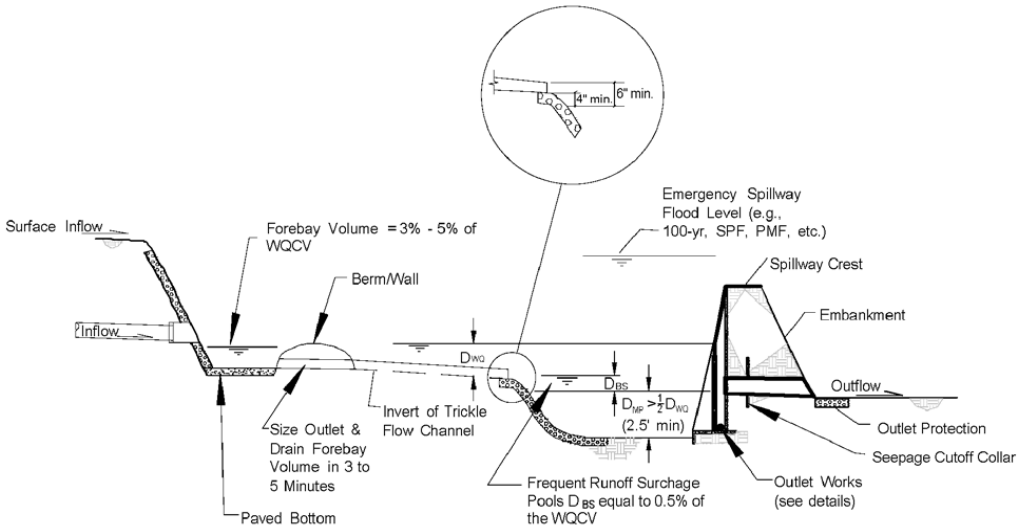
STORMWATER MANAGEMENT MANUAL

EXTENDED DETENTION BASIN (EDB)



PLAN
Not to scale

Note: Provide energy disipating inlet such as impact basin for pipes and GSB drop or baffle chute for channel/swales.



PROFILE
Not to scale

Revision	Date
ORIGINAL ISSUE	3/27/06
UDFCD UPDATE	12/6/07

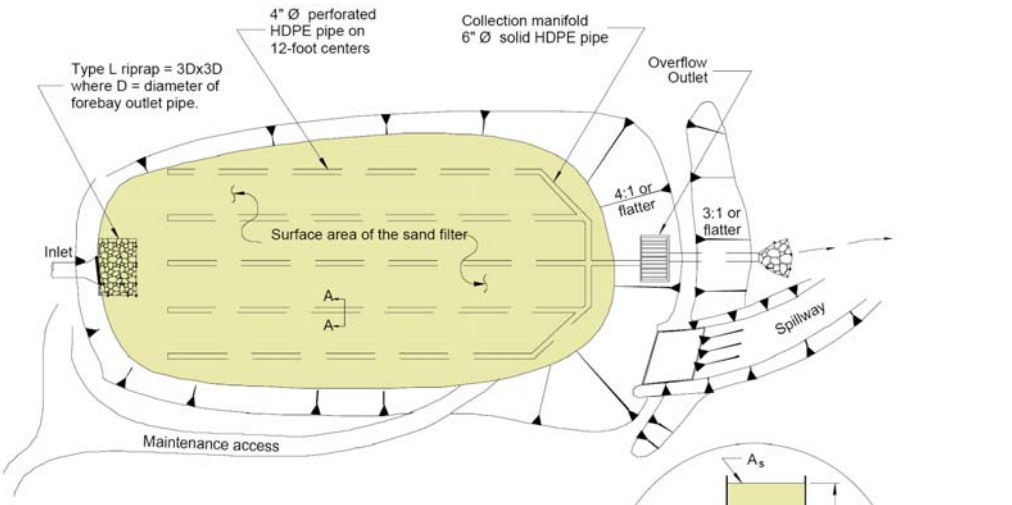
WRC ENGINEERING, INC.

REFERENCE: *UDFCD. URBAN DRAINAGE CRITERIA MANUAL VOLUME 3 BEST MANAGEMENT PRACTICES*

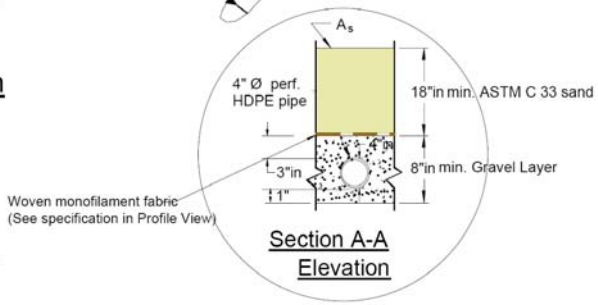
FIGURE 28.64.020(c)

STORMWATER MANAGEMENT MANUAL

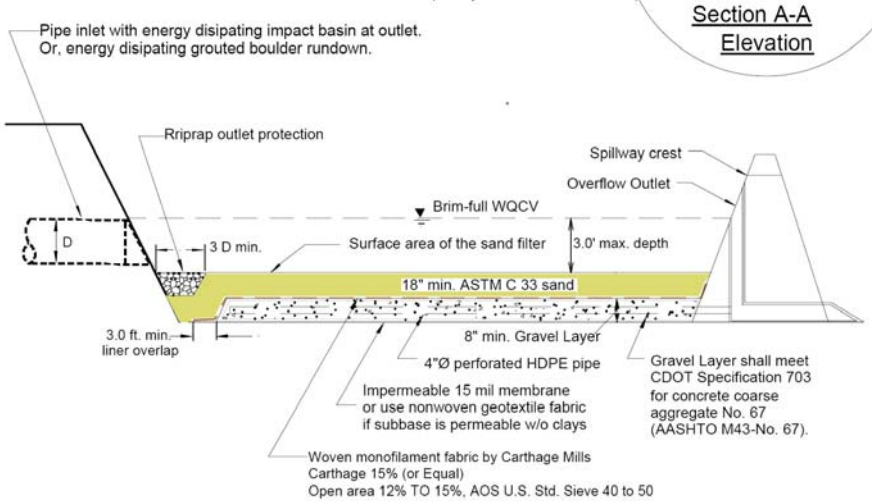
SAND FILTER EXTENDED DETENTION BASIN (SFB)



Plan



Section A-A
Elevation



Profile

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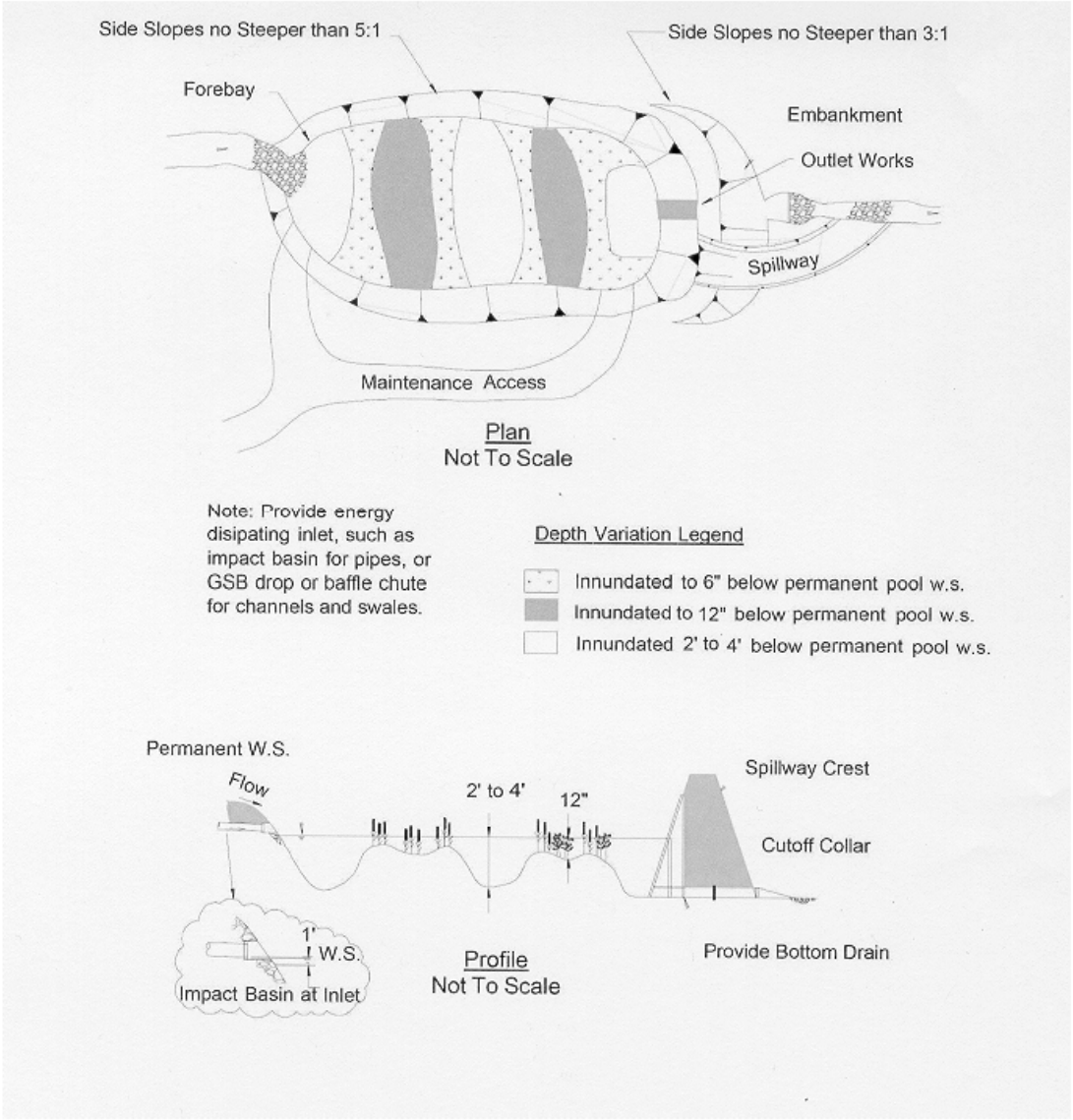
REFERENCE: *UDFCD. URBAN DRAINAGE CRITERIA MANUAL VOLUME 3 BEST MANAGEMENT PRACTICES*

FIGURE 28.64.020(d)

STORMWATER MANAGEMENT MANUAL

CONSTRUCTED WETLAND BASIN (CWB)



Revision	Date
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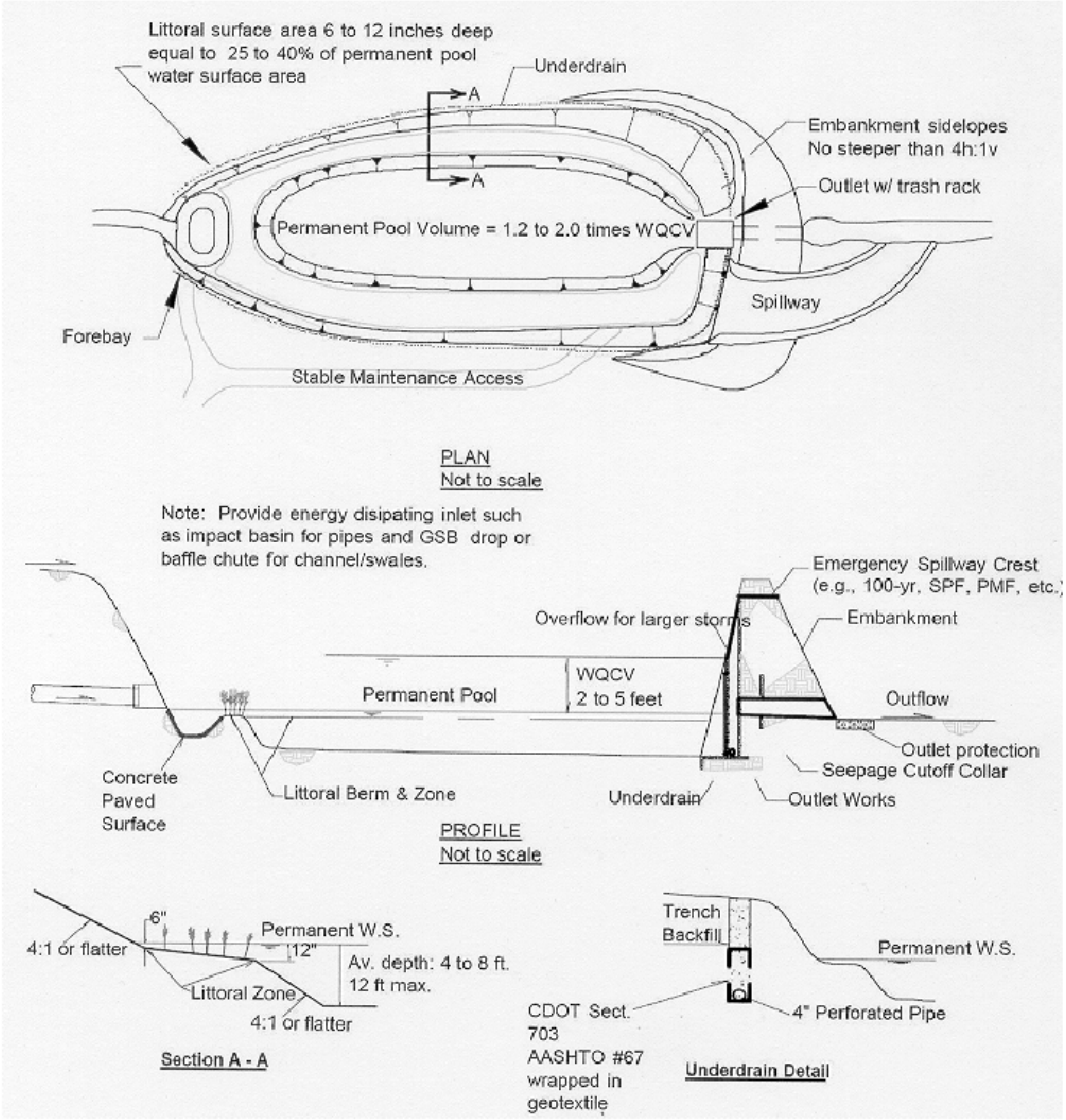
URC ENGINEERING, INC.	REFERENCE: UDFCD. URBAN DRAINAGE CRITERIA MANUAL VOLUME 3 BEST MANAGEMENT PRACTICES	FIGURE 28.64.020(e)

STORMWATER MANAGEMENT MANUAL

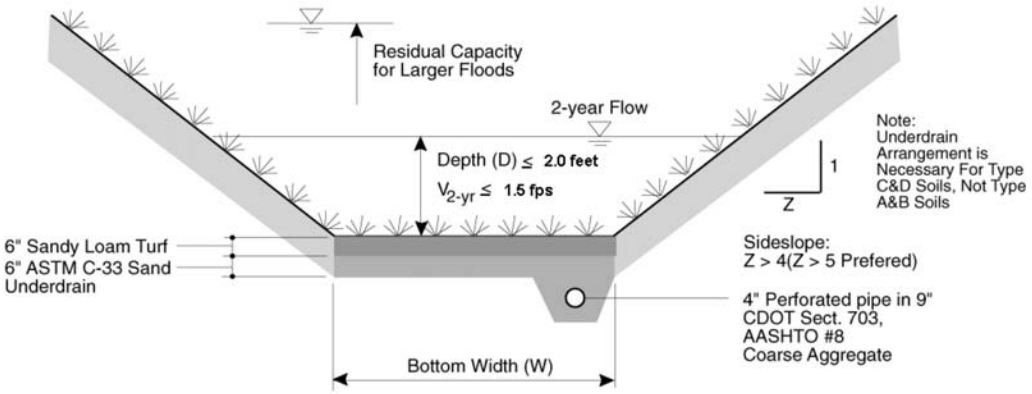
RETENTION BASIN (RB)



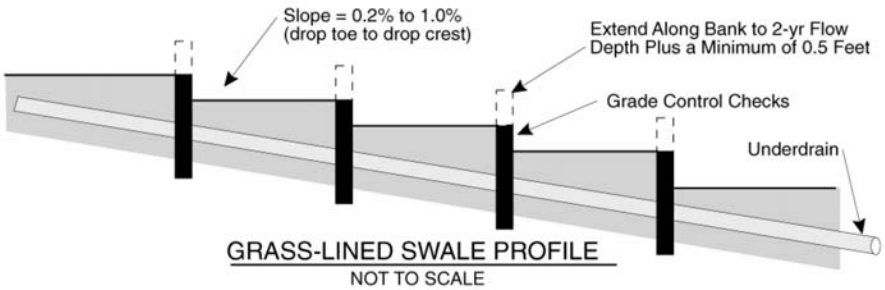
Revision	Date
ORIGINAL ISSUE	3/27/08

URS ENGINEERING, INC.	REFERENCE: *UDFCD. URBAN DRAINAGE CRITERIA MANUAL VOLUME 3 BEST MANAGEMENT PRACTICES*	**FIGURE 28.64.020(f)**

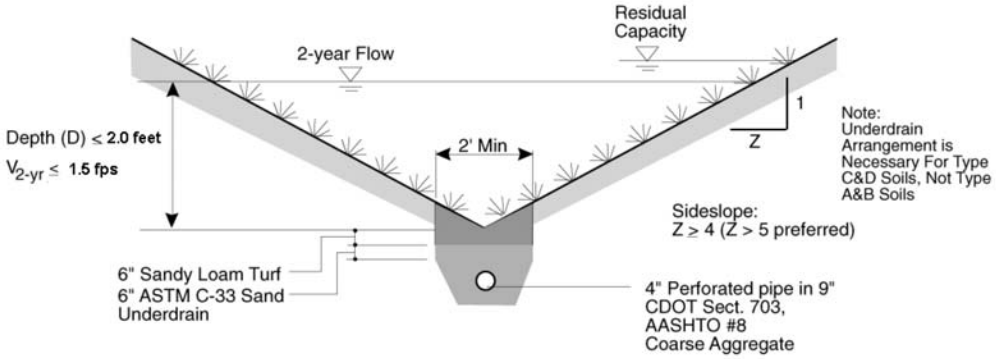
STORMWATER MANAGEMENT MANUAL



TRAPEZOIDAL GRASS-LINED SWALE SECTION
NOT TO SCALE



GRASS-LINED SWALE PROFILE
NOT TO SCALE



TRIANGULAR GRASS-LINED SWALE SECTION
NOT TO SCALE

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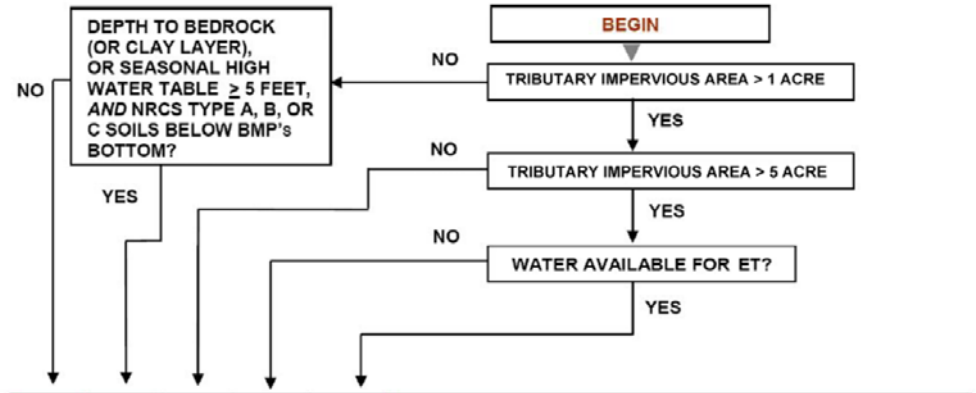
WRC ENGINEERING, INC

REFERENCE: *UDFCD. URBAN DRAINAGE CRITERIA MANUAL VOLUME 3 BEST MANAGEMENT PRACTICES*

FIGURE 28.64.020(g)

STORMWATER MANAGEMENT MANUAL

DECISION TREE FOR IDENTIFYING POTENTIAL INDIVIDUAL SITE BMPS



▫	▫				GREEN ROOF WITH IRRIGATION
▫	▫				GRASS BUFFER (GB)
▫	▫	▫	▫	▫	GRASS SWALE (GS)
	▫				POROUS PAVEMENT (PP) WITH INFILTRATION
▫					POROUS PAVEMENT (PP) WITH UNDERDRAINS
	◆				POROUS PAVEMENT DETENTION (PPD) WITH INFILTRATION
◆					POROUS PAVEMENT DETENTION (PPD) WITH UNDERDRAINS
	◆				POROUS LANDSCAPE DETENTION (PLD) WITH INFILTRATION
◆					POROUS LANDSCAPE DETENTION (PLD) WITH UNDERDRAINS
		●	●	●	EXTENDED DETENTION BASIN (EDB) ***
◆	◆	◆	◆	◆	SAND FILTER DETENTION BASIN (EDB)
				●	CONSTRUCTED WETLAND BASIN (CWB)
				●	RETENTION POND (RP)
▫	▫	▫	▫	▫	CONSTRUCTED WETLAND CHANNEL (CWC)

Legend:
- ▫ Provides for reductions in runoff volume, along with some reduction in pollutant EMCs
- ◆ Provides for reductions in runoff volume and the recommended *WQCV*
- ● Provides recommended *WQCV*
- *** EDBs are not very suitable for catchments with less than 5 acres of impervious tributary area. The International BMP Database reports EDBs provide as much as 30% reductions in annual runoff volume.

Revision	Date
ORIGINAL ISSUE	12/6/07

WRC ENGINEERING, INC.	REFERENCE: *UDFCD. URBAN DRAINAGE CRITERIA MANUAL VOLUME 3 BEST MANAGEMENT PRACTICES*	**FIGURE 28.64.020(h)**

(Res. 40-08 (§ 1602.1), 3-19-08)

28.64.030 Standards for best management practices (BMPs) – Aesthetic requirements.

When storm runoff will be treated by an extended detention basin (dry), a retention pond with a permanent pool (wet), or constructed wetlands, the facility shall be designed with the intent of improving appearance in accordance with requirements under Chapter 28.56 GJMC, Detention and Retention.

(Res. 40-08 (§ 1602.2), 3-19-08)

28.64.040 Standards for best management practices (BMPs) – Proprietary BMPs.

Proprietary systems which meet the requirements of this chapter and have continued inspection/operation and maintenance guarantees in place are allowed provided:

(a) Clear evidence must be provided why WQCV cannot be provided on the ground surface using volume-capture BMPs, and why the use of a subsurface proprietary device is the best choice for the site, considering factors such as initial installation, maintenance, and ability to assure long-term function.

(b) Proprietary BMPs are limited to commercial, new development and redevelopment sites with an area less than five acres tributary to the proprietary BMP. If greater than five acres, a variance or deviation may be requested as described in GJMC 28.08.070.

(c) The proprietary device(s) must provide volume control based on a drain time of no less than six hours or be a supplement to other BMPs which meet these requirements.

(d) A binding, long-term inspection/operation and maintenance plan, including monitoring and reporting, and demonstration of adequate funding for such maintenance, must be provided.

(Res. 40-08 (§ 1602.3), 3-19-08)

28.64.050 Standards for best management practices (BMPs) – Considerations in BMPs selection.

Because of unique conditions in Mesa County, there are important considerations in the selection and design of BMPs. For example:

(a) Vegetation. Vegetation for stabilization is preferred over rock or other hardscape. Native vegetation and grasses that require little water will satisfy this requirement. However, BMPs that rely on vegetation that requires more water than nature provides must include a supplemental irrigation source to maintain adequate plant growth. BMPs such as grass swales and buffers can be supplemented through potable sources and landscape irrigation systems. However, wetlands, wetland ponds, and extended detention basins also require supplemental water sources that include watershed runoff and/or larger scale, irrigation-water sources to maintain vegetation.

(b) Infiltration. Due to the nature of the soils in Mesa County, BMPs that rely specifically on infiltration into the groundwater are discouraged, since some pollutants in the soils can also be leached into the groundwater and eventually to surface waters. However, specific requirements for some BMPs, such as wet-ponds, wetlands, and filtration systems which may result in infiltration, have been modified to require a liner and collection system to minimize or prevent infiltration.

(c) Maintenance Agreement and Guarantee. All drainage and water quality facilities must be designed to facilitate maintenance (see GJMC 28.16.120, Drainage facilities maintenance) and maintenance agreements shall be entered into between a landowner and the local jurisdiction.

Additional guidance on design, site selection, maintenance and other considerations can be found in:

(1) *Urban Drainage and Flood Control District (UDFCD) 1999.* Urban Storm Drainage Criteria Manual, Volume 3 – Best Management Practices. This document is available in .pdf form at the following website:

http://www.udfcd.org/usdcm/vol3.htm.

(2) City and County of Denver 2004. *Water Quality Management Plan 2004*. This document is available in .pdf form at the following website:

http://www.denvergov.org/WMDWaterQuality/77516706template3jump.asp

See Chapter 6 Stormwater Quality BMP Implementation Guidelines, Part 4 – BMP Fact sheets.

(Res. 40-08 (§ 1602.4), 3-19-08)

28.64.060 Standards for best management practices (BMPs) – Local modifications to minimum structural BMPs.

(a) Structural BMPs which typically employ micro-pools, namely extended detention basins, may be modified to omit the micro-pool should the local jurisdiction be concerned about negative side effects. Micro-pools were initially added to the standard design for extended detention basins because:

(1) They seemed to develop whether or not they were intended; and

(2) Some data suggested pollutant removal, particularly of nutrients, would improve.

(b) However, the West Nile Virus outbreak in 2003, several outbreaks of algae growth during the drought of 2002, and the increased operation and maintenance requirements that come with micro-pools prompted many communities to forgo their use completely. Given the very dry climate of Mesa County, micro-pools may be considered an optional feature of the extended detention basin (EDB) without compromising the standard of practice for stormwater quality control.

(c) The use of a micro-pool may be considered more appropriate when the:

(1) EDB has a more reliable source of water than solely stormwater runoff;

(2) EDB serves an area greater than 160 acres; and

(3) Permanent pool can be maintained as an aesthetic feature rather than a nuisance.

(Res. 40-08 (§ 1602.5), 3-19-08)

28.64.070 Final drainage report.

A final drainage report shall be prepared which includes a narrative, calculations and drawings showing location and sizes of permanent BMPs used to control the discharge of pollutants to the MS4 system after construction. Requirements for a final drainage report are described in Chapter 28.12 GJMC, Drainage Planning Submittal Requirements.

(Res. 40-08 (§ 1603), 3-19-08)

28.64.080 Water quality capture volume.

Water quality capture volume (WQCV) requirements for structural BMPs can be determined using the following sources. For this manual, equations developed by the UDFCD were used and adjusted for the Mesa County area.

(a) Urban Drainage and Flood Control District (UDFCD) 2002. *Urban Storm Drainage Criteria Manual, Volume 3 – Best Management Practices.* This document can be obtained in .pdf form at the following website:

http://www.udfcd.org/usdcm/vol3.htm

(b) EPA 2002. *Consideration in the Design of Treatment Best Management Practices (BMP) to Improve Water Quality. EPA 600 R-03/103*. This document can be obtained in .pdf form at the following website:

http://www.epa.gov/ORD/NRMRL/pubs/600r03103/600r03103chp5.pdf

(c) Water Environment Federation (WEF) and American Society of Civil Engineers (ASCE) 1998. *Urban Runoff Quality Management*. WEF Manual No. 23, ASCE Manual No. 87.

(Res. 40-08 (§ 1604), 3-19-08)

28.64.090 Directly connected impervious area.

The procedures described in Chapter 28.24 GJMC, Rainfall, and in Chapter 28.28 GJMC, Storm Runoff, are intended for the design of drainages and flood control facilities that prevent damage to property and help protect human life. These procedures show that the depth of rainfall produced from a design storm can vary with location and that runoff is a function of total imperviousness.

Post-construction BMPs focus more on the smaller events that deliver frequent flow pulses and pollutant loads to receiving waters. The runoff volume for smaller events is especially sensitive to the impervious area that is hydraulically connected to the stormwater runoff system. The impervious portion of a watershed determines the runoff volume that needs to be used for the design of water quality facilities, and the percentage of impervious surface therefore becomes important in the design of structural BMPs.

The methodology for calculating basin imperviousness is presented in Chapter 28.28 GJMC, Storm Runoff. This procedure needs to be modified, however, when using the practice of minimizing directly connected impervious areas in combination with extended detention basins, retention ponds, wetlands, and other practices dependent on a design water quality capture volume. See UDFCD Urban Storm Drainage Criteria Manual (USDCM) Volume 3 Best Management Practices for calculation details.

(Res. 40-08 (§ 1604.1), 3-19-08)

28.64.100 Water quality capture volume.

All structural BMPs recommended in this manual are based on the eightieth percentile storm event. Specific guidance for finding the needed WQCV for each BMP type's design section can be found in the USDCM Volume 3 chapter on Structural BMP. This WQCV varies with the type of BMPs used and is based on the time it takes to fully drain the brim-full WQCV, which varies from six hours to 40 hours, depending on the BMPs. WQCV can be determined using the following relationships:

$$WQCV = K \{a(0.91*I^3 - 1.19*I^2 + 0.78*I)\}$$

Where:

WQCV is in watershed inches

K	=	Adjustment to equation for Mesa County area = $d_6/0.43$
a	=	Adjustment for BMPs drain time
I	=	Watershed imperviousness as a decimal
d_6	=	Depth of average runoff-producing storm

BMP Drain Time (hrs)	Value of "a"
6	0.7
12	0.8
24	0.9
40	1.0

The average runoff-producing storm value, d_6 = 0.28 inches, was obtained from Driscoll, et al. 1989. *Analysis of Storm Event Characteristics for Selected Rainfall Gages Throughout the United States*. The value 0.43 is for the Denver metropolitan area, for which the original WQCV equation was derived (UDFCD 1999). Therefore, K = 0.28/0.43 = 0.65, which indicates that the Mesa County area requires approximately 35 percent less WQCV than along the front range.

Determine the required storage volume in acre-feet as follows:

Required storage = [WQCV/12]* Area

Where:

Required storage = Required storage volume, in acre-feet

Area = Tributary watershed area, in acres

Required storage volume shall be based on 120 percent of calculated WQCV to allow for sediment accumulation.

The local jurisdictions recognize that some sites cannot be graded in a reasonable manner so that the entire site drains to the detention basin. If at least 95 percent of the site drains to the detention pond, then local jurisdiction may accept the design, provided the WQCV is based on 100 percent of the site draining into the detention pond.

(Res. 40-08 (§ 1604.2), 3-19-08)

28.64.110 Nonstructural BMPs – General information.

For existing and new development areas, nonstructural BMPs shall be applied where considered appropriate by the local jurisdiction based on applicable regulations or industry standards. Also, the requirement to prepare and implement permanent BMPs described in the final drainage report in accordance with good drainage policy and criteria (i.e., this manual) constitute nonstructural BMPs. Examples of nonstructural BMPs include the following controls or management of activities:

- Disposal of Household Waste and Toxics
- Pesticides, Herbicides and Fertilizer Use
- Illicit Discharge
- Spill Prevention and Response
- Preventative Maintenance
- Painting Operations
- Outside Materials Storage
- Outside Manufacturing
- Stormwater Pollution Prevention Education
- Vehicle Washing
- Above Ground Storage Tanks
- Good Housekeeping
- Loading and Unloading
- Fueling
- Exposure Minimization
- Storm Drain Stenciling

Management and control of these activities will occur over time as part of the various program requirements under the CDPS permit.

(Res. 40-08 (§ 1605.1), 3-19-08)

28.64.120 Nonstructural BMPs – Spill prevention and response.

Presented below is a list of steps to minimize spill occurrence and response measures to address spills that do occur.

(a) Develop procedures to prevent/mitigate spills to storm drain systems. Standardize reporting procedures, containment, storage, and disposal activities, documentation, and follow-up procedures.

(b) Post "No Dumping" signs with a phone number for reporting illegal dumping and disposal.

(c) Conduct routine cleaning, inspections, and maintenance.

  (1) Sweep and clean storage areas consistently at a designated frequency (e.g., weekly, monthly). Do not hose down areas to storm drains.

  (2) Place drip pans or absorbent materials beneath all mounted taps, and at all potential drip and spill locations during filling and unloading of tanks. Reuse, recycle, or properly dispose of any collected liquids or soiled absorbent materials.

  (3) Check tanks (and any containment sumps) frequently for leaks and spills. Replace tanks that are leaking, corroded, or otherwise deteriorating with tanks in good condition. Collect all spilled liquids and properly dispose of them.

  (4) Check for external corrosion of material containers, structural failures, spills and overfills due to operator error, failure of piping system, etc.

  (5) Inspect tank foundations, connections, coatings, and tank walls and piping system.

(d) Properly store and handle chemical materials.

  (1) Designate a secure material storage area that is paved with portland cement concrete, free of cracks and gaps, and impervious in order to contain leaks and spills.

  (2) Do not store chemicals, drums, or bagged materials directly on the ground. Place these items in secondary containers.

  (3) Keep chemicals in their original containers, if feasible.

  (4) Keep containers well labeled according to their contents (e.g., solvent, gasoline).

  (5) Label hazardous substances regarding the potential hazard (corrosive, radioactive, flammable, explosive, and poisonous).

  (6) Prominently display required labels on transported hazardous and toxic materials (per U.S. DOT regulations).

(e) Utilize secondary containment systems for liquid materials.

  (1) Surround storage tanks with a berm or other secondary containment system.

  (2) Slope the area inside the berm to a drain.

  (3) Drain liquids to the sanitary sewer if available. Do not discharge wash water to sanitary sewer until contacting the local authority to find out if pretreatment is required.

  (4) Pass accumulated stormwater in petroleum storage areas through an oil/water separator.

  (5) Use catch basin filtration inserts.

(f) Protect materials stored outside from stormwater. Construct a berm around the perimeter of the material storage area to prevent uncontaminated stormwater from adjacent areas from coming in contact with runoff from the stored material.

(g) Secure drums stored in an area where unauthorized persons may not gain access to prevent accidental spillage, pilferage, or any unauthorized use.

(h) Identify key spill response personnel.

(i) Adopt a hazardous materials response plan, which includes a set of planned responses to hazardous materials emergencies that include:

(1) Description of the facility, owner and address, activities and chemicals present;

(2) Facility map;

(3) Notification and evacuation procedures;

(4) Cleanup instructions;

(5) Identification of responsible departments.

(j) Clean up leaks and spills immediately.

(1) Place a stockpile of spill cleanup materials where they will be readily accessible (e.g., near storage and maintenance areas).

(2) Utilize dry cleaning methods to clean up spills to minimize the use of water. Use a rag for small spills, a damp mop for general cleanup, and absorbent material for larger spills. If the spilled material is hazardous, then used cleanup materials are also hazardous and must be sent to a certified laundry (rags) or disposed of as hazardous waste. Physical methods for the cleanup of dry chemicals include the use of brooms, shovels, sweepers, or plows.

(3) Do not hose down or bury dry material spills. Sweep up the material and dispose of properly.

(4) Clean up chemical materials with absorbents, gels, and foams. Use adsorbent materials on small spills rather than hosing down the spill. Remove and dispose the adsorbent materials promptly.

(5) For larger spills, a private spill cleanup company or hazmat team may be necessary.

(k) Reporting.

(1) Report spills that pose an immediate threat to human health or the environment to local agencies.

(2) Establish a system for tracking incidents. The system shall be designed to identify: types and quantities (in some cases) of wastes, patterns in time of occurrence (time of day/night, month, or year), mode of dumping (abandoned containers, midnight dumping from moving vehicles, direct dumping of materials, accidents/spills), and responsible parties.

(l) Training. Educate employees about spill prevention and cleanup.

(1) Establish training that provides employees with the proper tools and knowledge to immediately begin cleaning up a spill.

(2) Educate employees on aboveground storage tank requirements.

(3) Train all employees upon hiring and on an annual basis.

(4) Train employees responsible for aboveground storage tanks and liquid transfers on adopted spill plan.

(m) Stencil Storm Drains. Storm drain system signs act as highly visible source controls that are typically stenciled directly adjacent to storm drain inlets. Stencils shall read "No Dumping: Drains to River."

(Res. 40-08 (§ 1605.2), 3-19-08)

28.64.130 Inspection and enforcement.

(a) Mesa County. Post-construction BMPs shall be inspected by the engineer of record during construction, and record drawings of completed drainage facilities shall be submitted to the County along with certification that the facilities were constructed in accordance with approved plans (see GJMC 28.12.120, Record drawings and acceptance). The County will audit a portion of the record drawings to verify completeness.

Maintenance of all drainage facilities shall be performed by the owner, in accordance with GJMC 28.16.120, Drainage facilities maintenance, and required by maintenance agreement, GJMC 28.64.050(c). The County requires that all facilities be inspected annually by a qualified erosion control specialist to verify maintenance activities and that inspection reports be provided to the County, who will audit 10 percent of all inspections. The County will provide necessary forms for inspection. Failure to properly maintain drainage facilities may result in enforcement actions, in accordance with the Land Development Code.

(b) City of Grand Junction. Inspection and enforcement of permanent BMPs will be performed in accordance with the stormwater pollution prevention ordinance, Chapter 13.28 GJMC.

(1) Structural BMPs located on property shall be owned, operated, inspected and maintained by the owner(s) of the property and those persons responsible for the property on which the BMPs are located. The legal responsibility to maintain the BMPs shall be included in property owners' association (POA) declarations, incorporation articles, bylaws and/or development agreements for commercial sites. As a condition of approval of the BMPs, the owner and those persons responsible for the property shall also agree to maintain the BMPs to their design capacity unless or until the City shall relieve the property owner of that responsibility in writing. Drainage easements for inspection, installation, operation, repair and maintenance along with easements required to access and inspect the BMP(s) and to perform routine maintenance as necessary to ensure proper functioning of the stormwater BMPs shall be dedicated to the City. The building of any structures on such easements is prohibited. Any agreement arising out of or under Chapter 13.28 GJMC may be recorded as directed by the City Manager in the office of the Grand Junction City Clerk and/or the Mesa County land records.

(2) The City may issue annual notices to POAs as well as to commercial and industrial sites to ensure inspections and maintenance of permanent BMPs are performed properly.

(c) Other Municipalities. Contact the City of Fruita, the Town of Palisade, and the Grand Junction Drainage District to determine inspection and enforcement requirements.

(Res. 40-08 (§ 1606), 3-19-08)

28.64.140 BMPs for industrial and commercial activities.

This section contains guidance for BMPs that control illicit discharges from industrial and commercial activities that come in contact with precipitation and result in contaminated stormwater discharges to the MS4. Owners of industrial or commercial activities that may come in contact with precipitation shall prepare a stormwater management plan (SWMP) approved by the local jurisdiction and implement best management practices, as described herein. Owners shall also be required to obtain a discharge permit from the Industrial Permits Unit of the CDPHE prior to receiving plan approval.

(Res. 40-08 (§ 1607), 3-19-08)

28.64.150 Industrial and commercial activities.

(a) Federal regulations define an illicit discharge as "...any discharge to an MS4 that is not composed entirely of stormwater..." with some exceptions. These exceptions include discharges from CDPS-permitted industrial sources and discharges from fire-fighting activities and certain municipal activities. Illicit discharges are considered illicit because MS4s are not designed, or allowed by law, to accept, process, or discharge such nonstormwater wastes.

(b) Typical illicit stormwater discharges may contain fuel, oil, solvents, degreasing agents, waste automotive fluids, acids, lubricants, caustic fluids, paint, paint thinners and solvents, dust from sanding and grinding, sand blasting residue, metal and wood shavings, industrial chemicals, herbicides, lawn products, hazardous wastes, sediment, dirt, toxic substances, trash and other pollutants. Example commercial and industrial activities where these illicit discharges may occur, if allowed to come in contact with precipitation, include:

(1) Manufacturing.

(2) Material handling, including loading and unloading.

(3) Vehicle and equipment maintenance, storage, parking, and washing.

(4) Waste containment.

(5) Painting.

(6) Material and product storage.

(7) Fueling areas.

(Res. 40-08 (§ 1607.1), 3-19-08)

28.64.160 Best management practices.

BMPs to control illicit discharges from commercial and industrial activities can be grouped into source controls and treatment practices. Source controls are measures that prevent an illicit discharge from occurring (i.e., spill prevention), while treatment practices remove pollutants from stormwater prior to leaving the site, which is the classical definition of structural practices.

(a) Source Controls. Source controls include:

(1) Prevention. Practices that eliminate or reduce the amount and the chance of pollutants being generated on the site. This category includes good housekeeping practices, such as employee training, signage, and labeling.

(2) Exposure Minimization. Practices that eliminate or minimize the chances of stormwater runoff coming in contact with pollutants. Simply covering the activity greatly reduces, if not eliminates the possibility of an illicit discharge.

Source control BMPs for industrial and commercial activities are listed on **Figure 28.64.160(a)**. This information can be found at the following webpage:

http://www.pweng.slco.org/pdf/imatrix.pdf

Then by clicking on the source control BMPs, a one-page fact sheet can be obtained which describes the application, the criteria, limitations, and targeted pollutants.

For additional information regarding industrial stormwater discharges, refer to UDFCD Urban Drainage Criteria Manual, Volume 3 Best Management Practices (USDCM). This document is available in .pdf form at:

http://www.udfcd.org/usdcm/vol3.htm

(b) Treatment Practices. Treatment practices involve cleaning up or recovering a substance after it has been released or spilled, which is the last line of defense after the pollutant has been released on site. Treatment practices are considered a last resort and shall be used only when source control options are not practical. GJMC 28.64.020 through 28.64.060, standards for best management practices, describe the preferred treatment options.

For small sites where oil spills are probable, such as parking lots, industrial yards, etc., a treatment device referred to as an oil/water separator may be required. General information on oil/water separators can be found at the following:

http://www.pweng.slco.org/pdf/imatrix.pdf

then click on "OWS" in the "Treatment Control BMPs to Consider" table.

Where oil/water separators are being considered, the following limitations are recommended:

(1) The tributary area must be small (i.e., less than one acre) and essentially 100 percent impervious.

(2) The site grading and drainage must be designed to minimize the area to the maximum extent practicable.

(3) Oil/water separators shall precede all other stormwater treatment BMPs and be located off-line from the stormwater conveyance or detention system.

(4) Oil/water separators shall be either the coalescing plate/media type, filter-type, or other type system with the following sizing requirements:

(i) Peak flow rate is based on the mean storm intensity of 0.044 inches per hour with provisions for diversion of larger storm events.

(ii) Include a forebay to collect floatable and larger settleable solids with a surface area of not less than 20 square feet per 10,000 square feet of tributary area.

(iii) Remove droplets 90 microns and larger with a rise-rate of 0.033 feet per minute. Limited data from petroleum-storage-terminal discharges suggest that 80 percent of droplets are greater than 90 microns.

(iv) If coalescing plates are used, they shall be separated by no less than three-quarters inches and be angled from 45 to 60 degrees from the horizontal.

(5) Provide access to all chambers for monitoring and maintenance.

(6) Requires a formal operations and maintenance agreement between the local jurisdiction and the property owner be in force.

Two examples of proprietary products that can separate oil and water are shown on **Figures 28.64.160(b) and 28.64.160(c)**. Reference to any proprietary product does not imply endorsement of the product by the local jurisdictions, but is meant to demonstrate that different products are available. **Figure 28.64.160(b)** shows an example of a precast concrete vault which includes a coalescing media. The media attracts oil droplets and increases the oil droplet size allowing more oil to rise to the surface than a system that relies on gravity alone. **Figures 28.64.160(c)** shows an example of a system that relies on the filtering mechanism to remove oil droplets. Both systems also capture coarse sediment, floatables and trash.

STORMWATER MANAGEMENT MANUAL

Source Control BMPs to Consider		BMP Criteria							
Abbreviation	Title	Manufacturing	Material Handling	Vehicle Maintenance	Construction	Commercial Activity	Roadways	Waste Containment	Housekeeping Practices
ACP	Area Control Procedures	X				X			X
ATL	Aboveground Tank Leak and Spill Control	X	X			X	X	X	
BGM	Buildings and Grounds Maintenance					X	X		X
BRRC	Building Repair, Remodeling and Construction				X	X			X
CD	Containment Dikes	X						X	
CESA	Contaminated or Erodible Surface Areas	X			X		X		
CO	Covering	X	X	X	X	X		X	X
CU	Curbing		X		X	X		X	X
DCUS	De-Icing Chemical Use and Storage	X	X				X	X	X
DP	Drip Pans	X						X	
ET	Employee Training	X	X	X	X	X	X	X	X
HWM	Hazardous Waste Management	X	X	X	X			X	X
NSWD	Non-Storm Water Discharges to Drains			X		X		X	X
OCSL	Outdoor Container Storage of Liquids		X		X	X		X	X
OLUM	Outdoor Loading/Unloading of Materials	X	X		X	X			X
OPE	Outdoor Process Equipment Operations	X		X	X	X			X
OSRM	Outdoor Storage of Raw Materials	X	X		X	X			X
SL	Signs and Labels					X			X
VEC	Vehicle and Equipment Cleaning			X	X	X			X
VEF	Vehicle and Equipment Fueling		X	X	X	X			X
VEMR	Vehicle and Equipment Maintenance & Repair		X	X	X	X			X
WHD	Waste Handling and Disposal		X		X	X		X	X

Note:
Go to the following internet link: http://www.pweng.slco.org/pdf/imatrix.pdf.
Then by clicking on the source control BMP, a one-page fact sheet can be obtained which describes the application, the criteria, limitations, and targeted pollutants.

Revision	Date
ORIGINAL ISSUE	3/27/06
CORRECTED TITLE	12/6/07

WRC ENGINEERING INC.

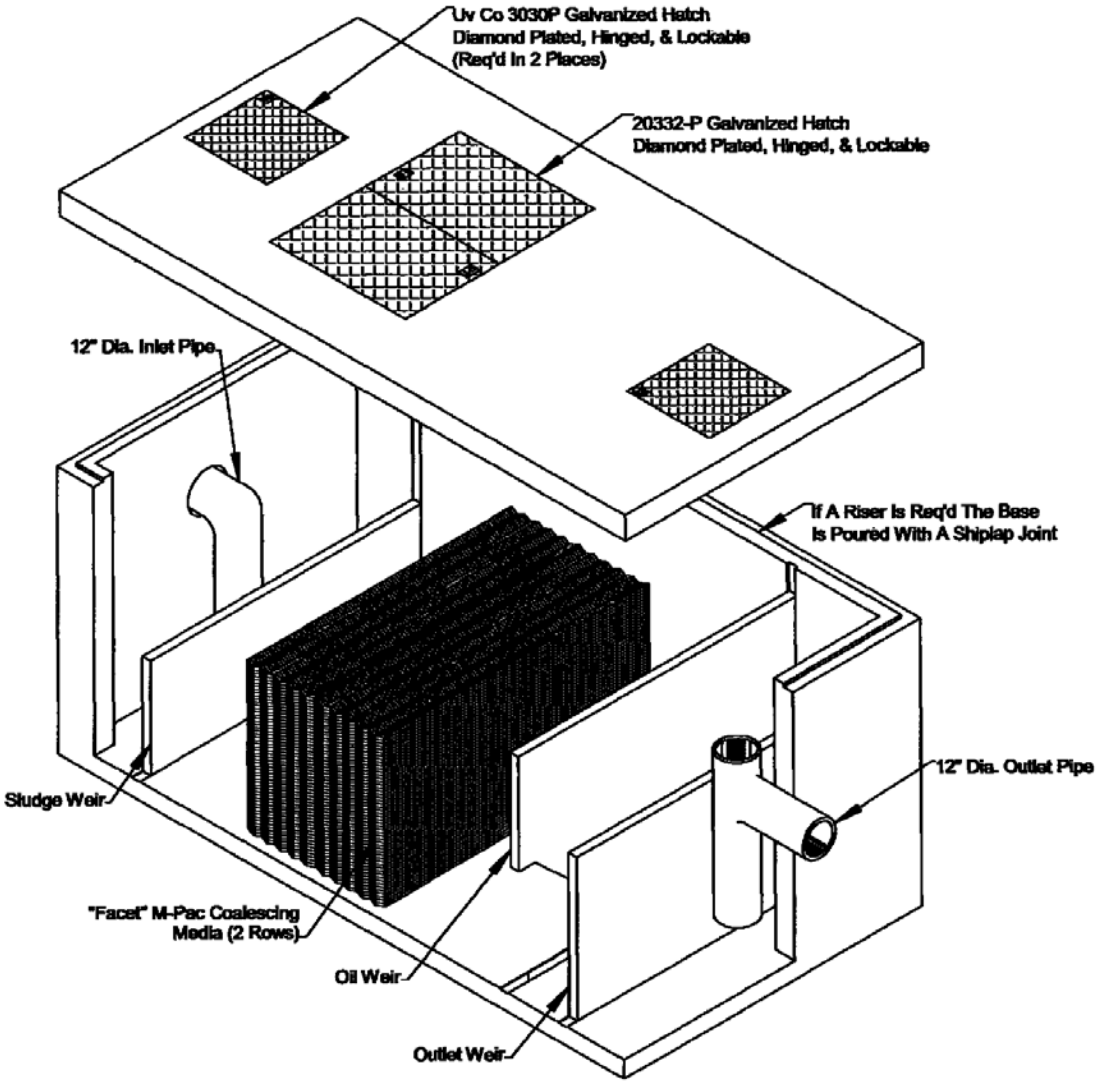
REFERENCE: *SALT LAKE COUNTY 1999. STORMWATER DISCHARGE MANAGEMENT FROM INDUSTRIAL ACTIVITIES*

FIGURE 28.64.160(a)

STORMWATER MANAGEMENT MANUAL

OIL/WATER SEPARATOR - COALESCING MEDIA

(Note: Reference to any proprietary product does not imply endorsement by the County or other local jurisdiction)



Revision	Date
ORIGINAL ISSUE	3/27/06

WRC ENGINEERING, INC.

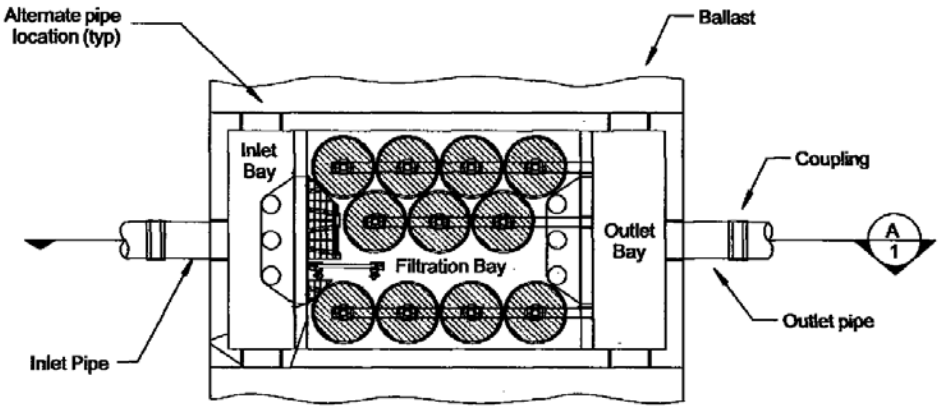
REFERENCE: OLDCASTLE PRECAST, AMCOR PRECAST DIVISION APRIL 2001. WWW.OLDCASTLE.COM

FIGURE 28.64.160(b)

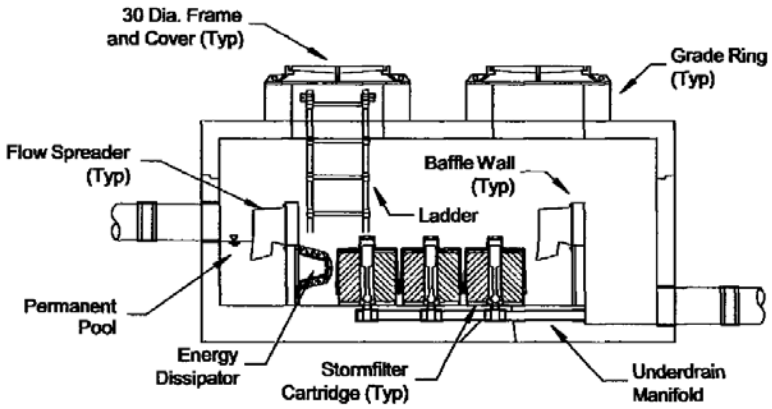
STORMWATER MANAGEMENT MANUAL

OIL/WATER SEPARATOR - FILTER MEDIA

(Note: Reference to any proprietary product does not imply endorsement by the County or other local jurisdiction)



6' x 12' STORMFILTER - PLAN VIEW 1/1



6' x 12' STORMFILTER - SECTION VIEW A/1

THE STORMWATER MANAGEMENT StormFilter® U.S. PATENT No. 5,322,629, No. 5,707,527, No. 6,027,639 No. 6,649,048, No. 5,624,576, AND OTHER U.S. AND FOREIGN PATENTS PENDING

©2005 Stormwater360

Revision	Date
ORIGINAL ISSUE	3/27/06

WRC ENGINEERING, INC.

REFERENCE: THE STORMWATER MANAGEMENT, STORMFILTER 2005 STORMWATER 360, WWW.STORMWATER360.COM

FIGURE 28.64.160(c)

(Res. 40-08 (§ 1607.2), 3-19-08)

Chapter 28.68

STANDARD FORMS

Sections:

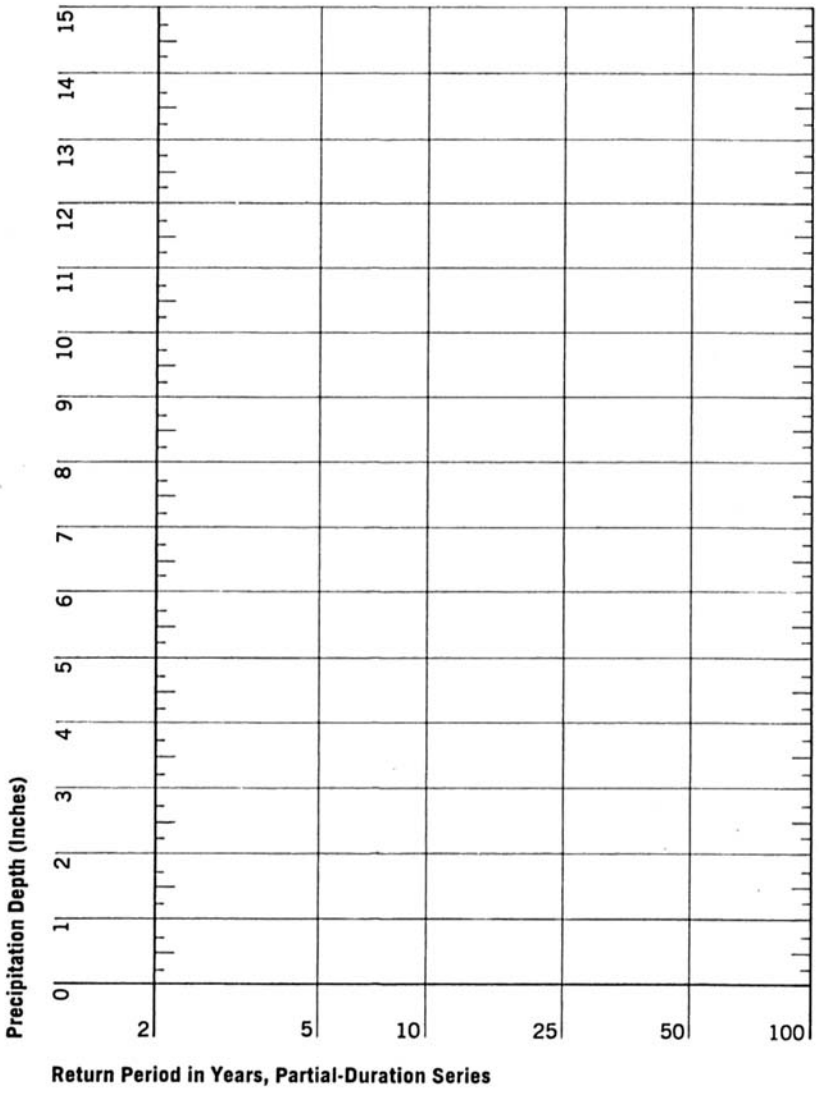
28.68.010 Hydrologic and hydraulic design forms.
28.68.020 Stormwater permit applications and report forms.

28.68.010 Hydrologic and hydraulic design forms.

(a) Standard Form 1 – Precipitation Depth vs. Return Period.

STORMWATER MANAGEMENT MANUAL

PRECIPITATION DEPTH VS. RETURN PERIOD



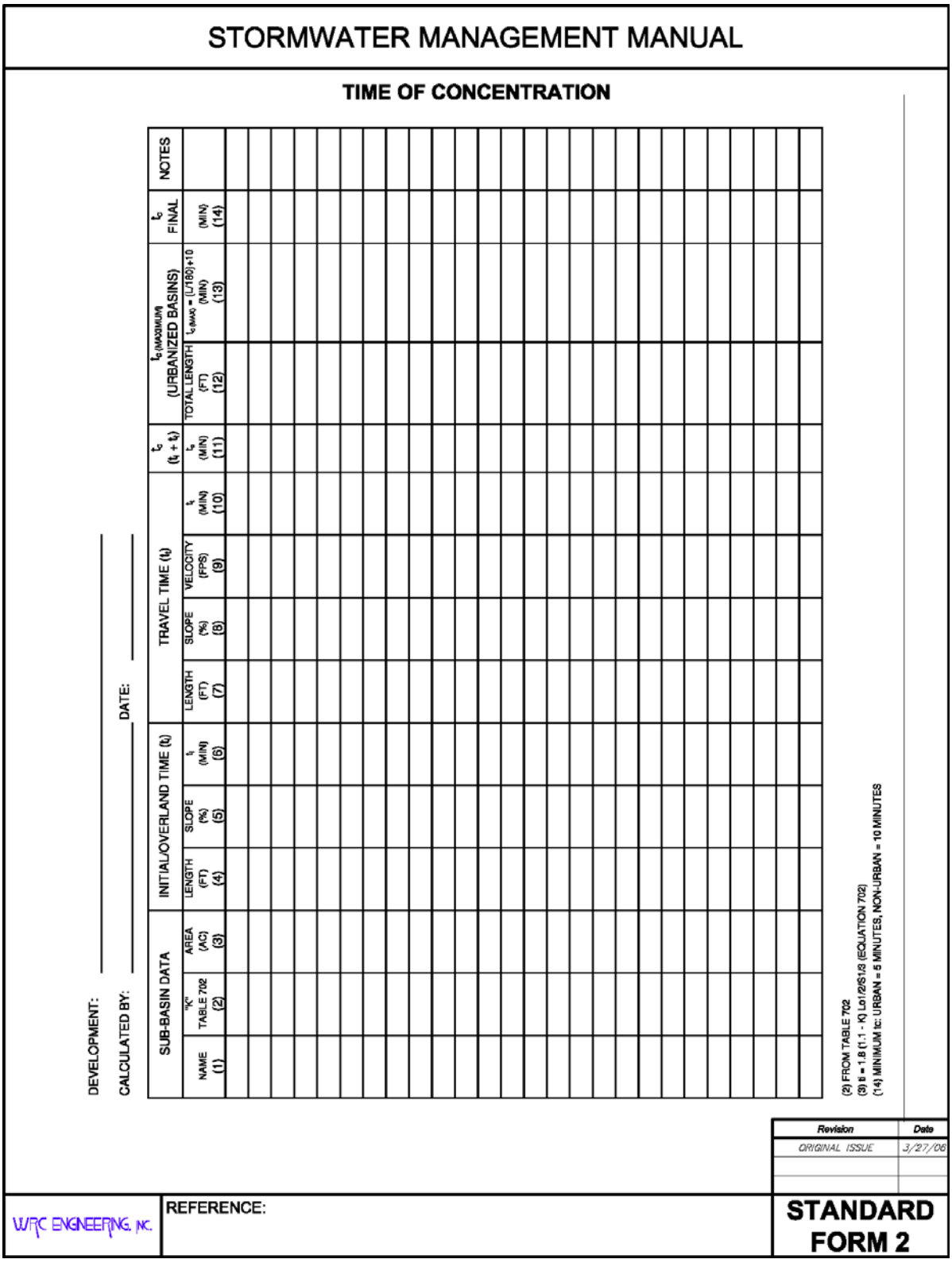
Revision	Date
ORIGINAL ISSUE	3/27/06

WRC ENGINEERING, INC.

REFERENCE: NOAA ATLAS 2, VOLUME III COLORADO, 1973

STANDARD FORM 1

(b) Standard Form 2 – Time of Concentration.



STORMWATER MANAGEMENT MANUAL

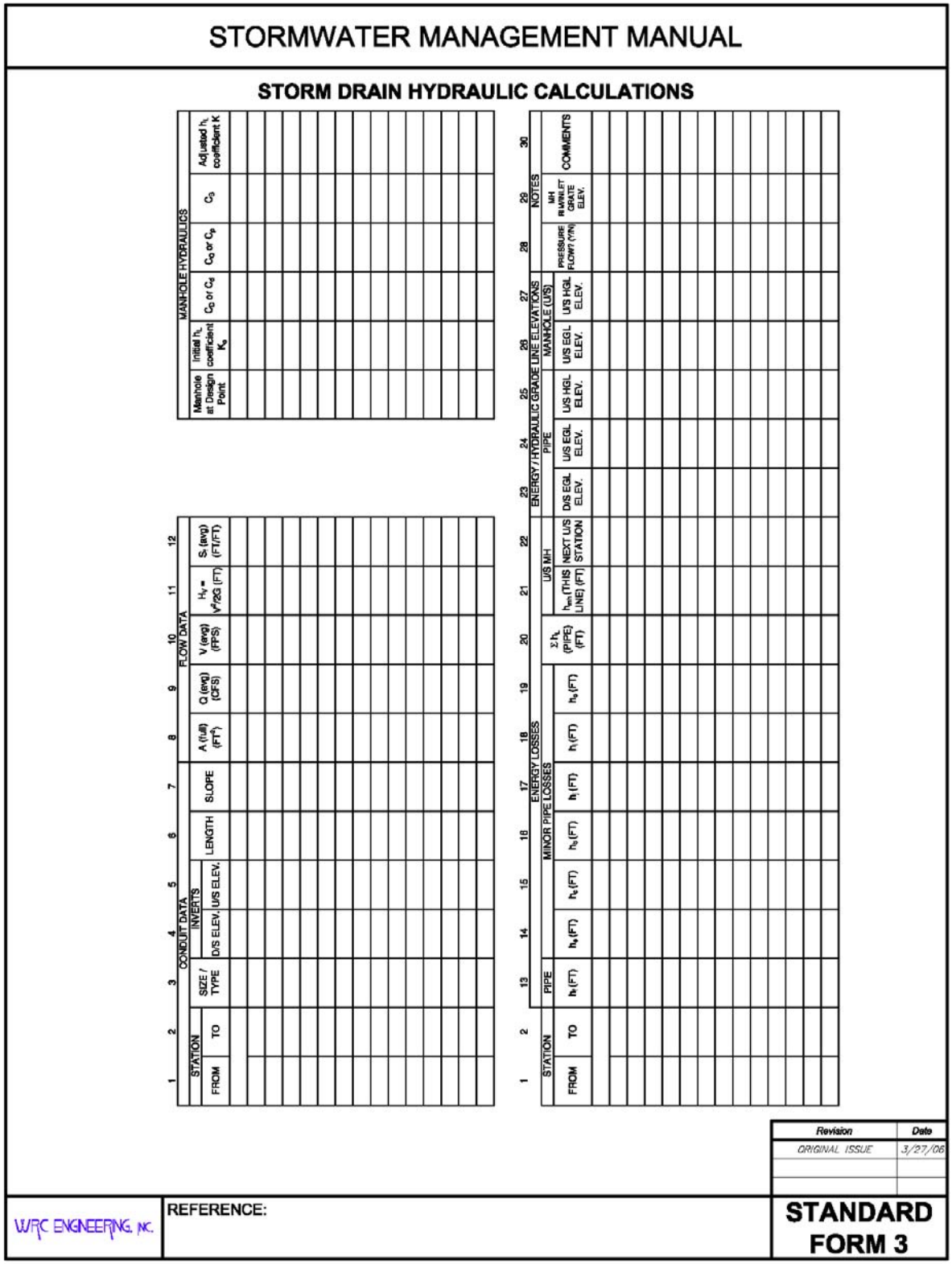
TIME OF CONCENTRATION

DEVELOPMENT: _____

CALCULATED BY: _____ DATE: _____

SUB-BASIN DATA			INITIAL/OVERLAND TIME (t_i)			TRAVEL TIME (t_t)					t_c (t_i + t_t)	$t_{c\,(MAXIMUM)}$ (URBANIZED BASINS)		t_c FINAL	NOTES
NAME (1)	"K" TABLE 702 (2)	AREA (AC) (3)	LENGTH (FT) (4)	SLOPE (%) (5)	t_i (MIN) (6)	LENGTH (FT) (7)	SLOPE (%) (8)	VELOCITY (FPS) (9)	t_t (MIN) (10)	t_c (MIN) (11)	TOTAL LENGTH (FT) (12)	t_c = (L/180)+10 (MIN) (13)	(MIN) (14)	

(c) Standard Form 3 – Storm Drain Hydraulic Calculations.



STORMWATER MANAGEMENT MANUAL

STORM DRAIN HYDRAULIC CALCULATIONS

MANHOLE HYDRAULICS					
Manhole at Design Point	Initial h_L coefficient K_o	C_D or C_d	C_D or C_p	C_b	Adjusted h_L coefficient K

1	2	3	4	5	6	7	8	9	10	11	12
CONDUIT DATA							FLOW DATA				
STATION		SIZE / TYPE	INVERTS		LENGTH	S.LOPE	A (full) (FT^2)	Q (avg) (CFS)	V (avg) (FPS)	$H_V = V^2/2G$ (FT)	S_o (avg) (FT/FT)
FROM	TO		D/S ELEV.	U/S ELEV.							

1	2	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
STATION		PIPE	MINOR PIPE LOSSES			ENERGY LOSSES				U/S MH		ENERGY / HYDRAULIC GRADE LINE ELEVATIONS						NOTES	
												PIPE		MANHOLE (U/S)					
FROM	TO	h_f (FT)	h_e (FT)	h_c (FT)	h_o (FT)	h_i (FT)	h_f (FT)	h_L (FT)	Σh_L (PIPE) (FT)	h_{MH} (THIS LINE) (FT)	NEXT U/S STATION	D/S EGL ELEV.	U/S EGL ELEV.	U/S HGL ELEV.	U/S EGL ELEV.	U/S HGL ELEV.	PRESSURE FLOW? (Y/N)	MH RIM/INLET GRATE ELEV.	COMMENTS

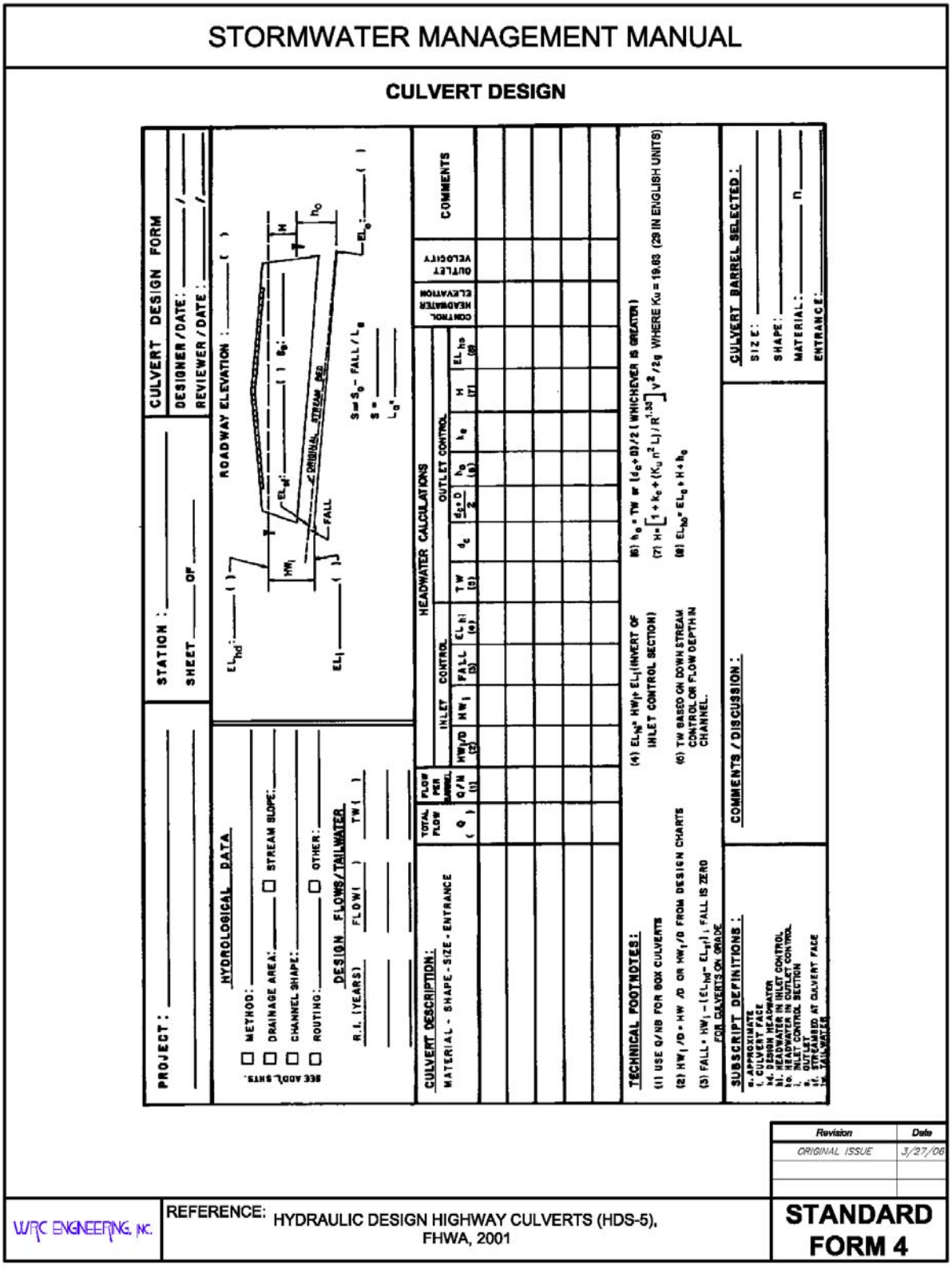
Revision	Date
ORIGINAL ISSUE	3/27/06

WRC ENGINEERING, INC.

REFERENCE:

STANDARD FORM 3

(d) Standard Form 4 – Culvert Design.



(Res. 40-08 (§ 1700), 3-19-08)

28.68.020 Stormwater permit applications and report forms.

(a) Mesa County Engineering Division Stormwater Construction Permit.

Permit No. _____

Mesa County
Engineering Division
Stormwater Construction Permit

Please print or type. All items must be completed accurately and in their entirety or the application will be deemed incomplete and the application returned. Processing of the application will not begin until all information is received. **Review of a complete permit application will be completed within twenty calendar days.** Original signature for Part 7 is required.

A Stormwater Construction Permit is required, within the urbanized area, for all land disturbance activities equal to or greater than 1 one (1) acre or for land disturbance activities less than one (1) acre that are part of a larger common plan of development or sale that would disturb one (1) acre or more.

1. Name and address of the Permittee:

Property Owner: _____
Mailing Address: _____
City, State and Zip Code: _____
Phone Number ( ) _____
Legally Responsible Person (application signer) E-mail Address: _____

Project Site Contact (familiar with facility): _____
Title _____ Phone Number ( )_____
Site Contact E-mail Address: _____

2. List, in addition to the permittee, any site personnel along with their contact information, who will have the authority to make modifications to the Construction Stormwater Management Plan.

Name: _____Phone Number ( )_____
Name: _____Phone Number ( )_____
Name: _____Phone Number ( )_____
Name: _____Phone Number ( )_____

3. Location of the project site:

Street Address (or cross streets): _____
Name of plan, project, or development: _____
Current Mesa County Assessor's Tax parcel number: _____

4. Area of the project site:

Total area of project site (acres):_____
Area of project site to undergo disturbance (acres):_____
Total disturbed area of Larger Common Plan of Development or Sale, if applicable (i.e., total including all phases, filings, lots, and infrastructure not covered by this application.): _____

Last edited 2/12/2007

Permit No. _____

5. Nature of the construction activities:

Check the appropriate box(es) or provide a brief description that indicates the general nature of the construction activities. (The full description of activities must be included in the Stormwater Management Plan.)

☐Single Family Residential Development
☐Multi-Family Residential Development
☐Commercial Development
☐Highway/Road Development (not including roadways associated with commercial or residential development)
☐Utility
☐Other Describe: _____

_____

6. Anticipated construction schedule:

Construction Start Date: _____/____/_____ Final Stabilization Date: ____/____/_____
month day year month day year

7. Acknowledgement Certificate:

By signing below, the Permittee hereby applies for a Mesa County Stormwater Construction Permit for the aforementioned property and certifies as follows:

a) To the best of my knowledge, the information provided herein is correct; and is consistent with the development plans approved by the planning and/or building departments.
b) A Construction Stormwater Management Plan for the disturbed area on the project site was prepared and submitted in accordance with the Stormwater Management Manual (SWMM) and the applicable Mesa County Land Development Code.
c) I certify that I am legally authorized to sign on behalf of and bind the above-listed entity.

The Stormwater Construction Permit is granted with the explicit understanding that it is the Permittee's responsibility to:

a) Comply with all requirements of the SWMM and applicable Mesa County Land Development Code.
b) Allow Mesa County or it's designee reasonable access to the project site to conduct regular site inspections.
c) Immediately cease land-disturbing and all other construction activities upon receipt of a written Stop Work Order from an authorized representative of Mesa County.
d) Comply with any and all directives of Mesa County contained in any Notice of Violation pertaining to the project site issued to the Permittee by Mesa County.

Last edited 2/12/2007

Permit No. _____

By signing below the Permittee agrees as follows:

a) If the Construction Stormwater Management Plan is submitted lacking the required information outlined in the SWMM, the Construction Stormwater Management Plan will be returned to the Permittee for revisions.
b) If the Permittee becomes insolvent or declares bankruptcy, such that the requirements of this Permit are not being met, Mesa County may perform any and all necessary corrective actions, at the sole and absolute discretion of Mesa County, to provide sufficient remedies to correct project site deficiencies.
c) Mesa County may issue a Stop Work Order and/or a Notice of Violation and/or may revoke this Permit or pursue any other legal remedies available if Mesa County determines the Permittee is not in compliance with the SWMM, Stormwater Construction Permit, and applicable Mesa County Land Development Code, or the Permittee fails to take all corrective action requested within the time specified on any Stop Work Order or Notice of Violation issued to the Permitte by Mesa County.
d) That in addition to other remedies, a violation of the Permit shall constitute a violation of the Land Development Code; and
e) Any approval obtained from Mesa County does not absolve the need to comply with requirements of Sections 7 and 9 of the Endangered Species Act of 1973, 16 U.S.C. 11531, et seq., as amended, or with any other applicable federal, state, or local laws or regulations.

_____

Signature of Legally Responsible Person (submission must include original signature) Date Signed

_____

Name (printed) Title

7. Approval

Mesa County Approval:_____

Date: _____

Last edited 2/12/2007

Permit No. _____

Instructions

1. **Name and address of the Permittee:** The Permittee must be the current property owner of the project. An authorized agent may submit a permit application if, the agent is legally authorized to sign on behalf of and bind the Permittee. A project site contact is necessary to provide Mesa County a person to contact on the site in regards to inspections and compliance issues.
2. The Construction Stormwater Management Plan is a working document and field changes are expected. List the names of site personnel along with their contact information, who will have the authority to make modifications to the Construction Stormwater Management Plan.
3. **Location of Project Site:** Indicate the street address or cross streets, if a street address is not available, name of plan, project, or development, and current Mesa County Assessor's Tax Parcel number.
4. **Area of Project Site:** Indicate the total area of the project site in acres, and the area of project site to undergo disturbance. Disturbance includes any activity that disturbs the soil on the site, including: grading, clearing, excavation activities, areas receiving overburden (e.g. stockpiles), demolition areas, and areas with equipment/vehicle traffic and storage that disturb vegetative cover.
5. **Nature of Construction Activities:** Either check the appropriate box or boxes, or if the given descriptions do not fit the project, provide a brief description that indicates the general nature of the construction activities for which permit coverage is being requested. A more detailed description of the project must be included in the Construction Stormwater Management Plan.
6. **Anticipated Construction Schedule:** Provide the current estimated start and final stabilization dates for the construction project as follows:
   a) Construction Start Date - This is the day you expect to begin disturbing soils, including grubbing, stockpiling, excavating, demolition, and grading activities.
   b) Final Stabilization Date - in terms of permit coverage, this is when the site is finally stabilized. This means that all disturbed areas have been either built on, paved, or a uniform vegetative cover has been established. **Permit coverage must be maintained until that time.** Even if the Permittee is only doing one part of the project, the estimated completion date must be for the overall project. If permit coverage is still required once the Permittee's part is completed, the permit certification may be transferred or reassigned to a new responsible entity(s).
7. Acknowledgement Certificate: The Permittee must be the property owner of the project site. The application must be signed by the Permittee to be considered complete. In all cases, it shall be signed as follows:
   a) In the case of corporations, by a principal executive officer of at least the level of vice-president or his or her duly authorized

Last edited 2/12/2007

Permit No. _____

representative, if such representative is responsible for the overall operation of the facility from which the discharge described in the application originates.

b) In the case of a partnership, by a general partner.
c) In the case of a sole proprietorship, by the proprietor.
d) In the case of a municipal, state, or other public facility, by either a principal executive officer, ranking elected official, or other duly authorized employee.

Last edited 2/12/2007

(b) Mesa County Stormwater Construction Permit Field Inspection Report.

DRAFT MESA COUNTY STORMWATER CONSTRUCTION PERMIT FIELD INSPECTION REPORT

(1) Date of Inspection

(2) Property Owner

(3) Site Contact Name (print)

(4) Inspector Name (print)

(5) Project Name

(6) Permit No.

(7) Reason for Inspection :

- ❑ Required Maximum 14 Calendar Day Inspection
- ❑ Required 30 Calendar Day Inspection for Completed Projects
- ❑ Required Storm Event Inspection
- ❑ Complaint:_____
- ❑ Other:_____

(8) CONSTRUCTION SITE ASSESSMENT

- ❑ Construction site perimeter contained. Offsite tracking minimized.
- ❑ Disturbed areas contained.
- ❑ Estimate disturbed area at the time of the inspection. _____ Acres
- ❑ Areas used for material and waste storage and fueling contained.

(9) CSWMP MANAGEMENT

- ❑ Does site have current CSWMP Yes / No
- ❑ Changes noted & dated on the plans? Yes / No
- ❑ Contents of CSWMP:
  - ❑ Site Description Yes / No
  - ❑ Site Map Yes / No
  - ❑ Description of BMPs during construction activities Yes / No
  - ❑ Materials Handling & Spill Prevention Yes / No
- ❑ Contents of CSWMP (Cont.)
  - ❑ Final Stabilization Yes / No
  - ❑ Other Controls Yes / No
  - ❑ Inspection & Maintenance Yes / No
  - ❑ Certification Yes / No

BEST MANAGEMENT PRACTICES (BMPS)

(10) BMP Type	(11) Practice Req/Used		(12) Reason	(13) Maintenance/ Sediment Removal Required Y/N	(14) Course of Action	(15) Date for Action to be Completed
EROSION CONTROL						
Seeding						
Mulching						
Blankets						
Check Dams						
Earth Berms						
Diversion						
Embankment Protector						
Outlet Protection						
Surface Roughening						
Other:						
Other:						

PAGE 1 OF 4

(10) BMP Type	(11) Practice Req/Used		(12) Reason	(13) Maintenance/ Sediment Removal Required Y/N	(14) Course of Action	(15) Date for Action to be Completed
SEDIMENT CONTROL						
Inlet Protection						
Erosion Bales						
Silt Fence						
Sediment Trap/Basin						
Stabilized Construction Entrance						
Dewatering Structure						
Other:						
MATERIALS HANDLING AND SPILL PREVENTION, WASTE MANAGEMENT AND GENERAL POLLUTION PREVENTION						
Stockpile Management						
Materials Delivery and Storage						
Spill Prevention and Control						
Concrete Washout						
Concrete Saw Water Containment						
Solid Waste						
Sanitary Waste						
Maintenance and Fueling						
Street Sweeping Vacuuming						
Other:						
Other:						

Comments:

(16) **INSPECTIONS AND MAINTENANCE PROGRAM**	
❑ Inspection occurring at least every 14 calendar days.	Course of Action:
❑ Inspections occurring after storm events that result in runoff.	Course of Action:
❑ Inspections occurring at least every 30 calendar days since project completion.	Course of Action:
❑ Inspection reports retained at the construction project site.	Course of Action:
❑ Corrective measures completed within 7 calendar days of inspection.	Course of Action:
CERTIFICATION **I certify this Stormwater Construction Permit Field Inspection Report is complete and accurate.**	
Inspector Signature	Date

Stormwater Management Plan Field Inspection Report
Instructions

1. **Date of Inspection:** Indicate the date the inspection was completed on.
2. **Property Owner:** Indicate the name of the property owner.
3. **Site Contact:** Indicate the main contact for the site.
4. **Inspector Name**: Indicate the name of the Inspector completing the inspection.
5. **Project Name**: Indicate the name of the project for which the report is being completed.
6. **Permit No.**: Indicate the permit number issued with the approval of the permit.
7. **Reason for Inspection**: Indicate the purpose for the inspection. The types of inspections include the following:
   - "Required 14 Calendar Day Inspection". These inspections are required at least every 14 calendar days during the life of the construction project.
   - "Required 30 Day Inspection for Completed Projects". These inspections are required at least every 30 calendar days following the completion of the construction project where final stabilization has not been achieved.
   - "Required Storm Event Inspection". These inspections are required after a storm event that results in runoff.
   - Inspection as a response to a complaint.
   - Inspection for any other reason.

   The first three types of inspections are required to comply with Mesa County Construction Stormwater Permit and the Colorado Discharge Permit System General Permit for Stormwater Discharges Associated with Construction Activity (CDPS General Permit).
8. **Construction Site Assessment**: Inspect the noted areas of the construction site and indicate with a "✓" the items which apply.
   - "Construction site perimeter contained". Are the appropriate BMPs in place and offsite sediment tracking minimized? Is there any evidence of pollutants entering a storm drainage system?
   - "Disturbed areas contained". Are the appropriate BMPs implemented to minimize erosion or sediment tracking from the disturbed areas? Is there any evidence of pollutants entering a storm drainage system? Provide an estimate of the disturbed area at the time of the inspection.
   - "Areas used for material and waste storage and fueling contained". Are the appropriate BMPs implemented to prevent and contain spills? Are wastes removed from the site and disposed of properly? Are the storage areas located at least 50 feet from a watercourse? Is there any evidence of pollutants entering a storm drainage system?
9. **CSWMP Management**:
   - Indicate if the Construction site has a current and update CSWMP, by circling yes or no.
   - Indicate if the required contents of the CSWMP are included, by circling yes or no on each line.
   - Indicate whether changes have been made to the CSWMP during construction and whether the changes have been documented and dated.
10. **BMP**: The BMPs shown may not be a complete list of what is required by the CSWMP. Cross out the BMPs not required by the CSWMP and add the BMPs that are required. Additional sheets can be inserted to show all the BMPs required by the CSWMP.
11. **Practice Req/Used**: This column can be used as follows:
    - If the BMP is required by the CSWMP and implemented, indicate by placing a "✓ " in both the "Req" and "Used" columns.
    - If the BMP is required by the CSWMP, but not implemented, indicate by placing a "✓ " in the "Req" column. Indicate the reason for the change in column (14), "Reason".
    - If the BMP has been added to the CSWMP, indicate with a "✓ " in the "Used " column. Indicate the reason for the change in column (14), "Reason".
12. **Reason**: Indicate the reason(s) for the deletion, addition, and modification of BMP(s) to the SWMP.
13. **Maintenance/Sediment Removal Required**: Indicate whether maintenance and sediment removal are required with a Yes or No. If maintenance and sediment removal are required, indicate what the action plan is in column (15), "Course of Action".
14. **Course of Action**: If maintenance and/or sediment removal is required, describe the action plan.
15. **Date for Action to be Completed**: Indicate the date for which the course of action will be completed. The course of action must be completed in a timely manner, but in no case more than 7 days after the inspection.
16. **Inspections and Maintenance**: Evaluate the inspection and maintenance aspect of the construction project and check all that applies with an " ✓". To comply with Mesa County Construction Stormwater Permit and the CDPS General Permit, all of the items identified must be adhered to.

(c) Mesa County Post-Construction Stormwater Controls and Best Management Practices Operations and Maintenance Agreement.

MESA COUNTY
POST-CONSTRUCTION STORMWATER CONTROLS AND
BEST MANAGEMENT PRACTICES
OPERATIONS AND MAINTENANCE AGREEMENT

THIS AGREEMENT, made and entered into this _____ day of _____, 200__, by and between _____, (hereinafter the "Landowner"), and Mesa County, Colorado (hereinafter "County");
WITNESSETH

RECITALS

The Landowner is the owner of certain real property described by a recorded deed in the land records of Mesa County, Colorado, Deed Book_____ at Page _____, the "Property";

The Landowner is developing the Property;

The County, and the Landowner, his successors and assigns, agree that the health, safety, and welfare of the residents of the County and the protection and maintenance of water quality require that on-site stormwater Best Management Practices be constructed and maintained on the Property.

For the purposes of this agreement, the following definition shall apply:

BMP – "Best Management Practice;" activities, facilities, designs, measures or procedures used to manage stormwater impacts from land development, to protect and maintain water quality and groundwater recharge and to otherwise meet the purposes of the Municipal Stormwater Pollution Prevention Ordinance, including but not limited to infiltration trenches, seepage pits, filter strips, bioretention, wet ponds, permeable paving, grassed swales, forested buffers, sand filters and detention basins.

State of Colorado BMP definition: schedules of activities, prohibitions of practices, maintenance procedures, and other management practices to prevent or reduce pollution of waters of the State. BMPs also include treatment requirements, operating procedures, and practices to control site runoff, spillage or leaks, waste disposal, or drainage from material storage. Another definition from the State of Colorado: physical, structural, and/or managerial practices that, when used singly or in combination, prevent or reduce pollution of stormwater.

The County requires, through the implementation of this Agreement, that Post-Construction Storm Water Management BMPs as required by the Final Drainage Report, Stormwater Management Manual, and the Land Development Code be constructed and adequately operated and maintained by the Landowner, his successors and assigns;

NOW, THEREFORE, in consideration of the foregoing promises, the mutual covenants contained herein and the following terms and conditions, the parties hereto agree as follows:

DRAFT

1. The BMPs shall be constructed by the Landowner in accordance with the plans and specifications shown and described in the Final Drainage Report.

2. The Landowner shall operate and maintain the BMP(s) as shown and described on the Final Drainage Report in good working order acceptable to the County and in accordance with the specific maintenance requirements noted on the Final Drainage Report. Inspections of the BMP(s) shall be performed on an annual basis to ensure good working order of the BMP(s) with the inspection results sent to the County. Inspections must be performed by a qualified person, either a professional engineer or a person with training in the inspections of these BMP(s).

3. The Landowner hereby grants permission to the County, its authorized agents and employees, to enter upon the property, at reasonable times and upon presentation of proper identification to the Land Owner if requested, to inspect the BMP(s) whenever it deems necessary. The County shall notify the Landowner prior to entering the property.

4. In the event the Landowner fails to operate and maintain the BMP(s) as shown and described on the Final Drainage Report in good working order acceptable to the County, the County or its representatives may enter upon the Property and take whatever action is deemed necessary to maintain and/or reconstruct said BMP(s). This provision shall not be construed to allow the County to erect any permanent structure on the land of the Landowner. It is expressly understood and agreed that the County is under no obligation to maintain or repair said facilities, and in no event shall this Agreement be construed to impose any such obligation on the County.

5. In the event the County, pursuant to this Agreement, performs work of any nature, or expends any funds in performance of said work for labor, use of equipment, supplies, materials, and the like, the Landowner shall reimburse the County for all expenses (direct and indirect) incurred within 10 days of receipt of invoice from the County.

6. The intent and purpose of this Agreement is to ensure the proper maintenance of the onsite BMP(s) by the Landowner; provided, however, that this Agreement shall not be deemed to create or effect any additional liability of any party for damage alleged to result from or be caused by stormwater runoff.

7. The Landowner, its administrators, assigns, and other successors in interests, shall release the County's employees and designated representatives from all damages, accidents, casualties, occurrences or claims which might arise or be asserted against said employees and representatives from the construction, presence, existence, or maintenance of the BMP(s) by the Landowner or County. In the event that a claim is asserted against the County, its designated representatives or employees, the County shall promptly notify the Landowner and the Landowner shall defend, at his own expense, any suit based on the claim. If any judgment or claims against the County's employees or designated representatives shall be

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allowed, the Landowner shall pay all costs and expenses regarding said judgment or claim.

This Agreement shall be recorded in the Mesa County, Colorado land records and shall constitute a covenant running with the Property and/or equitable servitude, and shall be binding on the Landowner, his administrators, executors, assigns, heirs and any other successors in interests, in perpetuity.

ATTEST:

This section will be different based on whether the owner is an individual or an entity!

WITNESS the following signatures and seals:

(SEAL) For Mesa County:

_____

(SEAL) For the Landowner:

_____

ATTEST:

_____ (Mesa County)

County of Mesa, Colorado

I, _____, a Notary Public in and for the County and State aforesaid, whose commission expires on the _____ day of _____, 20__, do hereby certify that _____ whose name(s) is/are signed to the foregoing Agreement bearing date of the _____ day of _____, 20__, has acknowledged the same before me in my said County and State.

GIVEN UNDER MY HAND THIS _____ day of _____, 200_.

_____ _____

NOTARY PUBLIC **(SEAL)**

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(d) City of Grand Junction Storm Water Construction Permit Application.

CITY OF Grand Junction COLORADO	**Storm Water Construction Permit Application**	Permit Number _____ Date Submitted_____ Final Stabilization Date _____

COMMUNITY DEVELOPMENT DEPARTMENT
250 N. 5TH STREET GRAND JUNCTION, COLORADO 81501
GENERAL INFORMATION (970) 244-1430 (FAX) 970-256-4031 www.gjcity.org

A Storm Water Construction Permit is required for all land disturbance activities equal to or greater than one (1) acre OR for land disturbance activities less than one (1) acre that are part of a larger common plan of development or sale that would disturb one (1) acre or more.

NOTE: This permit is separate from any permits required by the Colorado Department of Public Health and Environment (CDPHE), Water Quality Control Division under the Colorado Discharge Permit System.

(1) Project Information:		
Project Name:	City Project Number:	
Address/Location:	Current Mesa County Assessor's Tax Parcel Number:	
Existing Land Use:	Proposed Land Use:	
(2) Contact Information:		
(a) Project Owner:		
Contact Person:	Company:	
Address:		
Phone:	Email:	
Fax:	Mobile:	Pager:
(b) Contractor (Site contact familiar with project)		
Contact Person:	Company:	
Address:		
Phone:	Email:	
Fax:	Mobile:	Pager:
(c) Other:		
Contact Person:	Company:	
Address:		
Phone:	Email:	
Fax:	Mobile:	Pager:
(3) Construction Site Operator (Permittee):		
Name: (Print)	Check One: ☐ Phone; ☐ Mobile; ☐ Pager:	Number: _____

(4) List, in addition to the permittee, any site personnel along with their contact information, who will have authority to make modifications to the Construction Stormwater Management Plan (CSWMP):

Name:	Check One: ☐ Phone; ☐ Mobile; ☐ Pager:	Number: _____
Name:	Check One: ☐ Phone; ☐ Mobile; ☐ Pager:	Number: _____
Name:	Check One: ☐ Phone; ☐ Mobile; ☐ Pager:	Number: _____

(5) Project Information:

Total area of project (acres): _____	Area of project to undergo disturbance (acres): _____	Total disturbed area of larger common plan or development or sale if applicable (acres): _____

(6) Nature of Construction Activities:

Check the appropriate box(es) or provide a brief description that indicates the general nature of the construction activities. (The full description of activities and construction phases must be included in the Construction Storm Water Management Plan.) ☐ Single Family Residential ☐ Multi-Family Residential ☐ Commercial / Industrial

☐ Utility ☐ Highway / Road ☐ Other (describe): _____

Brief Description of Project:

(7) Project Schedule:

Expected project start date: _____	Expected project completion date: _____	Expected final stabilization date: _____

(8) Acknowledgement Certificate:

By signing below, I hereby apply for a City of Grand Junction Storm Water Construction Permit for the aforementioned property and certify that I agree to follow this permit including but not limited to applicable conditions in the Storm Water Management Manual (SWMM) and the project-specific Construction Storm Water Management Plan (CSWMP).

_____ _____
Signature of Legally Responsible Person (submission must include original signature) Date Signed

_____ _____
Name (printed) Title

***** FOR OFFICE USE ONLY *****

CDPHE Stormwater Discharge Permit Received: ☐ No ☐ Yes, _____ date received; Permit No. _____

City Approval: _____ Date: _____

Stormwater Management Plan (CSWMP) and drawings received: ☐ No ☐ Yes, _____ date received

Total Performance Security collected: $ _____
Date Paid: _____
Method of Payment: _____

Sediment/Erosion Control Plan Sheet Drawings Received: ☐ No ☐ Yes, _____ date received;

File Number: _____
Security date of expiration: _____
DIA period of performance: _____

(e) Reassignment of Permit Coverage.

STATE OF COLORADO

NOTICE OF REASSIGNMENT OF PERMIT COVERAGE
FOR A PORTION OF A PERMITTED AREA
AND GENERAL PERMIT APPLICATION
GENERAL PERMIT FOR
STORMWATER DISCHARGES ASSOCIATED WITH CONSTRUCTION ACTIVITY

This form is to be used when a permittee under the State of Colorado General Permit for Stormwater Discharges Associated with Construction Activity (the Construction General Permit) no longer has control of a specific portion of a permitted site through either ownership or contract, and wishes to transfer coverage of that portion of the site to a second party that does not currently have coverage under the Construction General Permit. **If both parties currently have permit coverage, refer to the Alternative Options section for additional guidance.** This application covers Large Construction Sites (disturbing 5 or more acres) and Small Construction Sites (disturbing at least 1 but less than 5 acres). Sites that are part of a larger common plan of development or sale that will disturb at least 1 acre are also included. A "common plan of development or sale" is a site where multiple separate and distinct construction activities may be taking place at different times on different schedules, but still under a single plan. This includes phased projects, projects with multiple filings or lots, and projects in a contiguous area that may be unrelated but still under the same contract

The following actions will be triggered by completion and submittal of this form:

- The Permit certification in Item II.A will be amended to no longer include the area described in Items I.B and I.C. **The current permittee will not receive a revised certification**. The corrected information will be placed in the permit file. If the current permittee requires notification of the Water Quality Control Division's (the Division's) receipt of this information, it is up to the permittee to request verification of delivery from the carrier (i.e., by sending certified mail).
- A new permit certification under the General Permit for Stormwater Discharges Associated with Construction Activity will be issued to the *new permittee* listed in Part I. A new permit certification and permit materials will be sent to the attention of the legally responsible person for the new permittee (Item I.i. on the form).

Alternative Options: To transfer the entire permit certification, the Notice of Transfer of Permit Coverage form must be used instead. Also, if both parties are currently permit holders for portions of the overall project (i.e., at least two permit certifications are issued for the project and cover both the party wishing to reassign coverage and the party wishing to accept coverage), and it is not desired that a new permit certification be issued, the permittees may amend their permit certifications instead of completing this form. For additional instructions, please refer to the guidance on "Amending Your Permit Certification" in the Stormwater Fact Sheet for Construction, available from the Division's web site at www.cdphe.state.co.us/wq/PermitsUnit.

Applicant Liability: For the area described for which permit coverage is to be reassigned (Part I.b of the form), permit coverage and liability will be assigned to the new permit applicant, regardless of ownership or contract, until the certification is transferred, amended, inactivated, or expired. (Note that even though the new permittee will be liable for permit compliance for the reassigned area, if the new permittee does not meet the definition of owner or operator as discussed in the "Who May Apply" section below, the entity(s) that does could be held liable for operating without the necessary permit coverage.) The permittee may amend their application in writing to cease coverage for a portion of a site that the permittee no longer either owns or is under contract for. Information on the procedures that must to be used for such amendments will be supplied with the permit certification.

A more detailed explanation is available in the Stormwater Fact Sheet for Construction, available from the Division's web site at www.cdphe.state.co.us/wq/PermitsUnit. **The Division strongly recommends that entities involved with sites where multiple owners/operators exist review this information.**

Who May Apply For and Maintain Permit Coverage: The applicant must be a legal entity that meets the definition of either the owner and/or operator of the construction site, in order for this application to legally cover the activities occurring at the site. The applicant must have day-to-day supervision and control over activities at the site and implementation of the Stormwater Management Plan (SWMP) discussed in Item I.h of the instructions. Although it is acceptable for the applicant to meet this requirement through the actions of a contractor, as discussed in the examples below, the applicant remains liable for violations resulting from the actions of their contractor. Examples of acceptable applicants include:

- **Owner or Developer-** An owner or developer who is operating as the site manager or otherwise has supervision and control over the site, either directly or through contract with an entity such as those listed below.
- **General Contractor or Subcontractor -** A contractor with contractual responsibility and operational control (including SWMP implementation) to address the impacts construction activities may have on stormwater quality.
- **Other Delegated Agents/Contractors** - Other agents, such as a consultant acting as construction manager under contract with the owner or developer, with contractual responsibility and operational control to address the impacts construction activities may have on stormwater quality (including SWMP implementation).

An entity engaged in construction activities may be held liable for operating without the necessary permit coverage if a site does not have a permit certification in place that is issued to either an owner and/or operator. For example, if a site, or portion of a site, is sold or contractors change, so that the site's permit certification is then held by a permittee that is no longer either the owner or operator (such as the previous owner or contractor), that permit certification will no longer cover the new operator's activities, and a new certification must be issued, or the current certification transferred.

A separate permit certification is not needed for subcontractors, such as utility service line installers, whose activities result in earth disturbance, but where the permittee or their contractor is identified as having the operational control to address the impacts their activities may have on stormwater quality.

Stormwater Management Plan (SWMP): Both the current permittee and the new applicant must develop and maintain SWMPs that accurately reflect the activities and BMPs for the areas for which they will have permit coverage. The **current permittee** must already have a SWMP in place as required by their permit coverage, but must revise this plan to account for the changes in their covered area and activities. As discussed in Item I.h. of the instructions, the **new applicant** must also develop a SWMP for their covered area, prior to submittal of this form. Although the new applicant may utilize the current permittee's SWMP, if available, in development of their own SWMP, it must be modified and maintained to accurately reflect the new applicant's activities. Appendix A of the General Permit Application and Stormwater Management Plan Guidance for Stormwater Discharges Associated with Construction Activity (available from the Division's web site at www.cdphe.state.co.us/wq/PermitsUnit) contains the requirements for the SWMP. Failure by either entity to maintain a SWMP in accordance with this guidance is a violation of the permit. Additional guidance for multi owner/operator development is also available in the Stormwater Fact Sheet for Construction, also available from the Division's web site.

Application Due Dates: At least **ten days** prior to the requested effective date for the coverage reassignment, the owner or operators of the construction activities shall submit this form to the Water Quality Control Division (the "Division"). This form may be reproduced, and is also available from the Division's web site at www.cdphe.state.co.us/wq/PermitsUnit.

Permit Fee: The new permittee does not send any payment with this form. They will be billed once they are covered under a permit. Current permit fees can be obtained from the Division's web site at www.cdphe.state.co.us/wq/PermitsUnit.

Application Completeness: All items of the form must be completed accurately and in their entirety or the application will be deemed incomplete, and processing of the form will not begin until all information is received. (Do not include a copy of the Stormwater Management Plans for either the current or new permittee, unless requested by the Division.) One original copy of the completed form (**no faxes or e-mails**), signed by both the new permittee and the current permittee, shall be submitted, only to:

Colorado Department of Public Health and Environment
Water Quality Control Division
WQCD-Permits
4300 Cherry Creek Drive South
Denver, Colorado 80246-1530

Note: Partial applications will not be accepted.

If you have questions on completing this application, you may contact the Division at cdphe.wqstorm@state.co.us or (303) 692-3517.

REASSIGNMENT FORM

INSTRUCTIONS

PART I - (To be completed by the New permit applicant.)

Part I of the application is to be filled out by the new permit applicant who will be assuming permitting liability for the reassigned portion of the original applicant's site. The **effective date** when the area addressed in the form will be reassigned must be provided at the beginning of Part I. The effective date must be at least ten days following the receipt of this form by the Division. It will be the effective date of the new permit certification issued to the new applicant in Part I.

Item I.a.: Provide the name and address of the new permit applicant, including the company name, local contact, phone number, and mailing address. Indicate whether the applicant is the owner, developer or contractor.

Item I.b.:. Provide the street address of the site that will be covered under the new certification and removed from the current certification. If an exact address is not available you may use an approximate address, the nearest intersection or boundary streets including directional identifiers (e.g., "S. of Park St. between 5th Av and 10th Av.", or "W. side of C.R. 21, 3.25 miles N. of Hwy 10") or other identifying information. For the approximate center point of the property, the longitude/latitude, to the nearest 15 seconds, **must** be included. The latitude and longitude must be provided as either degrees, minutes, and seconds, or in decimal degrees with three decimal places. This information may be obtained from a variety of sources, including:

- Surveyors or engineers for the project should have, or be able calculate, this information.
- EPA maintains a web-based siting tool as part of their Toxic Release Inventory program that uses interactive maps and aerial photography to help users get latitude and longitude. The siting tool can be accessed at: www.epa.gov/tri/report/siting_tool/index.htm
- U.S. Geological Survey topographical map, available at area map stores.
- Using a Global Positioning System (GPS) unit to obtain a direct reading.

Item I.c.: One of these two items **must** be provided:

- Legal Description of the entire site covered by the application that must include subdivision(s), block(s), and lot(s) (providing the metes and bounds or just the township/section/range, is not adequate). This information should be available for subdivided properties from documents submitted to or maintained by the city or county, such as the subdivision plat or deed. If this information is not available, a map must be submitted. – **or** –
- Site Map that defines the boundaries of the site being applied for. The level of detail that must be provided will depend on the nature of the project and must be adequate so that it can be determined during a field audit what construction activities are covered under the issued certification. For typical developments within a specific surveyed property, a map clearly showing the property boundaries should be obtainable. For projects located in areas with adjacent construction areas that will not be covered by the application (such as multi-lot developments with multiple owners/operators), this detail is essential. However, for projects such as road or utility projects, where providing this detail may not be feasible or necessary to distinguish the project from adjacent activities, a less detailed map showing the approximate area is adequate. Maps must have a minimum scale of 1:24000 (the scale of a USGS 7.5 minute map). Maps must be folded to 8½ x 11 inches. Do not submit grading plans or other blueprints as the site map.

Item I.d.: Provide both the total area of the construction site that will be covered under the new certification, and the area that will undergo disturbance, in acres. **Note:** aside from clearing, grading and excavation activities, disturbed areas also include areas receiving overburden (e.g., stockpiles), demolition areas, and areas with heavy equipment/vehicle traffic and storage that disturb existing vegetative cover.

Item I.e.: Either check the appropriate box or boxes, or if the given descriptions do not fit the project, provide a brief description that indicates the general nature of the construction activities for which permit coverage is being requested. A more detailed description of the project must be included in the Stormwater Management Plan (see Item I.i.).

Item I.f.: Provide the current estimated completion date for the construction project to be covered under the new certification. In terms of permit coverage, the completion date is when the site is finally stabilized. This means that all disturbed areas have been either built on, paved, or a uniform vegetative cover has been established. **Permit coverage must be maintained until that time.** If permit coverage is still required once your part is completed, the permit must be transferred to a new responsible entity.

Item I.g.: Identify the receiving water. Receiving waters are any waters of the State of Colorado. These include any and all surface waters that are contained in or flow in or through the State of Colorado (except for water withdrawn for use until use and treatment have been completed). This definition includes all water courses, even if they are usually dry. If stormwater from the construction site enters a ditch or storm sewer system, identify that system and indicate the ultimate receiving water for the ditch or storm sewer. **Note:** a stormwater discharge permit does not allow a discharge into a ditch or municipal storm sewer system without the approval of the owner/operator of that system if such approval is otherwise needed.

Item I.h.: The certification of completion of a Stormwater Management Plan (SWMP) **must** be signed by the applicant or their authorized agent. Appendix A of the General Permit Application and Stormwater Management Plan Guidance for Stormwater Discharges Associated with Construction Activity (available form www.cdphe.state.co.us/wq/PermitsUnit) contains the requirements for the SWMP during the period of construction (as listed in the general permit). Submittal of the SWMP is **not** required, however it must be developed and implemented and kept at the construction site. The Division reserves the right to request the SWMP at any time.

Item I.i.: The applicant must be either the owner and/or operator of the construction site. Refer to page i of the instructions for additional information. The application **must be signed** to be considered complete. In all cases, it shall be signed as follows:

a) In the case of corporations, by a principal executive officer of at least the level of vice-president or his or her duly authorized representative, if such representative is responsible for the overall operation of the facility from which the discharge described in the application originates.
b) In the case of a partnership, by a general partner.
c) In the case of a sole proprietorship, by the proprietor.
d) In the case of a municipal, state, or other public facility, by either a principal executive officer, ranking elected official, or other duly authorized employee.

This certification includes an acknowledgment that the applicant understands that the permit coverage, and therefore the applicant's liability, will be for the entirety of the portion of the construction project described and applied for, until such time as the application is amended or the certification is transferred, inactivated, or expired.

PART II - (To be completed by the Current permittee.)

Part II of the application, starting on page 3 of the form, is to be completed by the **current** permittee. The information provided in Part II.b should be revised from the original application to take into account the changes in the site based on reassignment of the applied-for area. Refer to the instructions for I.c and I.d above for information on providing location and construction activity description information.

NOTICE OF
REASSIGNMENT OF PERMIT COVERAGE
and GENERAL PERMIT APPLICATION

STORMWATER DISCHARGES ASSOCIATED WITH
CONSTRUCTION ACTIVITY (Permit No. COR-030000)

For Agency Use Only **C O R - 0 3** ____ ____ ____ ____

Date Received: ___ ___ / ___ ___ / ___ ___ ___ ___
Day Month Year

9A

Please print or type. All items must be completed accurately and in their entirety or the application will be deemed incomplete and processing of the permit/reassignment will not begin until all information is received. Please refer to the instructions for information about the required items. Original signatures of the new permit applicant and the current permittee are **required.**

Part I of the application beginning below is to be filled out by the new permit applicant that will be assuming permitting liability for the reassigned portion of the original applicant's site. **Part II** of the application, starting on page 3 of the form, is to be completed by the current permittee. **Both Parts I (pages 1 and 2) and II (page 3) must be completed**.

PART I - To be completed by the New permit applicant:

I hereby accept the reassignment of permit coverage for the area described in this application. I have reviewed the terms and conditions of this permit and the Stormwater Management Plan and accept full responsibility, coverage and liability.

This reassignment will be effective on: __ __ / __ __ / __ __ __ __
month day year

I.a. Name and address of the new permit applicant:

Company Name _____

Mailing Address _____

City, State and Zip Code _____

Phone No. (_____) _____ Who is applying? Owner ☐ Developer ☐ Contractor ☐

Local Contact (familiar with facility) _____

Title _____ Phone Number (_____) _____

Local Contact E-mail Address (if available) _____

Legally Responsible Person (application signer) E-mail Address _____

I.b. Location of the area to be covered under the new permit certification:

Street Address (or Cross Streets) _____

City (if unincorporated, so indicate) _____ County _____

Name of plan, project, or development _____

Latitude/Longitude – use one of the following formats:

Latitude ___ ___ / ___ ___ / ___ ___ Longitude ___ ___ ___ / ___ ___ / ___ ___ (e.g., 39°42'11'', 104°55'57'')
degrees minutes seconds degrees minutes seconds

-or-

Latitude ___ ___ . ___ ___ ___ Longitude ___ ___ ___ . ___ ___ ___ (e.g., 39.703°, 104.933°')
degrees (to 3 decimal places) degrees (to 3 decimal places)

I.c. Legal Description (subdivision, block, and lot) or Map Indicating Site Location/Boundaries:

If a map is attached to provide this information, this must be indicated below. Maps must be folded to 8½ x 11 inches.
Map Attached? ☐ Yes, skip to item 4 ☐ No; include legal description **per Instructions** (use separate sheet if needed):

Subdivision(s), Lot(s), Block(s): _____

_____

I.d. **Area of the construction site**:

Total area of project site (acres) _____

Area of project site to undergo disturbance (acres) _____

I.e. **Nature of the construction activity**:
Check the appropriate box(s) or provide a brief description that indicates the general nature of the construction activities. (The full description of activities must be included in the Stormwater Management Plan.)

☐ Single Family Residential Development

☐ Multi-Family Residential Development

☐ Commercial Development

☐ Other, Describe: _____

_____

I.f. **Anticipated Final Stabilization Date**: __ __ / __ __ / __ __ __ __
month day year

I.g. **The name of the receiving stream(s).** (If discharge is to a ditch or storm sewer, also include the name of the ultimate receiving water): _____

STOP! A Stormwater Management Plan must be completed prior to signing the following certifications!

I.h. **Stormwater Management Plan Certification (new applicant)**:

"I certify under penalty of law that a **complete Stormwater Management Plan, as described in Appendix A of the General Permit Application and Stormwater Management Plan Guidance for Stormwater Discharges Associated with Construction Activity, has been prepared for my activity**. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the Stormwater Management Plan is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for falsely certifying the completion of said SWMP, including the possibility of fine and imprisonment for knowing violations."

_____

Signature of Legally Responsible Person (submission must include original signature) Date Signed

_____

Name (printed) Title

I.i **Signature of Applicant (legally responsible person - new applicant)**

"I certify under penalty of law that I have personally examined and am familiar with the information submitted in this application and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine or imprisonment.

"I understand that submittal of this application is for coverage under the State of Colorado General Permit for Stormwater Discharges Associated with Construction Activity **for the entirety of the construction site/project described and applied for, until such time as the application is amended or the certification is transferred, inactivated, or expired**."

_____

Signature of Legally Responsible Person (submission must include original signature) Date Signed

_____

Name (printed) Title

PART II – Amendment to the current permit certification
To be completed by the Current permittee:

II.a. Current Permit Certification Information

Certification Number: **COR-03** ___ ___ ___ ___ Check if this is a new name, address, etc.

Permittee (Company) Name: _____ ☐

Permittee Address: _____ ☐

_____

Local Contact: _____ ☐

Phone No. (_____) _____ ☐

E-mail Address (if available) _____ ☐

Name of plan, project, or development _____ ☐

II.b. Revised Site Information

Legal Description or Map Indicating Site Boundaries: (Subdivision, block, and lot, or similar information clearly identifying the site area that retains coverage under the current certification. If a map is attached to provide this information, this must be indicated below. Maps must be folded to 8½ x 11 inches.)
Map Attached? ☐ Yes ☐ No; include legal description **per Instructions** (use separate sheet if needed):

Subdivision(s), Lot(s), Block(s): _____

_____

Check the appropriate box(s) or provide a brief description that indicates the general nature of the construction activities. (The full description of activities must be included in the Stormwater Management Plan.)

☐ Single Family Residential Development

☐ Multi-Family Residential Development

☐ Commercial Development

☐ Other, Describe:_____

_____

II.c. Certification for Reassignment

"I certify under penalty of law that I have personally examined and am familiar with the information submitted in Part II of this application and all attachments in reference to Part II and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine or imprisonment.

"As the permittee currently covered by the above-referenced certification, I hereby agree to reassign the permit coverage for the area and activity described in Items I.b. and I.c., and all responsibilities thereof, from the above-referenced permit certification to the new permittee listed in Part I of this form."

_____

Signature of Legally Responsible Person (submission must include original signature) Date Signed

_____

Name (printed) Title Title

(f) Grand Junction Post-Construction Stormwater Control Operations and Maintenance Agreement.

POST-CONSTRUCTION STORMWATER CONTROL OPERATIONS AND MAINTENANCE AGREEMENT

THIS AGREEMENT is made and entered into this _____ day of _____, 20____, by and between _____, (hereinafter the "Landowner"), and the City of Grand Junction, Colorado (hereinafter "Municipality");

RECITALS

The Landowner is the owner of the following real property:

hereinafter referred to as "the Property."

The Landowner is developing the Property;

The Municipality and the Landowner, on behalf of all successors and assigns, agree that the health, safety, and welfare of the residents of the Municipality and the protection and maintenance of water quality require that on-site stormwater Best Management Practices be constructed and maintained on the Property.

For the purposes of this agreement, the following definitions shall apply:

BMP – "Best Management Practice;" activities, facilities, designs, measures or procedures used to manage stormwater impacts from land development, to protect and maintain water quality and groundwater recharge and to otherwise meet the purposes of the Municipal Stormwater Pollution Prevention Ordinance, including but not limited to infiltration trenches, seepage pits, filter strips, bioretention, wet ponds, permeable paving, grassed swales, forested buffers, sand filters and detention basins.

As part of the approval of the development of the property, the Municipality will review and approve a Final Drainage Report which will implement Post-Construction Storm Water Management BMPs required by the Municipal Stormwater Pollution Prevention Ordinance.

The purpose of this Agreement is to insure the adequate maintenance, operation and repair of the storm water management facilities, in perpetuity, by the owners of the property served by these facilities.

The Landowner desires to subject and place upon the Property the covenants and servitudes set forth herein which shall run with the Property and be binding on all parties having any right, title, or interests in the Property or any part thereof, their heirs, personal representatives, successors and assigns, and shall inure to the benefit of each owner thereof.

NOW, THEREFORE, in consideration of the foregoing promises, the mutual covenants contained herein and the following terms and conditions, the parties hereto agree as follows:

1. The BMPs shall be constructed by the Landowner in accordance with the plans and specifications shown and described in the Final Drainage Report.

2. The Landowner shall operate and maintain in perpetuity the BMP(s) as shown and described on the Final Drainage Report in good working order as reasonably determined by the Municipality and in accordance with the specific maintenance requirements noted on the Final Drainage Report. The Landowner shall cause the BMP(s) to be inspected annually by a Qualified Erosion Control Specialist to ensure good working order and shall send a report from said inspection to the Municipality annually, on or before December 31st of each year.

3. The Landowner hereby grants a perpetual easement to the Municipality, its authorized agents and employees, to enter upon the Property, at reasonable times and upon presentation of proper identification, to inspect the BMP(s) whenever it deems necessary. The Municipality shall make reasonable efforts to notify the Landowner prior to entering the Property.

4. In the event the Landowner fails to operate and maintain the BMP(s) as shown and described on the Final Drainage Report in good working order as reasonably determined by the Municipality, the Municipality or its representatives may enter upon the Property and take action to maintain and/or repair and/or reconstruct said BMP(s). It is expressly understood and agreed that the Municipality is under no obligation to maintain or repair said facilities, and in no event shall this Agreement be construed to impose any such obligation on the Municipality.

5. In the event the Municipality, pursuant to this Agreement, performs work of any nature, or expends any funds in performance of said work for labor, use of equipment, supplies, materials, and the like, the Landowner shall reimburse the Municipality for all reasonable expenses (direct and indirect) incurred within 10 days of receipt of invoice from the Municipality.

6. The intent and purpose of this Agreement is to ensure the proper maintenance of the onsite BMP(s) by the Landowner. This Agreement shall not be deemed to create or effect any additional liability of any party for damage alleged to result from or be caused by stormwater runoff.

7. The Municipality may conduct routine inspections of the BMP(s) to verify their continued adequate functioning. The Municipality may also inspect the BMP(s) in the event of reported or suspected failure to function adequately. These inspection activities shall not absolve the Landowner of its obligation to maintain the BMPs in perpetuity or to provide the Municipality with the required Landowner inspection report.

8. This Agreement shall not be interpreted or deemed to limit the authority, privilege or right of the Municipality pursuant to any duly enacted ordinance of the Municipality, charter provision, statute or any duly granted federal or state water discharge permit.

9. Notifications and reports made under this Agreement shall be provided to the City at:

Mr. Chris Spears
Street Systems Supervisor
250 N 5th Street-
Grand Junction, CO 81501

and to the Landowner at:

This Agreement shall be recorded in the Mesa County, Colorado land records and shall, once recorded, constitute a covenant running with the Property and shall be an equitable servitude binding on present and subsequent owners of the Property in whole or in part, and their administrators, executors, assigns, heirs and successors in interest, in perpetuity.

ATTEST:

WITNESS the following signatures and seals:

(SEAL) For the City of Grand Junction:

_____

(SEAL) For the Landowner:

_____

ATTEST:

_____ (City of Grand Junction)

County of Mesa, Colorado

I, _____, a Notary Public in and for the County and State aforesaid, whose commission expires on the _____ day of _____, 20__, do hereby certify that _____ whose name(s) is/are signed to the foregoing Agreement bearing date of the _____ day of _____, 20__, has acknowledged the same before me in my said County and State.

GIVEN UNDER MY HAND THIS _____ day of _____, 200_.

_____ _____

NOTARY PUBLIC **(SEAL)**

(g) City of Grand Junction Stormwater Construction Permit Field Inspection Report.

CITY OF GRAND JUNCTION STORMWATER CONSTRUCTION PERMIT FIELD INSPECTION REPORT

(5) Project Name

(6) Permit No.

(7) Reason for Inspection :

- ❑ Required Maximum 14 Calendar Day Inspection
- ❑ Required 30 Calendar Day Inspection for Completed Projects
- ❑ Required Storm Event Inspection
- ❑ Complaint:_____
- ❑ Other:_____

(1) Date of Inspection

(2) Property Owner

(3) Site Contact Name (print)

(4) Inspector Name (print)

(8) **CONSTRUCTION SITE ASSESSMENT**

- ❑ Construction site perimeter contained. Offsite tracking minimized.
- ❑ Disturbed areas contained.
- ❑ Estimate disturbed area at the time of the inspection. _____ Acres
- ❑ Areas used for material and waste storage and fueling contained.

(9) **CSWMP MANAGEMENT**

- ❑ Does site have current CSWMP Yes / No
- ❑ Changes noted & dated on the plans? Yes / No
- ❑ Contents of CSWMP:
  - ❑ Site Description Yes / No
  - ❑ Site Map Yes / No
  - ❑ Description of BMPs during construction activities Yes / No
  - ❑ Materials Handling & Spill Prevention Yes / No
- ❑ Contents of CSWMP (Cont.)
  - ❑ Final Stabilization Yes / No
  - ❑ Other Controls Yes / No
  - ❑ Inspection & Maintenance Yes / No
  - ❑ Certification Yes / No

BEST MANAGEMENT PRACTICES (BMPS)

(10) BMP Type	(11) Practice Req/Used		(12) Reason	(13) Maintenance/ Sediment Removal Required Y/N	(14) Course of Action	(15) Date for Action to be Completed
EROSION CONTROL						
Seeding						
Mulching						
Blankets						
Check Dams						
Earth Berms						
Diversion						
Embankment Protector						
Outlet Protection						
Surface Roughening						
Other:						
Other:						

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(10) BMP Type	(11) Practice Req/Used		(12) Reason	(13) Maintenance/ Sediment Removal Required Y/N	(14) Course of Action	(15) Date for Action to be Completed
SEDIMENT CONTROL						
Inlet Protection						
Erosion Bales						
Silt Fence						
Sediment Trap/Basin						
Stabilized Construction Entrance						
Dewatering Structure						
Other:						
MATERIALS HANDLING AND SPILL PREVENTION, WASTE MANAGEMENT AND GENERAL POLLUTION PREVENTION						
Stockpile Management						
Materials Delivery and Storage						
Spill Prevention and Control						
Concrete Washout						
Concrete Saw Water Containment						
Solid Waste						
Sanitary Waste						
Maintenance and Fueling						
Street Sweeping Vacuuming						
Other:						
Other:						

Comments:

(16) **INSPECTIONS AND MAINTENANCE PROGRAM**	
❑ Inspection occurring at least every 14 calendar days.	Course of Action:
❑ Inspections occurring after storm events that result in runoff.	Course of Action:
❑ Inspections occurring at least every 30 calendar days since project completion.	Course of Action:
❑ Inspection reports retained at the construction project site.	Course of Action:
❑ Corrective measures completed within 7 calendar days of inspection.	Course of Action:
CERTIFICATION **I certify this Stormwater Construction Permit Field Inspection Report is complete and accurate.**	
Inspector Signature	Date

Stormwater Management Plan Field Inspection Report
Instructions

1. **Date of Inspection:** Indicate the date the inspection was completed on.
2. **Property Owner:** Indicate the name of the property owner.
3. **Site Contact:** Indicate the main contact for the site.
4. **Inspector Name**: Indicate the name of the Inspector completing the inspection.
5. **Project Name**: Indicate the name of the project for which the report is being completed.
6. **Permit No.**: Indicate the permit number issued with the approval of the permit.
7. **Reason for Inspection**: Indicate the purpose for the inspection. The types of inspections include the following:
   - "Required 14 Calendar Day Inspection". These inspections are required at least every 14 calendar days during the life of the construction project.
   - "Required 30 Day Inspection for Completed Projects". These inspections are required at least every 30 calendar days following the completion of the construction project where final stabilization has not been achieved.
   - "Required Storm Event Inspection". These inspections are required after a storm event that results in runoff.
   - Inspection as a response to a complaint.
   - Inspection for any other reason.

   The first three types of inspections are required to comply with Mesa County Construction Stormwater Permit and the Colorado Discharge Permit System General Permit for Stormwater Discharges Associated with Construction Activity (CDPS General Permit).
8. **Construction Site Assessment**: Inspect the noted areas of the construction site and indicate with a "✔" the items which apply.
   - "Construction site perimeter contained". Are the appropriate BMPs in place and offsite sediment tracking minimized? Is there any evidence of pollutants entering a storm drainage system?
   - "Disturbed areas contained". Are the appropriate BMPs implemented to minimize erosion or sediment tracking from the disturbed areas? Is there any evidence of pollutants entering a storm drainage system? Provide an estimate of the disturbed area at the time of the inspection.
   - "Areas used for material and waste storage and fueling contained". Are the appropriate BMPs implemented to prevent and contain spills? Are wastes removed from the site and disposed of properly? Are the storage areas located at least 50 feet from a watercourse? Is there any evidence of pollutants entering a storm drainage system?
9. **CSWMP Management**:
   - Indicate if the Construction site has a current and update CSWMP, by circling yes or no.
   - Indicate if the required contents of the CSWMP are included, by circling yes or no on each line.
   - Indicate whether changes have been made to the CSWMP during construction and whether the changes have been documented and dated.
10. **BMP**: The BMPs shown may not be a complete list of what is required by the CSWMP. Cross out the BMPs not required by the CSWMP and add the BMPs that are required. Additional sheets can be inserted to show all the BMPs required by the CSWMP.
11. **Practice Req/Used**: This column can be used as follows:
    - If the BMP is required by the CSWMP and implemented, indicate by placing a "✔ " in both the "Req" and "Used" columns.
    - If the BMP is required by the CSWMP, but not implemented, indicate by placing a "✔ " in the "Req" column. Indicate the reason for the change in column (14), "Reason".
    - If the BMP has been added to the CSWMP, indicate with a "✔ " in the "Used " column. Indicate the reason for the change in column (14), "Reason".
12. **Reason**: Indicate the reason(s) for the deletion, addition, and modification of BMP(s) to the SWMP.
13. **Maintenance/Sediment Removal Required**: Indicate whether maintenance and sediment removal are required with a Yes or No. If maintenance and sediment removal are required, indicate what the action plan is in column (15), "Course of Action".
14. **Course of Action**: If maintenance and/or sediment removal is required, describe the action plan.
15. **Date for Action to be Completed**: Indicate the date for which the course of action will be completed. The course of action must be completed in a timely manner, but in no case more than 7 days after the inspection.
16. **Inspections and Maintenance**: Evaluate the inspection and maintenance aspect of the construction project and check all that applies with an " ✔". To comply with Mesa County Construction Stormwater Permit and the CDPS General Permit, all of the items identified must be adhered to.

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(Res. 40-08 (§ 1700), 3-19-08)

Chapter 28.72

REFERENCES

Sections:
28.72.010 References.

28.72.010 References.

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(Res. 40-08 (§ 1800), 3-19-08)

Chapter 28.76

DRAINAGE LAW

Sections:

28.76.010 Introduction.
28.76.020 Historical evolution of surface water drainage law.
28.76.030 Legal principles.
28.76.040 Local governments – Drainage responsibilities and powers.
28.76.050 Applicable drainage laws.
28.76.060 Special matters – Irrigation ditches.
28.76.070 Special matters – Ditch owner's duty to maintain, use and manage their ditches.
28.76.080 Special matters – Water quality.
28.76.090 Special matters – Economic loss rule – Duty of care.
28.76.100 Special matters – Water rights and drainage improvements.
28.76.110 Special matters – Governmental entity not liable for refusal to issue certificate of occupancy of residence constructed in a floodplain.
28.76.120 Special matters – Any legislatively formulated assessment, fee or charge that is imposed on a broad class of property owners by a local government is not considered taking of property.
28.76.130 Special matters – Governmental immunity in regard to irrigation and drainage ditches used as part of stormwater drainage system.
28.76.140 Special matters – Concerning interference with the flow of water in ditch.

28.76.010 Introduction.

The materials contained in this chapter are not intended to be an exhaustive presentation of each area of law which is discussed. The purpose is to familiarize the design professionals with these areas to enable them to better perform engineering duties and tasks contained in this title. These materials should not be used in place of a consultation with an attorney and no liability is being assumed with respect to the use of these materials for such purpose.

An important lesson which has been learned is that stormwater does not respect arbitrary jurisdictional boundaries. Stormwater does not respect the various rights and liabilities of adjacent land owners as it flows through depressions, gullies, and washes seeking refuge. However, engineers are presented with the enormous task of attempting to control the drainage of water while at the same time maintaining the integrity of natural flow paths and existing legal relationships arising from land ownership. The goal of maintaining both natural flow paths and existing legal relationships is not easily achieved. However, this goal can be more easily achieved if the engineer is familiar with the basic legal framework against which legal relationships will be adjudicated.

This chapter includes a brief description and citing of applicable State and local laws. The contents rely heavily on a similar section included in the Colorado Floodplain and Stormwater Criteria Manual prepared for the Colorado Water Conservation Board. The reader is encouraged to read the Drainage Law section of the UD&FCD's Drainage Criteria Manual, which represents the genesis for the update by the Colorado Water Conservation Board.

The user of this manual is encouraged to check the applicability of the laws and court cases included herein at the time of its use. Applicable statutes, ordinances, court cases and other local laws change with time. The materials contained herein should be reviewed periodically and updated as deemed appropriate.

(Res. 40-08 (Appx. A § A101), 3-19-08)

28.76.020 Historical evolution of surface water drainage law.

It is important for the engineer to be aware of the development of the historical principles and theories involved in drainage law. There are three common early doctrines which were followed in the United States: The doctrines were the common enemy doctrine, civil law rule, and the rule of reasonable use.

(a) The Common Enemy Doctrine. The common enemy doctrine is a harsh rule which is still followed in some states. Stated in its extreme form, the common enemy doctrine provides that as an incident to property use each landowner has an unqualified right, by operations on the land, to fight off surface waters as necessary without being required to take into account the consequences to other land owners, who have the duty and right to protect themselves as best they can.

Surface water was thus regarded as a common enemy which each property owner could fight off or control by any means such as retention, diversion, repulsion or altered conveyance. Thus, there was no cause of action even if some injury occurred to the adjoining parcel.

All jurisdictions originally following this harsh rule have either modified the rule or adopted the civil law rule or reasonable use.

(b) Civil Law Rule. Courts later recognized the rule of water drainage law which is basically diametrically opposed to the common enemy doctrine. The civil law rule recognizes a natural servitude for natural drainage between adjoining lands, so that the lower owner must accept the surface water which naturally drains onto its land, but on the other hand, the upper owner has no right to change the natural system of drainage to increase the burden on the lower parcel. This rule caused problems with allowing development because virtually almost any development has a tendency to increase the flow either in quantity or velocity.

According to the civil law rule, if the quantity or velocity of water flow were increased, the natural flow on the downstream property would be changed and would be in violation of the civil law rule. Thus, with the evolution of drainage law the courts sought to modify the law to consider the competing interests of adjoining land owners and allocate the burden of risk associated with development.

The civil law rule analyzes drainage problems in terms of property law concepts such as servitudes and easements. It did not consider tort law analysis of what is reasonable.

(c) Reasonable Use Rule. The rule of reasonable use was developed as an alternative between the civil law rule and the common enemy doctrine. The courts attempted to balance the hardships created in attempting to control surface waters and relevant factors in the relationship between the competing rights/liabilities of adjoining land owners.

The rule was apparently developed to provide flexibility in avoiding harsh results which often occurred in applying both the common enemy doctrine and the civil law rule to various factual situations.

Under the reasonable use rule, a property owner can legally make reasonable use of its land, even though the flow of surface waters is altered and causes some harm to others. However, liability occurs when the property owners' harmful interference with the flow of surface water is "unreasonable." A balancing test is utilized to determine whether a landowner's use of his property is unreasonable. The analysis involves three basic questions:

(1) Was there reasonable necessity for the property owner to alter the drainage to make use of his land?

(2) Was the alteration done in a reasonable manner?

(3) Does the utility of the actor's conduct reasonably outweigh the gravity of harm to others?

(Res. 40-08 (Appx. A § A102), 3-19-08)

28.76.030 Legal principles.

This section has been reproduced from the Colorado Floodplain and Stormwater Criteria Manual prepared for the Colorado Water Conservation Board.

(a) The owner of upstream property possesses a natural easement on land downstream for drainage of surface water flowing in its natural course. The upstream property owner may alter drainage condi-

tions so long as the water is not sent down in a manner or quantity to do more harm to the downstream land than formerly. Bittersweet Farms, Inc. v. Zimbelman, 976 P.2d 326 (Colo. App. 1998).

(b) For purposes of determining liability in a negligence action, the duty of a public entity shall be determined in the same manner as if it were a private party. Leake v. Cain, 720 P.2d 152 (Colo. 1986).

(c) A natural watercourse may be used as a conduit or outlet for the drainage of lands, at least where the augmented flow will not tax the stream beyond its capacity and cause flooding of adjacent lands. Ambrosio v. Pearl-Mack Construction Co., 351 P.2d 803 (Colo. 1960).

(d) Ditch corporations that own ditches owe a duty to those property owners through which their ditches pass to maintain their ditches using ordinary care so as to prevent damage to adjoining real property. Oliver v. Amity Mut. Irrigation Co., 994 P.2d 495 (Colo. App. 1999).

(e) Construction or enlargement of jurisdictional dams or reservoirs is subject to approval by the Colorado State Engineer, which includes consideration of requiring their spillways to be capable of passing the inflow design flood generated by 100 percent of the probable maximum precipitation. A "jurisdictional dam" is defined as a dam that impounds water above the elevation of the natural surface of the ground creating a reservoir with a capacity of more than 100 acre-feet or creating a reservoir with a surface area exceeding 20 acres at the high waterline or exceeding 10 feet in height measured vertically from the elevation of the lowest point of the natural surface of the ground where that point occurs along the longitudinal centerline of the dam up to the flow line crest of the emergency spillway of the dam. Rules 4 and 5 of the Department of Natural Resources, Division of Water Resources, Office of the State Engineer, Rules and Regulations for Dam Safety and Dam Construction.

(f) The boundaries of the floodplain should be accurately determined and based on a reasonable standard. Mallett v. Mamarooneck, 125 N.E. 2d 875 (N.Y. 1955).

(g) Adoption of a floodplain regulation to regulate flood-prone areas is a valid exercise of police power and is not a taking as long as the regulation does not go beyond protection of the public's health, safety, morals, and welfare. Hermanson v. Board of County Commissioners of Fremont, 595 P.2d 694 (Colo. App. 1979).

(h) The adoption by a municipality of floodplain ordinances to regulate flood-prone areas is a valid exercise of police power and is not a taking. Morrison v. City of Aurora, 745 P.2d 1042 (Colo. App. 1987).

(i) A zoning ordinance is not unconstitutional because it prohibits a landowner from using or developing his land in the most profitable manner. It is not required that a landowner be permitted to make the best, maximum or most profitable use of his property. Baum v. City and County of Denver, 363 P.2d 688 (Colo. 1961) and Sundheim v. Board of County Commissioners of Douglas County, 904 P.2d 1337 (Colo. App. 1995).

(j) The safest approach to avoiding liability in regard to drainage and flood control improvements is to assume that the defense of a design error will not protect a governmental entity from a lawsuit and liability for injury to property or person. Scott v. City of Greeley, 931 P.2d 525 (Colo. App. 1996) and § 24-10-106(1)(e) and (f), C.R.S.

(k) A dangerous condition constitutes an unreasonable risk to the health or safety of the public, which is known to exist or which in the exercise of reasonable care should have been known to exist and which condition is proximately caused by the negligent act or omission of the public entity in constructing or maintaining such facility. § 24-10-103, C.R.S.

(l) Under the Colorado Governmental Immunity Act (CGIA), a drainage and flood control facility is considered to be a sanitation facility and thus not protected by the defense that the facility caused damage solely because the design of the facility was inadequate. §§ 24-10-106 (f) and 24-10-103, C.R.S. and Burnworth v. Adams County, 826 P.2d 368 (Colo. App. 1991).

(m) Under the CGIA, a governmental entity will be liable for the negligent operation and maintenance of any drainage and flood control facility. §§ 24-10-106 (f) and 24-10-103, C.R.S. and Burnworth v. Adams County, 826 P.2d 368 (Colo. App. 1991).

(n) Under the CGIA, a governmental entity will not be liable for its failure to upgrade, modernize, modify, or improve the design or construction of a drainage or flood control facility. § 24-10-103(1) C.R.S.

(o) In imposing conditions upon the granting of land use approvals, no local government shall require an owner of private property to dedicate real property to the public or pay money to a public entity in an amount that is determined on an individual and discretionary basis, unless there is an essential nexus between the dedication or payment and a legitimate local government interest and the dedication or payment is roughly proportional both in nature and extent to the impact of the proposed use or development of such property. This law does not apply to any legislatively formulated assessment, fee, or charge that is imposed on a broad class of property owners by a local government. § 29-20-203 C.R.S.

(p) Public entities that own dams or reservoirs are not subject to strict liability for damages caused by water escaping from their dams or reservoirs. Further, those public entities have no duty to ensure that waters released from an upstream reservoir because of a dam failure would be contained by their facilities or would bypass those facilities without augmentation. Kane v. Town of Estes Park, 786 P.2d 412 (Colo. 1990).

(q) A professional engineer is required not only to serve the interests of his or her employer/client but is also required, as his or her primary obligation, to protect the safety, health, property, and welfare of the public. Rule I 2 of The Colorado Rules of Professional Conduct of the State Board of Registration for Professional Engineers and Professional Land Surveyors.

(r) Where a municipality imposes a special fee upon owners of property for purposes of providing a service and where the fee is reasonably designed to defray the cost of the service provided by the municipality, such a fee is a valid form of governmental charge within the legislative authority of the municipality. Bloom v. City of Fort Collins, 784 P.2d 304 (Colo. 1989).

(Res. 40-08 (Appx. A § A103), 3-19-08)

28.76.040 Local governments – Drainage responsibilities and powers.

Local governments bear the greatest responsibility for stormwater management. They can best determine the community needs and approaches through local regulation. Local governments, however, are constrained by their resources and the powers permitted them.

Various legal methods for managing stormwaters are authorized by enabling legislation. Zoning ordinances and subdivision regulations are the most important methods available to local governments, followed by building regulations and building codes. Stormwater management may also be carried out by drainage districts, local governments having home rule powers, such as the cities of Grand Junction and Fruita, and by government agencies having authority to regulate floodplains.

The inherent police powers of a municipality enable it to enact ordinances that provide for the protection of public's health, safety, morals, or general welfare. These powers are exercised when specific ordinances are enacted to address drainage issues.

Statutory powers also grant municipalities, counties, and State governments powers to provide directly or through special districts and authorities to construct, operate, and maintain a variety of public improvements including streets and sidewalks, water and sewage, storm drainage, and other facilities affecting stormwater quality and development in flood-prone areas.

(Res. 40-08 (Appx. A § A104), 3-19-08)

28.76.050 Applicable drainage laws.

(a) Municipalities.

(1) § 31-23-301, C.R.S. – Authorizes municipalities to adopt regulations to promote public health, safety and general welfare of its citizenry.

(2) §§ 31-15-701, 31-15-714 C.R.S. – Grants powers to municipalities to engage in public improvements.

(3) § 31-15-711(1)(a), C.R.S. – Allows municipalities to engage in activities to alter or change the natural channel of watercourses.

(4) §§ 31-25-501, 31-25-508, C.R.S. – Authorizes public improvements – Special improvement districts in municipalities.

(5) §§ 31-25-601, 31-25-604, C.R.S. – Allows municipalities to set up improvement districts with taxing powers for the purpose of constructing public improvements.

(6) §§ 31-35-401, 31-35-417, 31-35-401(6), C.R.S. – Allows municipalities to operate, maintain and finance facilities to include waters from storm, flood, or surface drainage.

(7) City of Fruita Land Use Code (Title 17) Section 17.45 – Floodways, Floodplains, Drainage and Erosion.

(b) Counties.

(1) §§ 30-20-401, 30-20-402, C.R.S. – Authorizes County to construct water and sewerage facilities for County's own use or private and public users.

(2) §§ 30-20-501, 30-20-504, C.R.S. – Authorizes creation of public improvement districts within any county as taxing units and for the purpose of implementing public improvements.

(3) §§ 30-20-601, 30-20-603, C.R.S. – Authorizes a county by resolution to construct local improvements.

(4) §§ 30-30-101, 30-28-105, C.R.S. – Authorizes the board of county commissioners of each county for flood control purposes only.

(5) §§ 37-20-101, 37-33-109, C.R.S. – Authorizes owner of agricultural lands subject to drainage problems from the same general system to petition the board of county commissions to set up a drainage district.

(6) Mesa County Land Development Code.

(i) Section 7.7, Drainage.

(ii) Section 7.12, Irrigation Canals and Laterals.

(iii) Section 7.13, Floodplain Regulations.

(c) State.

(1) §§ 24-65-101, 24-65-105, C.R.S. – Creates the Colorado Land Use Commission with authority to assist counties and municipalities in developing guidelines for developing land uses and construction control within designated floodways.

(2) § 29-1-204.2, C.R.S. – Allows for establishment of a drainage authority by any combination of municipalities, special districts, or other political subdivisions by entering into a contract with each other.

(3) §§ 37-60-101, 37-60-106, C.R.S. – Creates Colorado Water Conservation Board for the purpose of water conservation and flood prevention. The board has the duty to "designate and approve storm or floodwater runoff channels or basins, and to make such designations avail-

able to legislative bodies of cities and incorporated town, … and counties of the state." (§ 30-60-123, C.R.S.)

(4) §§ 30-28-111, 31-23-301, C.R.S. (§ 24-65.1-403, C.R.S.) – Provides that no floodplains shall be designed by any local government until such description has been first approved by the Colorado Water Conservation Board.

(5) § 29-1-201, C.R.S. – In 1974, Section 2 of Article VI of the State Constitution was amended to permit and encourage improvements to make the most efficient and effective use of their powers and responsibilities by cooperating and contracting with other governments.

(6) Water Quality Control Commission Regulations 93 (5CCR 1002-93, last date May 31, 2004) and 94 (SCR 1002-94, last date May 31, 2004).

(d) Federal (NPDES). On November 16, 1990, the EPA issued regulations on the control of stormwater from municipal and industrial stormwater discharges. The National Pollutant Discharge Elimination System (NPDES) includes stormwater management and discharge requirements and regulations, and is a part of the Federal Clean Water Act. The stormwater management regulation was developed to reduce the amount of pollutants entering streams, lakes and rivers as a result of runoff from residential, commercial and industrial areas. Regulations are found in 40 CFR 122.26, and are industry specific. Mesa County, City of Grand Junction and Grand Junction Drainage District have obtained permits to discharge stormwater under the Colorado Discharge Permit System (COR–090031). The County's CDPS Phase II Discharge Permit includes requirements to control erosion and sedimentation from construction activities.

(Res. 40-08 (Appx. A § A105), 3-19-08)

28.76.060 Special matters – Irrigation ditches.

In situations in which an irrigation ditch intersects a drainage basin, the irrigation ditch does not have to take underground waters diverted by a tile drain. However, the surface drainage must be accepted if the irrigation ditch is constructed in such a way that surface water would naturally flow into it. Clark v. Beauprez, 151 Colo. 119, 377 P.2d 105 (1962) (between private parties, the owner of an irrigation ditch can prevent an upstream landowner from diverting waters from their natural course into the irrigation ditch); City of Boulder v. Boulder and White Rock Ditch & Reservoir Company, 73 Colo. 426, 216 P. 553 (1923) (where an irrigation ditch was constructed in a natural drainageway into which surface water would naturally flow, the ditch owners could not complain merely on the grounds that the city, in building storm sewers, collected the surface water and accelerated its flow and precipitated or discharged it at some particular point in the line of the ditch instead of spreading it out at different places of entrance).

In urbanizing areas, the conflict between the natural flow of surface water and irrigation ditches which bisect many drainage basins continues to be a difficult condition to resolve, taking into consideration the rights and liabilities of upstream property owners and irrigation ditch owners. Innumerable natural drainageways have been blocked by irrigation ditches, although they were constructed long before the basin became urbanized. This special area of urban drainage points to the need for good land use requirements, as well as identification of potential problem areas.

§ 7-42-108, C.R.S. provides in part that:

> Every ditch corporation organized under the provisions of law shall be required to keep its ditch in good condition so that the water shall not be allowed to escape from the same to the injury of any mining claim, road, ditch, or other property.

This provision of Colorado law was recently interpreted in the case of Oliver v. Amity Mut. Irrigation Co., 994 P.2d 495 (Colo. App. 1999). In this case, the ditch company was being sued for damages to property resulting from a break in the bank of the ditch company's ditch. The court held that the statute imposed a duty of ordinary care, such as a person of average prudence and intelligence would use, under like circumstances to protect his or her own property. The court went on to state that, in order for the ditch

company to fulfill its statutory duty, it had to prevent erosion of the ditch bank, keep the ditch free of sediment and debris, and control the amount of water flowing through its ditch, among other things, keeping the spillway at the intersection of its ditch and another free of obstructions. Finally, the court concluded that, although a ditch company is not liable for damages caused solely by an act of God, the company may not escape liability if its negligence contributed to or cooperated with an act of God to cause the damage.

In conclusion, those that own ditches owe a duty to those property owners through which their ditches pass to maintain their ditches, using ordinary care so as to prevent damage to the adjoining real property.

(Res. 40-08 (Appx. A § A106.1), 3-19-08)

28.76.070 Special matters – Ditch owner's duty to maintain, use and manage their ditches.

In the Colorado Supreme Court case of Roaring Fork Club, L.P. v. St. Jude Company 36 P. 3d 1229 (Colo. 2001) the Court recognized that as early as Colorado's territorial legislatures, legislators recognized that our arid climate required the creation of a right to appropriate and convey water across the land of another so that lands not immediately proximate to water could be used and developed. Because of this importance of ditches, the holder of ditch easements has the right to inspect, operate, maintain, and repair the ditch. In addition, the owners of land upon which these ditches are located cannot damage the ditch or unreasonably inhibit the owner's ability to maintain the ditch. Thus, the owner of a ditch may go on the land of another for the purpose of cleaning out the waterway and making repairs. Additionally, the Colorado legislature has required ditch owners to undertake a host of duties in relation to ditch upkeep. The rights of ditch owners are so dominant that the Court held that the owner of property burdened by a ditch easement has no right to move or alter the easement without consent of the benefited owner unless he first obtains a declaration of a court that such alterations will cause no damage to the benefited owner.

(Res. 40-08 (Appx. A § A106.2), 3-19-08)

28.76.080 Special matters – Water quality.

Stormwater runoff is a major nonpoint source of water pollution. In urbanizing areas, where land-disturbing activities are numerous, stormwater washes soil and sediment into surface waters causing increased levels of turbidity and eutrophication, threatening fish and wildlife, and blocking drainage. In developed areas, runoff carries with it the pollutants from surfaces over which it runs, including oil, litter, chemicals, nutrients and biological wastes, together with soils eroded from downstream channels of the flow.

It is reasoned that water quality control should be an integral part of any drainage or stormwater management program, since stormwater management techniques are often consistent with water quality objectives. However, this special area, as related to urban drainage, has not been researched adequately enough so as to provide the facts upon which a cost-effective approach could integrate water quality objectives with plans for surface drainage improvements. See City of Boulder v. Boulder and White Rock Ditch & Reservoir Company, 73 Colo. 426, 216 P. 553, 555 (1923).

(Res. 40-08 (Appx. A § A106.3), 3-19-08)

28.76.090 Special matters – Economic loss rule – Duty of care.

In the case of BRW, Inc. et al. v. Dufficy & Sons, Inc. 99 P. 3d 66 (Colo. 2004), the Colorado Supreme Court addressed the economic loss rule as it applies to contractual relationships. It holds that courts must focus on the contractual relationship between and among the parties when there is a claim of economic loss as a result of a construction contract. Thus it is not enough to simply allege negligence in a construction claims case. There must be a contractual relationship between the parties in order to sustain a claim based upon an economic loss. The Court reasoned that the economic loss rule applies in construction cases in order to permit the court to enforce expectancy interests of the parties so that they can reliably allocate risks and costs during their bargaining and to encourage the parties to build the cost considerations into the contract because they will not be able to recover economic damages in tort. Therefore, it should be assumed that in order to successfully pursue a claim in economic loss in a construction contract,

there must be a contractual relationship, either express or implied, between the parties and the provisions of that contract must address the obligation that is being alleged was breached.

(Res. 40-08 (Appx. A § A106.4), 3-19-08)

28.76.100 Special matters – Water rights and drainage improvements.

Although infrequently raised, the issue of the impact of drainage improvements on existing water rights in Colorado should be considered, evaluated and addressed as part of any drainage improvement planning. The Water Right Determination and Administration Act of 1969 provides remedies for water right owners who are impacted by the action of others.

In the case of The Board of County Commissioners of the County of Arapahoe et al. v. Crystal Creek Homeowners' Association et al. 14 P. 3d 325 (Colo. 2000) the Colorado Supreme Court affirmed its earlier holding in the case of Pueblo West Metro. Dist v. Southeastern Colo. Water Conservation Dist. 689 P. 2d 594 that the capture and storage of flood waters may be a beneficial use underlying an appropriation of water. Therefore, these cases confirm that the capture and storage of flood water is a permitted use under the statutory water rights scheme in Colorado thus establishing the need to obtain a recognized water right if a drainage or flood control facility will impact the availability of water and thus other water rights holders.

(Res. 40-08 (Appx. A § A106.5), 3-19-08)

28.76.110 Special matters – Governmental entity not liable for refusal to issue certificate of occupancy of residence constructed in a floodplain.

In the case of Patzer v. City of Loveland 2003 Colo. App. LEXIS 1506 (Colo. App. 2003), the City of Loveland was sued by a construction company who had received a building permit for a residence based upon its engineer's report. After the residence was completed, the City refused to issue a certificate of occupancy due to the fact that the City's engineering report, completed after the building permit was issued, showed that the residence encroached into the 100-year floodplain. Although the City eventually issued the certificate of occupancy, the Court held that the issuance of a building permit is an exercise of the City's police powers which include the regulation of flood control. Further, that a building permit contains no agreement, consideration, or promise that a certificate of occupancy would be issued. Therefore, the City could not be held liable for breach of contract. Finally, the Court went on to hold that the Governmental Immunity Act protected the City from a claim of negligent misrepresentation. Thus, the construction company received no relief from the Court.

(Res. 40-08 (Appx. A § A106.6), 3-19-08)

28.76.120 Special matters – Any legislatively formulated assessment, fee or charge that is imposed on a broad class of property owners by a local government is not considered taking of property.

In the case of Marshall B. Krupp, et al. v. The Breckenridge Sanitation District, et al. 19 P. 3d 687 (Colo. 2001), the Court was asked to address Colorado's regulatory takings statute and the statute's explicit declination to apply the Nollan/Dolan tests to "any legislatively formulated assessment, fee, or charge that is imposed on a broad class of property owners by a local government." The Krupp case arose when the Breckenridge Sanitation District legislatively assessed a fee on all building projects within the district. The Krupps challenged the assessment of the fee on their new residential townhouse project on the basis that it amounted to an unconstitutional taking of property. The Colorado Supreme Court held that a legislatively created, generally applicable service fee is not subject to a takings analysis under Nollan/Dolan. Therefore, once a fee such as that in this case is assessed by way of a legislative act of the governmental entity it virtually cannot be challenged as being unconstitutional.

(Res. 40-08 (Appx. A § A106.7), 3-19-08)

28.76.130 Special matters – Governmental immunity in regard to irrigation and drainage ditches used as part of stormwater drainage system.

In the Colorado Supreme Court cases of City of Colorado Springs v. Powell 48 P. 3d 561 (Colo. 2002) and in the companion case of City of Longmont v. Henry-Hobbs 50 P. 3d 906 (Colo. 2002) the Court held that irrigation and drainage ditches used as part of a stormwater drainage system are considered "sanitation facilities" under the Colorado Governmental Immunity Act. Since those ditches are covered under the CGIA, a governmental entity that uses those ditches for drainage or flood control will be held legally responsible, within the limits of the CGIA, for their negligent design or negligent maintenance. In a final holding of the Court, the Court clearly stated that it was not holding that all irrigation ditches are sanitation facilities.

In the 2003 session of the Colorado General Assembly, House Bill 03-1288 was passed and signed by the Governor. That Act specifically addressed the City of Colorado Springs and City of Longmont cases and noted that those cases may have significantly expanded the potential liability of governmental entities providing utility services to the public. The Act specifically redefined the word "maintenance" to mean "the act or omission of a public entity or public employee in keeping a facility in the same general state of repair or efficiency as initially constructed or in preserving a facility from decline or failure. 'Maintenance' does not include any duty to upgrade, modernize, modify, or improve the design or construction of a facility." The purpose of this section of the Act was to clarify that governmental entities do not have an affirmative duty to improve the design or construction of a facility.

The Act went on to redefine what a "public sanitation facility" is and is not. In describing what a "public sanitation facility" is not, the Act reads as follows: "'Public sanitation facility' does not include: a public water facility; a natural watercourse even if dammed, channelized, or containing stormwater runoff, discharge from a storm sewer, or discharge from a sewage treatment plant outfall; a drainage, borrow, or irrigation ditch even if the ditch contains stormwater runoff or discharge from storm sewers; a curb and gutter system; or other drainage, flood control, and stormwater facilities." Therefore, after this Act became effective on July 1, 2003, governmental entities were again protected from liability under the CGIA for negligent design and maintenance of a drainage facility which includes an irrigation ditch.

(Res. 40-08 (Appx. A § A106.8), 3-19-08)

28.76.140 Special matters – Concerning interference with the flow of water in ditch.

§ 37-89-101, C.R.S. was amended in the 2001 session of the Colorado General Assembly and provides that anyone who "interferes with the flow of water in any drainage ditch" shall be legally responsible for full restitution for the actual damages that were sustained as a result of that interference.

(Res. 40-08 (Appx. A § A106.9), 3-19-08)

Chapter 28.80

EXCERPTS FROM UDSCD VOLUME 3

Sections:
28.80.010 Excerpts from UDSCD Volume 3.

28.80.010 Excerpts from UDSCD Volume 3.

6.0 EXTENDED DETENTION BASIN (EDB)—SEDIMENTATION FACILITY

6.1 Description

An extended detention basin (EDB) is a sedimentation basin designed to totally drain dry sometime after stormwater runoff ends. It is an adaptation of a detention basin used for flood control. The primary difference is in the outlet design. The EDB uses a much smaller outlet that extends the emptying time of the more frequently occurring runoff events to facilitate pollutant removal. The EDB's drain time for the brim-full water quality capture volume (i.e., time to fully evacuate the design capture volume) of 40 hours is recommended to remove a significant portion of fine particulate pollutants found in urban stormwater runoff. Soluble pollutant removal can be somewhat enhanced by providing a small wetland marsh or ponding area in the basin's bottom to promote biological uptake. The basins are considered to be "dry" because they are designed not to have a significant permanent pool of water remaining between storm runoff events. However, EDB may develop wetland vegetation and sometimes shallow pools in the bottom portions of the facilities.

6.2 General Application

An EDB can be used to enhance stormwater runoff quality and reduce peak stormwater runoff rates. If these basins are constructed early in the development cycle, they can also be used to trap sediment from construction activities within the tributary drainage area. The accumulated sediment, however, will need to be removed after upstream land disturbances cease and before the basin is placed into final long-term use. Also, an EDB can sometimes be retrofitted into existing flood control detention basins.

EDBs can be used to improve the quality of urban runoff coming from roads, parking lots, residential neighborhoods, commercial areas, and industrial sites and are generally

used for regional or follow-up treatment. Referring to Figure ND-8 in the earlier chapter, EDBs are most applicable for catchments with a tributary impervious area of 10 acres of more. They can be used as an onsite BMP that works well with other BMPs, such as upstream onsite source controls and downstream infiltration/filtration basins or wetland channels. If desired, a flood routing detention volume can be provided above the water quality capture volume (*WQCV*) of the basin.

6.3 Advantages/Disadvantages

6.3.1 General

An EDB can be designed to provide other benefits such as recreation and open space opportunities in addition to reducing peak runoff rates and improving water quality. They are effective in removing particulate matter and the associate heavy metals and other pollutants. As with other BMPs, safety issues need to be addressed through proper design.

6.3.2 Physical Site Suitability

Normally, the land required for an EDB is approximately 0.5 to 2.0 percent of the total tributary development area. In high groundwater areas, consider the use of retention ponds (RP) instead in order to avoid many of the problems that can occur when the EDB's bottom is located below the seasonal high water table. Soil maps should be consulted, and soil borings may be needed to establish design geotechnical parameters.

6.3.3 Pollutant Removal

The pollutant removal range of an EDB was presented in Table SQ-6 in the STORMWATER QUALITY MANAGEMENT chapter of this volume. Removal of suspended solids and metals can be moderate to high, and removal of nutrients is low to moderate. The removal of nutrients can be improved when a small shallow pool or wetland is included as part of the basin's bottom or the basin is followed by BMPs more efficient at removing soluble pollutants, such as a filtration system, constructed wetlands or wetland channels.

The major factor controlling the degree of pollutant removal is the emptying time provided by the outlet. The rate and degree of removal will also depend on influent particle sizes. Metals, oil and grease, and some nutrients have a close affinity for suspended sediment and will be removed partially through sedimentation.

6.3.4 Aesthetics and Multiple Uses

Since an EDB is designed to drain very slowly, its bottom and lower portions will be inundated frequently for extended periods of time. Grasses in this frequently inundated zone will tend to be stressed, with only the species that can survive the specific environment at each site eventually prevailing. In addition, the bottom will be the depository of all the sediment that settles out in the basin. As a result, the bottom can be muddy and may have an undesirable appearance to some. To reduce this problem and to improve the basin's availability for other uses (such as open space habitat and passive recreation), it is suggested that the designer provide a lower-stage basin as suggested in the Two Stage Design procedure. As an alternative, a retention pond (RP) could be used, in which the settling occurs primarily within the permanent pool.

6.4 Design Considerations

Whenever desirable and feasible, incorporate the EDB within a larger flood control basin or as a part of a full-spectrum detention facility. Also, whenever possible try to accommodate within the basin other urban uses such as passive recreation and wildlife habitat. If multiple uses are being contemplated, consider using a multiple-stage detention basin to limit inundation of passive recreational areas to one or two occurrences a year. Generally, the area within the *WQCV* is not well suited for active recreation facilities such as ballparks, playing fields, and picnic areas. These are best located above the *WQCV* pool level.

Figure EDB-1 shows a representative layout of an EDB. Although flood control storage can be accomplished by providing a storage volume above the water quality storage, how best to accomplish this is not included in this discussion. Whether or not flood storage is provided, all embankments should be protected from catastrophic failure when runoff exceeds the design event. The State Engineer's regulatory requirements for larger dam embankments and storage volumes must be followed whenever regulatory height and/or volume thresholds are exceeded. Below those thresholds, the engineer should design the embankment-spillway-outlet system so that catastrophic failure will not occur.

Perforated outlet and trash rack configurations are illustrated in the TYPICAL STRUCTURAL BMP DETAINS AND SPECIFICATIONS chapter. Figure EDB-3 equates the *WQCV* that needs to be emptied over 40 hours, to the total required area of perforations per row for the standard configurations shown in that section. The chart is based on the rows being equally spaced vertically at 4-inch centers. This total area of perforations per row is then used to determine the number of uniformly sized holes per row (see detail in the TYPICAL STRUCTURAL BMP DETAINS AND SPECIFICATIONS chapter). One or more perforated columns on a perforated orifice plate integrated into the front of the outlet can be used; however, the fewer the number of columns, the better, maximizing the size of the orifice. Using least number of columns and the largest possible orifice, reduces clogging possibilities. Other types of outlets may also be used, provided they control the release of the *WQCV* in a manner consistent with the drain time requirements and are approved in advance by the District.

Although the soil types beneath the pond seldom prevent the use of this BMP, they should be considered during design. Any potential exfiltration capacity should be considered a short-term characteristic and ignored in the design of the *WQCV* because exfiltration will decrease over time as the soils clog with fine sediment and as the groundwater beneath the basin develops a mound that surfaces into the basin. At the same time, the findings by the International BMP Database team suggest that an EDP can reduce annual runoff volume by about 30% and this finding can help justify the annual pollutant load reductions when assessing the performance of this facility.

High groundwater should not preclude the use of an EDB. Groundwater, however, should be considered during design and construction, and the outlet design must account for any upstream base flows that enter the basin or that may result from groundwater surfacing within the basin itself.

Stable, all weather access to critical elements of the pond, such as the inlet, outlet, spillway, and sediment collection areas must be provided for maintenance purposes.

6.5 Design Procedure and Criteria

The following steps outline the design procedure and criteria for an EDB.

1. Basin Storage Volume

Provide a storage volume equal to 120 percent of the *WQCV* based on a 40-hour drain time, above the lowest outlet (i.e., perforation) in the basin. The additional 20 percent of storage volume provides for sediment accumulation and the resultant loss in storage volume.

A. Determine the *WQCV* tributary catchment's percent imperviousness. Account for the effects of DCIA, if any, on Effective Imperviousness. Using runoff volume reduction practices in the tributary catchment and Figure ND-1, determine the reduction in impervious area to use with *WQCV* calculations.

B. Find the required storage volume (watershed inches of runoff):

Determine the Required *WQCV* (watershed inches of runoff) using Figure EDB-2, based on the EDB's 40-hour drain time.

Calculate the Design Volume in acre-feet as follows:

$$Design\ Volume = \left(\frac{WQCV}{12}\right) * Area * 1.2$$

In which:

Area	=	The watershed area tributary to the extended detention pond
1.2 factor	=	Multiplier of 1.2 to account for the additional 20% of required storage for sediment accumulation

2. Outlet Works

The Outlet Works are to be designed to release the *WQCV* (i.e., not the "Design Volume") over a 40-hour period. Refer to the TYPICAL STRUCTURAL BMP DETAINS AND SPECIFICATIONS chapter for schematics pertaining to structure geometry; grates, trash racks, and screens; outlet type: orifice plate or perforated riser pipe; cutoff collar size and location; and all other necessary components.

For a perforated outlet, use Figure EDB-3 to calculate the required area per row based on *WQCV* and the depth of perforations at the outlet. See the TYPICAL STRUCTURAL BMP DETAINS AND SPECIFICATIONS chapter to determine the appropriate perforation geometry and number of rows. The lowest perforations should be set at the water surface elevation of the outlet micro-pool. The total outlet area is calculated by multiplying the area per row by the number of rows.

Minimized the number of columns and maximize the perforation hole diameter when designing outlets to reduce chances of clogging by accepting the orifice site that will empty the *WQCV* in 36 to 44 hours.

3. Trash Rack

Provide a trash rack of sufficient size to prevent clogging of the primary water quality outlet. Size the rack so as not to interfere with the hydraulic capacity of the outlet. Using the total outlet area and the selected perforation diameter (or height), Figures 6, 6a or 7 in the TYPICAL STRUCTURAL BMP DETAINS AND SPECIFICATIONS chapter will help to determine the minimum open area required for the trash rack.

Use one-half of the perforated plate's total outlet area to calculate the trash rack's size. This accounts for the variable inundation of the outlet orifices. Figures 6 and 6a were developed as suggested standardized outlet designs for smaller sites.

4. Basin Shape

Shape the pond whenever possible with a gradual expansion from the inlet and a gradual contraction toward the outlet, thereby minimizing short circuiting. It is best to have a basin length to width ratio between 2:1 to 3:1. To achieve this, it may be necessary to modify the inlet and outlet points through the use of pipes, swales or channels to accomplish this.

Always maximize the distance between the inlet and the outlet.

5. Two-Stage Design

A two-stage design with a pool that fills often with frequently occurring runoff minimizes standing water and sediment deposition in the remainder of the basin. The two stages are as follows:

A. Top Stage: The top stage should be one or more feet deep with its bottom sloped at 1 to 2 percent toward the trickle flow channel.

B. Bottom Stage: The dry weather water surface of the active surcharge volume of the bottom stage should be 0.5 feet or more below the bottom of the top stage, but no less than 4-inches below the invert of the upstream trickle channel, and store no less than 0.5 percent of the *WQCV*.

Provide a permanent micro-pool below the active storage volume of the lower stage in front of the outlet. The pool should be 1/2 the depth of the top stage depth described above, or 2.5 feet, whichever results in the larger depth.

6. Low-Flow Channel

Conveys low flows from the forebay to the bottom stage. To provide a maintainable trickle-flow channel, lining its bottom with concrete is recommended. Otherwise line its sides with buried Type VL soil riprap and bottom with concrete. Make it at least 4-inches deep if concrete lined sides and 8-inches if buried riprap sides are used. At a minimum provide capacity equal to twice the release capacity at the upstream forebay outlet.

7. Basin Side Slopes

Basin side slopes should be stable and gentle to facilitate maintenance and access. Side slopes should be no steeper than 4:1 and the use of flatter slopes is recommended; the flatter, the better and safer.

8. Dam Embankment

Design the embankment not to fail during a 100-year and larger storms. Embankment slopes should be no steeper than 3:1, preferably 4:1 or flatter, and planted with turf forming grasses. Poorly compacted native soils should be excavated and replaced. Embankment soils should be compacted to at least 95 percent of their maximum density according to ASTM D 698-70 (Modified Proctor). Spillway structures and overflows should be designed in accordance with local drainage criteria and should consider UDFCD drop-structure design guidelines.

9. Vegetation

Bottom vegetation provides erosion control and sediment entrapment. Pond bottom, berms, and side sloping areas may be planted with native grasses or with irrigated turf, depending on the local setting and needs.

10. Access

All weather stable access to the bottom, forebay, and outlet works area shall be provided for maintenance vehicles. Grades should not exceed 10 percent, and a solid driving surface of gravel, rock, concrete, gravel-stabilized turf, or Type VL soil riprap should be provided.

11. Inlet

Dissipate flow energy at pond's inflow point(s) to limit erosion and promote particle sedimentation. Inlets should be designed in accordance with UDFCD drop structure criteria, impact basin outlet details, or other types of energy dissipating structures.

12. Forebay Design

Provides an opportunity for larger particles to settle out in the inlet in an area that has a solid surface bottom to facilitate mechanical sediment removal. A rock berm or concrete-wall should be constructed between the forebay and the main EDB. The forebay volume of the permanent pool should be about 3 to 5 percent of the design *WQCV*. A pipe throughout the berm to convey water the main body of the EDB should be offset from the inflow streamline to prevent short circuiting and should be sized to drain the forebay volume in 3 to 5 minutes, respectively. The floor of the forebay should be concrete or grouted boulder lined to define sediment removal limits.

13. Flood Storage

Combining the water quality facility with a flood control facility is recommended. The 5-year, 10-year, 100-year, or other floods may be detained above the *WQCV*. See Section 1.5.5 of the BMP PLANNING FOR NEW DEVELOPMENT AND SIGNIFICANT REDEVELOPMENT chapter of this volume for further guidance.

14. Multiple Uses

When desirable and feasible, incorporate the EDB within a larger flood control basin. Also, whenever possible, try to provide for other urban uses such as active or passive recreation, and wildlife habitat. If multiple uses are being contemplated, use the multiple-stage detention basin design approach to limit inundation of passive recreational areas to one or two occurrences a year. **The area within the *WQCV* is not suited for active**

recreation activities such as ballparks, playing fields, and picnic areas. These are best located above the *WQCV* level.

6.6 Design Example

Design forms that provide a means of documenting the design procedure are included in the DESIGN FORMS chapter. A completed form follows as a design example.

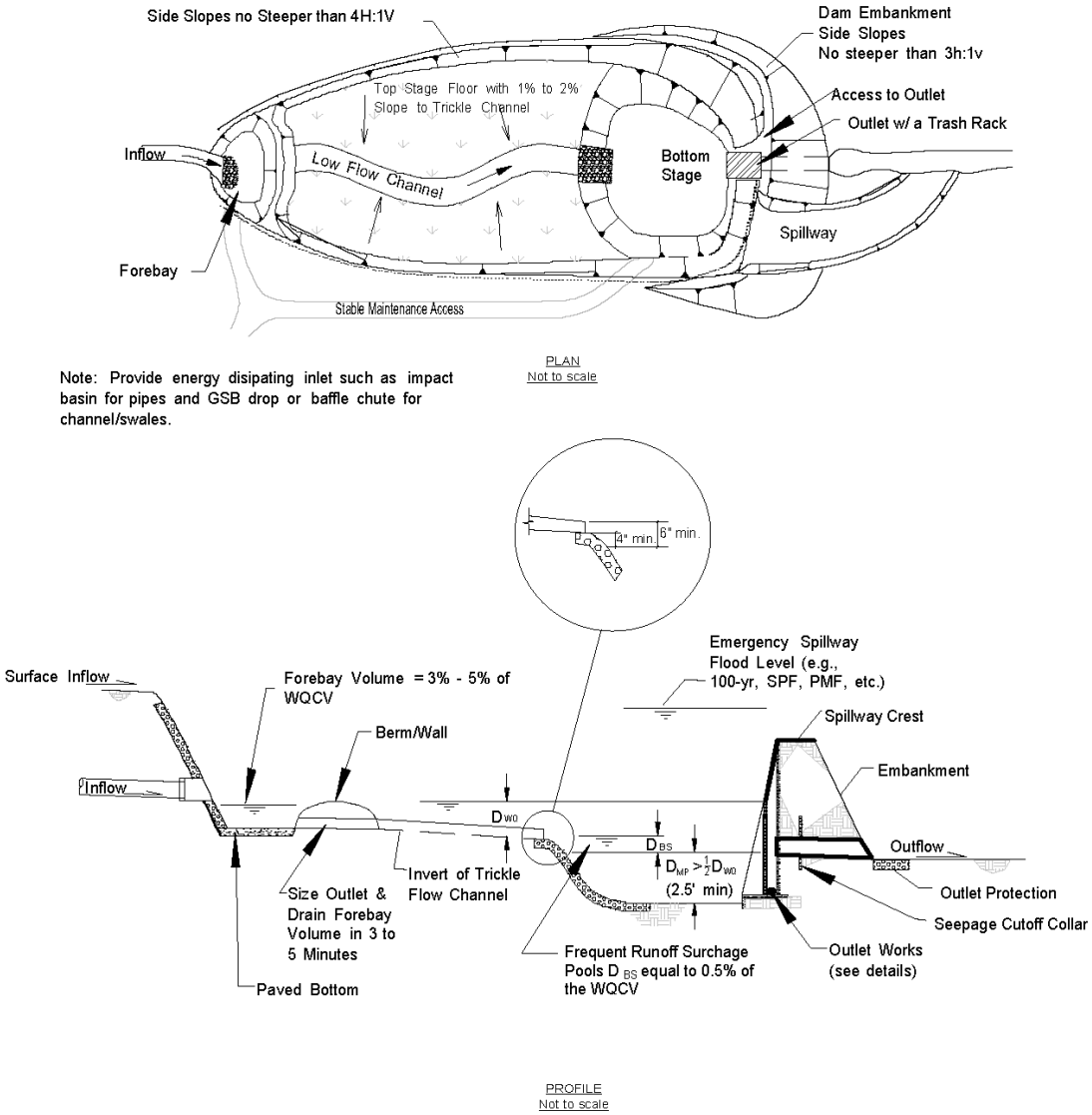


Figure EDB-1 –Extended Detention Basin (EDB) – Plan and Sections

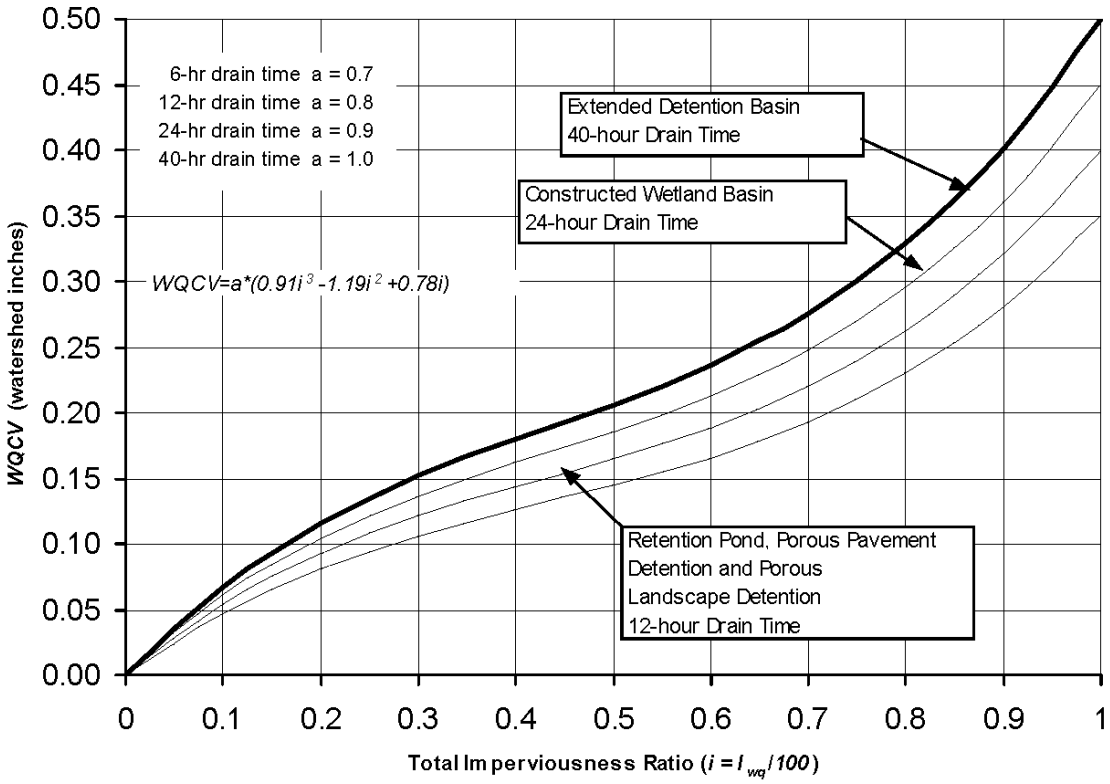


Figure EDB-2—Water Quality Capture Volume (*WQCV*), 80th Percentile Runoff Event

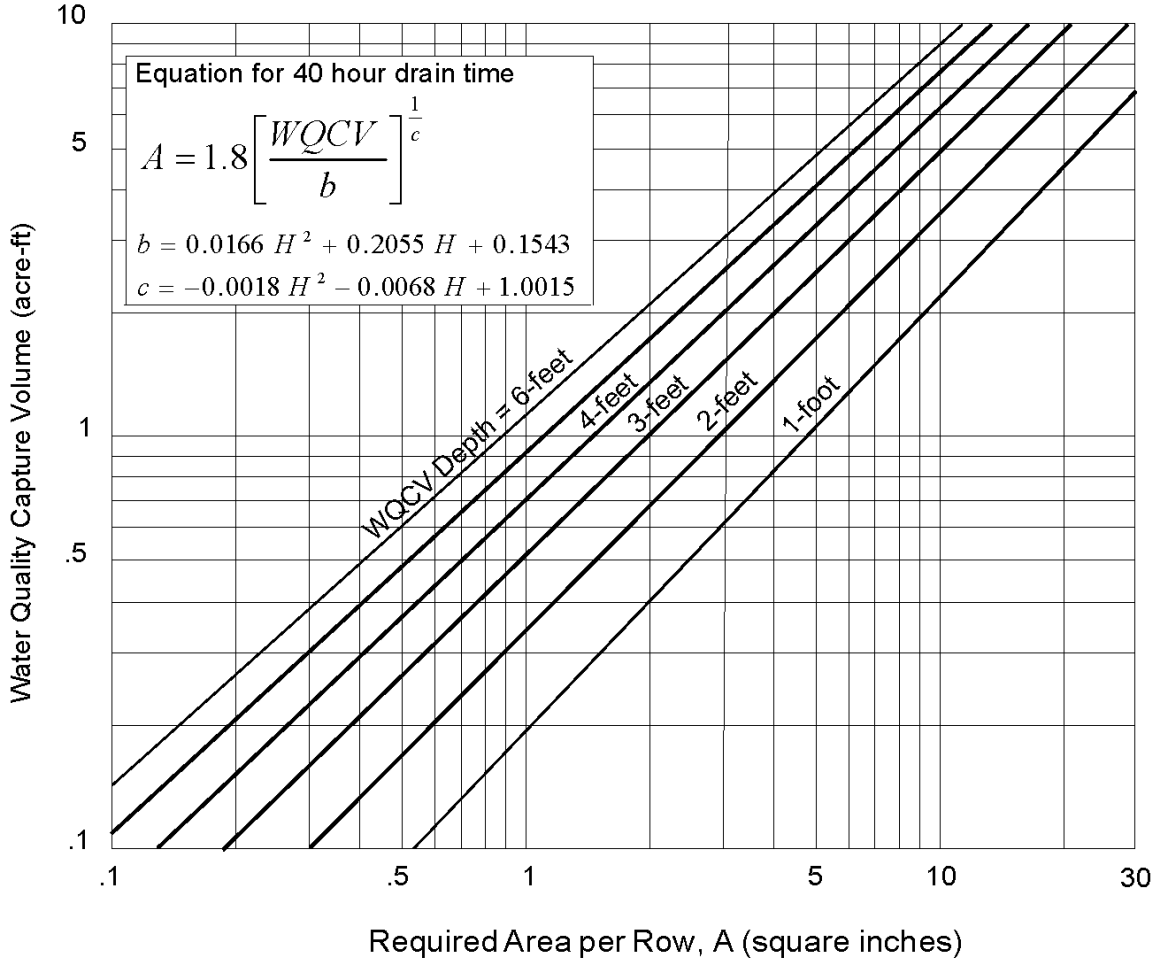


Figure EDB-3—Water Quality Outlet Sizing: Extended Detention Basin (Dry)
With 40-hour Drain Time for Capture Volume
(Equation on this figure valid only for WQCV Depth H ≤ 6 feet)

Design Procedure Form: Extended Detention Basin (EDB) - Sedimentation Facility

Sheet 1 of 3

Designer:	**Joseph Stormwater**
Company:	**BLWH, Inc.**
Date:	**October 1, 2005**
Project:	**Sleepy Acres Residential and Commenrcial Getaway**
Location:	**40th Latitude, Colorado.**

1. Basin Storage Volume	
A) Tributary Area's Imperviousness Ratio (i = I_a / 100)	I_a = 60.00 % i = 0.60
B) Contributing Watershed Area (Area)	Area = 45.000 acres
C) Water Quality Capture Volume (WQCV) (WQCV =1.0 * (0.91 * I^3 - 1.19 * I^2 + 0.78 * I))	WQCV = 0.24 watershed inches
D) Design Volume: Vol = (WQCV / 12) * Area * 1.2	Vol = 1.0627 acre-feet
2. Outlet Works	
A) Outlet Type (Check One)	X Orifice Plate Perforated Riser Pipe Other:
B) Depth at Outlet Above Lowest Perforation (H)	H = 2.50 feet
C) Recommended Maximum Outlet Area per Row, (A_o)	A_o = 1.7 square inches
D) Perforation Dimensions: i) Circular Perforation Diameter or ii) Width of 2" High Rectangular Perforations	 D = 1.500 inches W = inches
E) Number of Columns (nc, See Table 6a-1 For Maximum)	nc = 1 number
F) Actual Design Outlet Area per Row (A_o)	A_o = 1.8 square inches
G) Number of Rows (nr)	nr = 8 number
H) Total Outlet Area (A_{ot})	A_{ot} = 13.3 square inches
3. Trash Rack	
A) Needed Open Area: A_t = 0.5 * (Figure 7 Value) * A_{ot}	A_t = 424 square inches
B) Type of Outlet Opening (Check One)	X ≤ 2" Diameter **Round** 2" High **Rectangular** Other:
C) For 2", or Smaller, **Round Opening** (Ref.: Figure 6a):	
i) Width of Trash Rack and Concrete Opening (W_{conc}) from Table 6a-1	W_{conc} = 15 inches
ii) Height of Trash Rack Screen (H_{TR})	H_{TR} = 60 inches

Design Procedure Form: Extended Detention Basin (EDB) - Sedimentation Facility

Sheet 2 of 3

Designer: Joseph Stormwater
Company: BLWH, Inc.
Date: October 1, 2005
Project: Sleepy Acres Residential and Commenrcial Getaway
Location: 40th Latitude, Colorado.

iii) Type of Screen (Based on Depth H), Describe if "Other"	X S.S. #93 VEE Wire (US Filter) Other:
iv) Screen Opening Slot Dimension, Describe if "Other"	X 0.139" (US Filter) Other:
v) Spacing of Support Rod (O.C.) Type and Size of Support Rod (Ref.: Table 6a-2)	1.00 inches TE 0.074 in. x 0.50 in.
vi) Type and Size of Holding Frame (Ref.: Table 6a-2)	0.75 in. x 1.00 in. angle
D) For 2" High **Rectangular Opening** (Refer to Figure 6b):	
I) Width of Rectangular Opening (W)	W = inches
ii) Width of Perforated Plate Opening (W_{conc} = W + 12")	W_{conc} = inches
iii) Width of Trashrack Opening ($W_{opening}$) from Table 6b-1	$W_{opening}$ = inches
iv) Height of Trash Rack Screen (H_{TR})	H_{TR} = inches
v) Type of Screen (based on depth H) (Describe if "Other")	Klemp™ KPP Series Aluminum Other:
vi) Cross-bar Spacing (Based on Table 6b-1, Klemp™ KPP Grating). Describe if "Other"	inches Other:
vii) Minimum Bearing Bar Size (Klemp™ Series, Table 6b-2) (Based on depth of WQCV surcharge)	
4. Detention Basin length to width ratio	1.20 (L/W)
5 Pre-sedimentation Forebay Basin - Enter design values	
A) Volume (3% to 5% of Design Volume from 1D) (3% - 5% of Design Volume (0.0319 - 0.0531 acre-feet.)	0.0400 acre-feet
B) Surface Area	0.025 acres
C) Connector Pipe Diameter (Size to drain this volume in 5-minutes under inlet control)	4 inches
D) Paved/Hard Bottom and Sides	X yes/no

Design Procedure Form: Extended Detention Basin (EDB) - Sedimentation Facility

Sheet 3 of 3

Designer:	**Joseph Stormwater**
Company:	**BLWH, Inc.**
Date:	**October 1, 2005**
Project:	**Sleepy Acres Residential and Commenrcial Getaway**
Location:	**40th Latitude, Colorado.**

6. Two-Stage Design - See Figure EDB-1	
A) Top Stage (Depth D_{WQ} = 2' Minimum) Top Stage Storage: no less than 95.74% of Design Volume (1.0174 acre-feet.)	D_{WQ} = 2.00 feet Storage= 1.1000 acre-feet
B) Bottom Stage Depth (D_{BS} = 0.33' Minimum Below Trickle Channel Invert) Bottom Stage Storage: no less than 0.5% of Design Volume (0.0053 acre-feet.) Storage = A * Depth Above WS To Bottom Of Top Stage	D_{BS} = 0.33 feet Storage= 0.0055 acre-feet Surf. Area= 0.017 acres
C) Micro Pool (Minimum Depth = the Larger of 0.50 * Top Stage Depth (1 ') or 2.5 '	Depth= 2.60 feet
D) Total Volume: Vol_{tot} = Storage from 5A + 6A + 6B (Must be > Design Volume in 1D, or 1.0627 acre-feet.)	Vol_{tot} = 1.1455 acre-feet
7. Basin Side Slopes (Z, horizontal distance per unit vertical) Minimum Z = 4, Flatter Preferred	Z = 5.00 (horizontal/vertical)
8. Dam Embankment Side Slopes (Z, horizontal distance) per unit vertical) Minimum Z = 3, Flatter Preferred	Z = 4.00 (horizontal/vertical)
9. Vegetation (Check the method or describe "Other")	_____ Native Grass X Irrigated Turf Grass _____ Other: _____

Notes:

Extended Detention Basin (EDB)

Design Procedure Form: Extended Detention Basin (EDB) - Sedimentation Facility

Sheet 1 of 3

Designer: _____
Company: _____
Date: _____
Project: _____
Location: _____

1. Basin Storage Volume	
A) Tributary Area's Imperviousness Ratio ($i = I_a / 100$)	I_a = _____ % i = _____
B) Contributing Watershed Area (Area)	Area = _____ acres
C) Water Quality Capture Volume (WQCV) (WQCV =1.0 * (0.91 * I^3 - 1.19 * I^2 + 0.78 * I))	WQCV = _____ watershed inches
D) Design Volume: Vol = (WQCV / 12) * Area * 1.2	Vol = _____ acre-feet
2. Outlet Works	
A) Outlet Type (Check One)	_____ Orifice Plate _____ Perforated Riser Pipe _____ Other: _____
B) Depth at Outlet Above Lowest Perforation (H)	H = _____ feet
C) Recommended Maximum Outlet Area per Row, (A_o)	A_o = _____ square inches
D) Perforation Dimensions: i) Circular Perforation Diameter or ii) Width of 2" High Rectangular Perforations	 D = _____ inches W = _____ inches
E) Number of Columns (nc, See Table 6a-1 For Maximum)	nc = _____ number
F) Actual Design Outlet Area per Row (A_o)	A_o = _____ square inches
G) Number of Rows (nr)	nr = _____ number
H) Total Outlet Area (A_{ot})	A_{ot} = _____ square inches
3. Trash Rack	
A) Needed Open Area: A_t = 0.5 * (Figure 7 Value) * A_{ot}	A_t = _____ square inches
B) Type of Outlet Opening (Check One)	_____ ≤ 2" Diameter **Round** _____ 2" High **Rectangular** _____ Other: _____
C) For 2", or Smaller, **Round Opening** (Ref.: Figure 6a):	
i) Width of Trash Rack and Concrete Opening (W_{conc}) from Table 6a-1	W_{conc} = _____ inches
ii) Height of Trash Rack Screen (H_{TR})	H_{TR} = _____ inches

Design Procedure Form: Extended Detention Basin (EDB) - Sedimentation Facility

Sheet 2 of 3

Designer: _____
Company: _____
Date: _____
Project: _____
Location: _____

iii) Type of Screen (Based on Depth H), Describe if "Other"	_____ S.S. #93 VEE Wire (US Filter) _____ Other: _____
iv) Screen Opening Slot Dimension, Describe if "Other"	_____ 0.139" (US Filter) _____ Other: _____
v) Spacing of Support Rod (O.C.) Type and Size of Support Rod (Ref.: Table 6a-2)	_____ inches
vi) Type and Size of Holding Frame (Ref.: Table 6a-2)	
D) For 2" High **Rectangular Opening** (Refer to Figure 6b):	
I) Width of Rectangular Opening (W)	W = _____ inches
ii) Width of Perforated Plate Opening (W_{conc} = W + 12")	W_{conc} = _____ inches
iii) Width of Trashrack Opening ($W_{opening}$) from Table 6b-1	$W_{opening}$ = _____ inches
iv) Height of Trash Rack Screen (H_{TR})	H_{TR} = _____ inches
v) Type of Screen (based on depth H) (Describe if "Other")	_____ Klemp™ KPP Series Aluminum _____ Other: _____
vi) Cross-bar Spacing (Based on Table 6b-1, Klemp™ KPP Grating). Describe if "Other"	_____ inches _____ Other: _____
vii) Minimum Bearing Bar Size (Klemp™ Series, Table 6b-2) (Based on depth of WQCV surcharge)	
4. Detention Basin length to width ratio	_____ (L/W)
5 Pre-sedimentation Forebay Basin - Enter design values	
A) Volume (3% to 5% of Design Volume from 1D)	_____ acre-feet
B) Surface Area	_____ acres
C) Connector Pipe Diameter (Size to drain this volume in 5-minutes under inlet control)	_____ inches
D) Paved/Hard Bottom and Sides	_____ yes/no

Design Procedure Form: Extended Detention Basin (EDB) - Sedimentation Facility

Designer: _____

Company: _____

Date: _____

Project: _____

Location: _____

6. Two-Stage Design - See Figure EDB-1	
A) Top Stage (Depth D_{WQ} = 2' Minimum) Top Stage Storage (no less than 94% of Design Volume)	D_{WQ} = _____ feet Storage= _____ acre-feet
B) Bottom Stage Depth (D_{BS} = 0.33' Minimum Below Trickle Channel Invert) Bottom Stage Storage (no less than 0.5% of Design Volume from 1D) Storage = A * Depth Above WS To Bottom Of Top Stage	D_{BS} = _____ feet Storage= _____ acre-feet Surf. Area= _____ acres
C) Micro Pool (Minimum Depth = the Larger of 0.50 * Top Stage Depth or 2.5 Feet)	Depth= _____ feet
D) Total Volume: Vol_{tot} = Storage from 5A + 6A + 6B (Must be greater than the Design Volume in 1D.)	Vol_{tot} = _____ acre-feet
7. Basin Side Slopes (Z, horizontal distance per unit vertical) Minimum Z = 4, Flatter Preferred	Z = _____ (horizontal/vertical)
8. Dam Embankment Side Slopes (Z, horizontal distance) per unit vertical) Minimum Z = 3, Flatter Preferred	Z = _____ (horizontal/vertical)
9. Vegetation (Check the method or describe "Other")	_____ Native Grass _____ Irrigated Turf Grass _____ Other: _____

Notes: _____

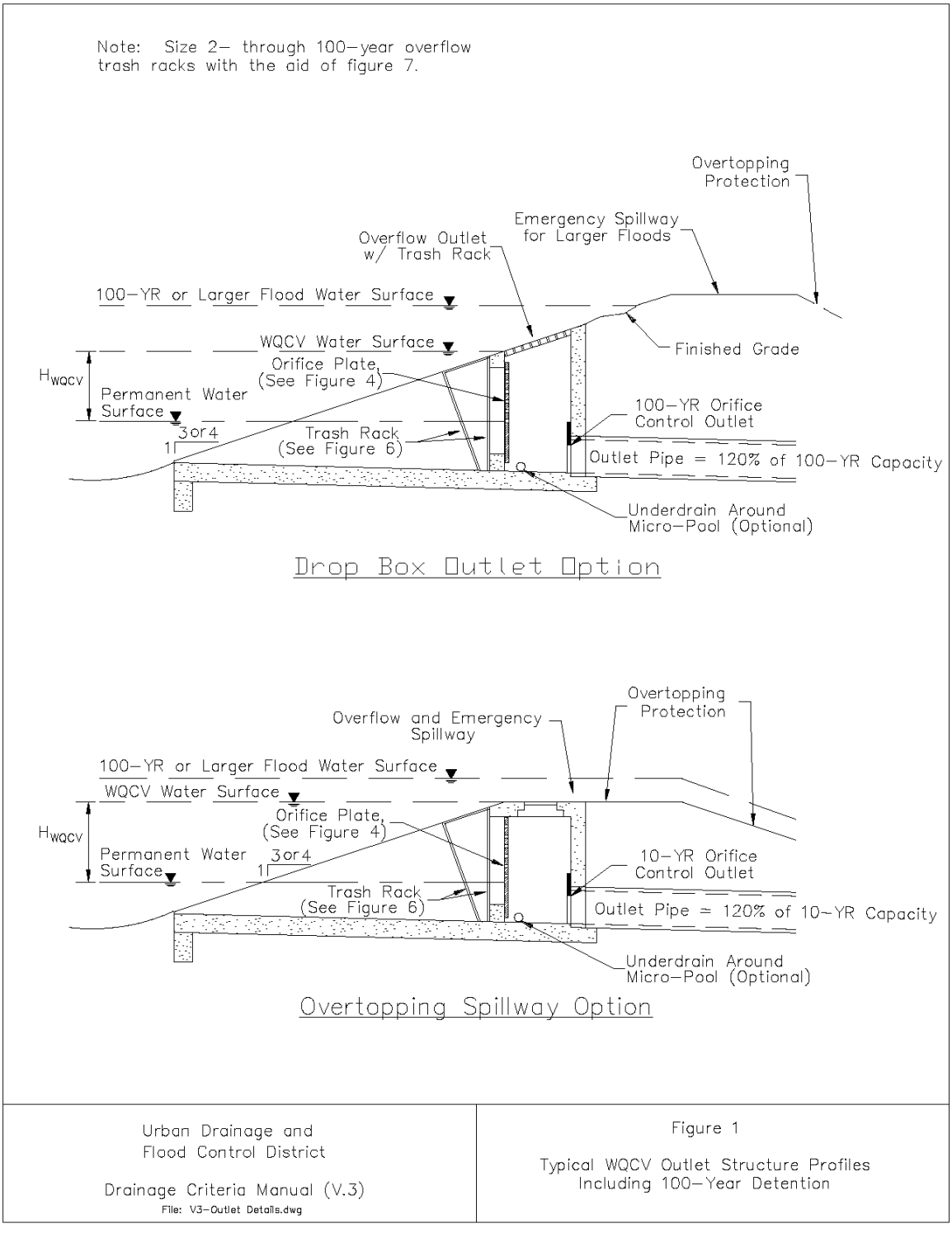


Figure 1—Typical WQCV Outlet Structure Profile, Including 100-year Detention.

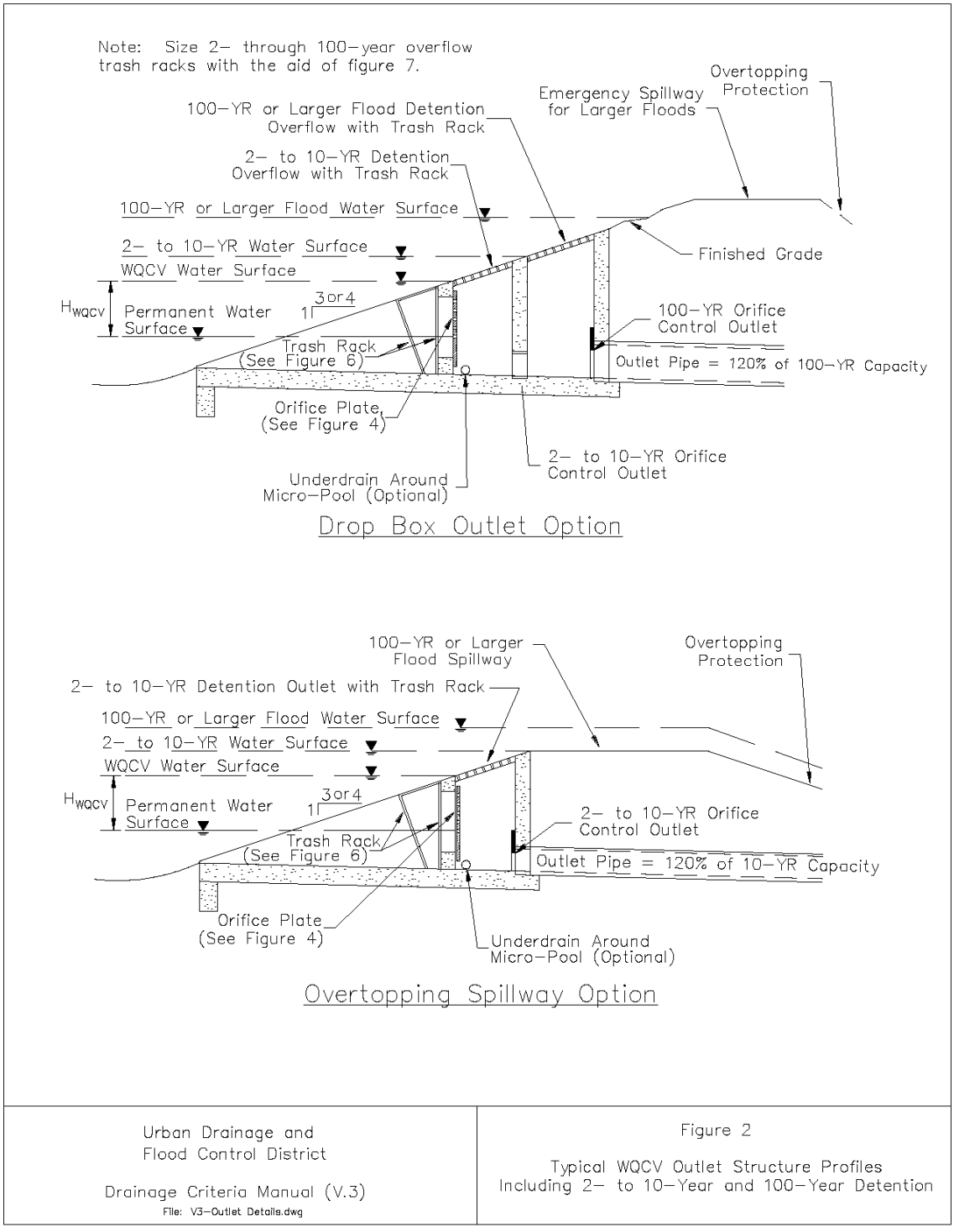


Figure 2—Typical WQCV Outlet Structure Profile, Including 2- to 10-year and 100-year Detention.

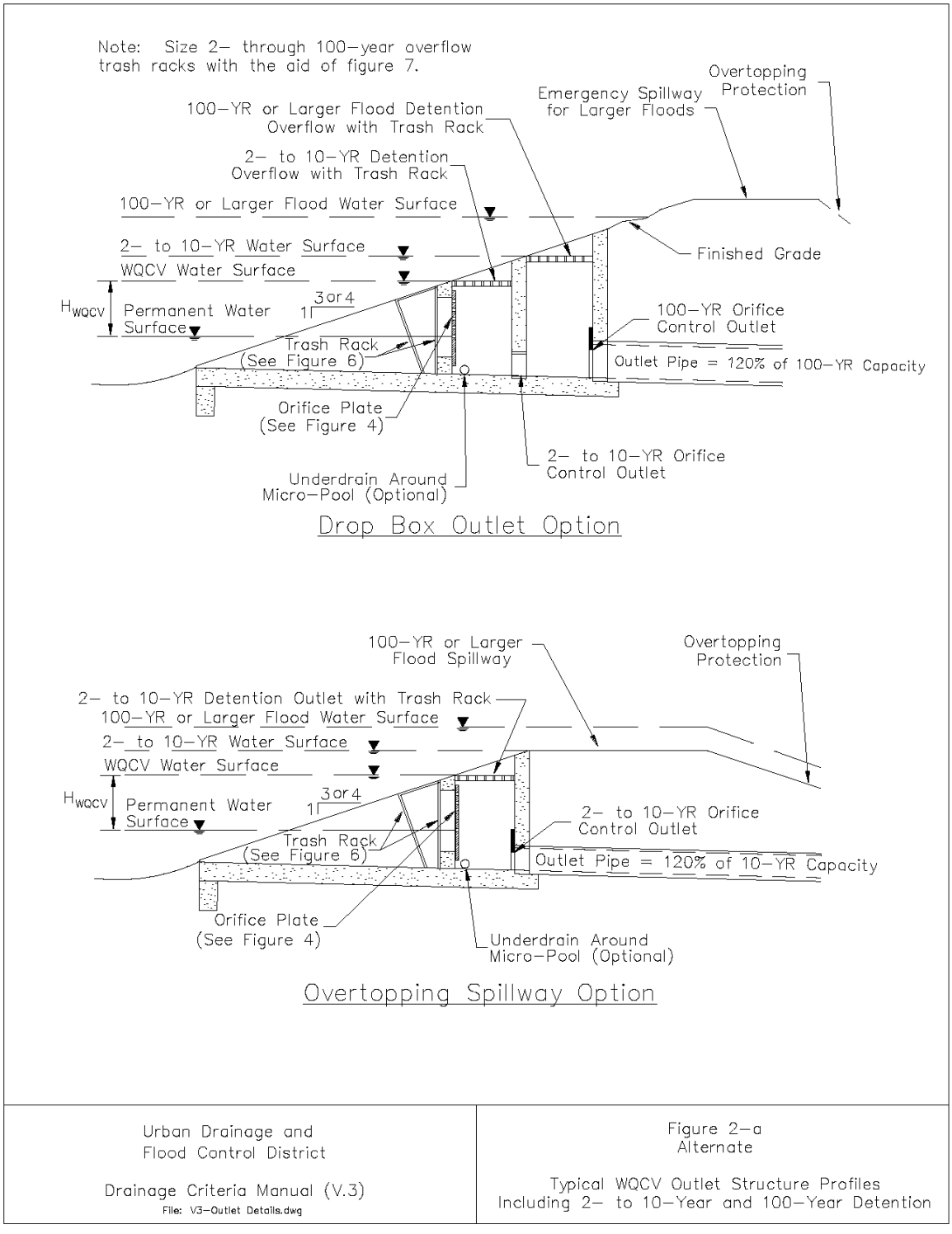


Figure 2-a—Typical WQCV Outlet Structure Profile, Including 2- to 10-year and 100-year Detention.

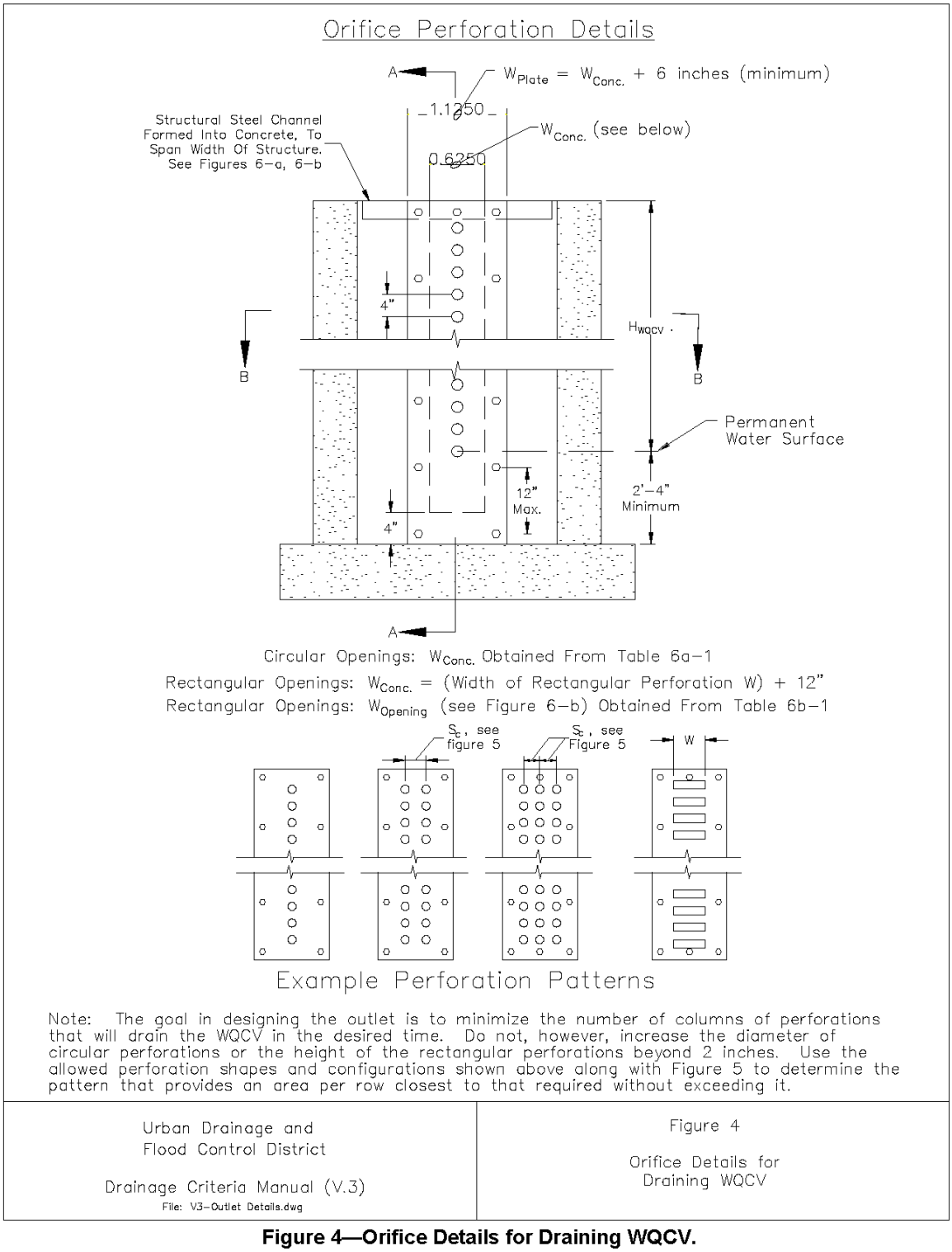
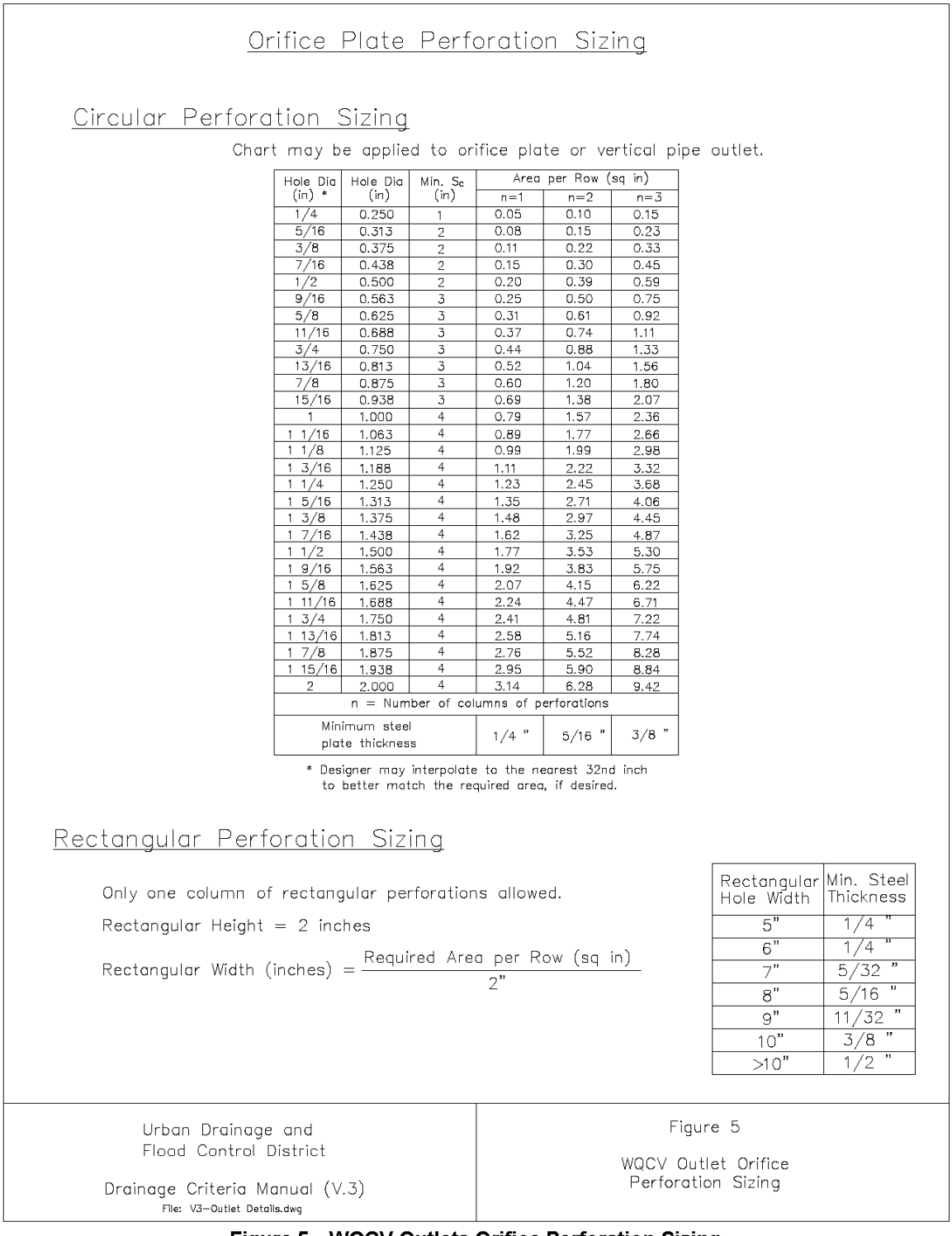


Figure 4—Orifice Details for Draining WQCV.



Orifice Plate Perforation Sizing

Circular Perforation Sizing

Chart may be applied to orifice plate or vertical pipe outlet.

Hole Dia (in) *	Hole Dia (in)	Min. S_c (in)	Area per Row (sq in)		
			n=1	n=2	n=3
1/4	0.250	1	0.05	0.10	0.15
5/16	0.313	2	0.08	0.15	0.23
3/8	0.375	2	0.11	0.22	0.33
7/16	0.438	2	0.15	0.30	0.45
1/2	0.500	2	0.20	0.39	0.59
9/16	0.563	3	0.25	0.50	0.75
5/8	0.625	3	0.31	0.61	0.92
11/16	0.688	3	0.37	0.74	1.11
3/4	0.750	3	0.44	0.88	1.33
13/16	0.813	3	0.52	1.04	1.56
7/8	0.875	3	0.60	1.20	1.80
15/16	0.938	3	0.69	1.38	2.07
1	1.000	4	0.79	1.57	2.36
1 1/16	1.063	4	0.89	1.77	2.66
1 1/8	1.125	4	0.99	1.99	2.98
1 3/16	1.188	4	1.11	2.22	3.32
1 1/4	1.250	4	1.23	2.45	3.68
1 5/16	1.313	4	1.35	2.71	4.06
1 3/8	1.375	4	1.48	2.97	4.45
1 7/16	1.438	4	1.62	3.25	4.87
1 1/2	1.500	4	1.77	3.53	5.30
1 9/16	1.563	4	1.92	3.83	5.75
1 5/8	1.625	4	2.07	4.15	6.22
1 11/16	1.688	4	2.24	4.47	6.71
1 3/4	1.750	4	2.41	4.81	7.22
1 13/16	1.813	4	2.58	5.16	7.74
1 7/8	1.875	4	2.76	5.52	8.28
1 15/16	1.938	4	2.95	5.90	8.84
2	2.000	4	3.14	6.28	9.42
n = Number of columns of perforations					
Minimum steel plate thickness			1/4 "	5/16 "	3/8 "

* Designer may interpolate to the nearest 32nd inch to better match the required area, if desired.

Rectangular Perforation Sizing

Only one column of rectangular perforations allowed.

Rectangular Height = 2 inches

$$\text{Rectangular Width (inches)} = \frac{\text{Required Area per Row (sq in)}}{2\text{"}}$$

Rectangular Hole Width	Min. Steel Thickness
5"	1/4 "
6"	1/4 "
7"	5/32 "
8"	5/16 "
9"	11/32 "
10"	3/8 "
>10"	1/2 "

Urban Drainage and Flood Control District

Drainage Criteria Manual (V.3)

File: V3-Outlet Details.dwg

Figure 5

WQCV Outlet Orifice Perforation Sizing

Figure 5—WQCV Outlets Orifice Perforation Sizing.

Orifice Plate Perforation Sizing

Circular Perforation Sizing

This table may be used to size perforation in a vertical plate of riser pipe.

Hole Dia. (in.) *	Hole Dia. (in.)	Min. S_c (in.)	Area per Row (sq. in.)		
			n = 1	n = 2	n = 3
1/4	0.250	1	0.05	0.10	0.15
5/16	0.313	2	0.08	0.16	0.24
3/8	0.375	2	0.11	0.22	0.33
7/16	0.438	2	0.15	0.30	0.45
1/2	0.500	2	0.20	0.40	0.60
9/16	0.563	3	0.25	0.50	0.75
5/8	0.625	3	0.31	0.62	0.93
11/16	0.688	3	0.37	0.74	1.11
3/4	0.750	3	0.44	0.88	1.32
13/16	0.813	3	0.52	1.04	1.56
7/8	0.875	3	0.60	1.20	1.80
15/16	0.938	3	0.69	1.38	2.07
1	1.000	4	0.79	1.58	2.37
1 1/16	1.063	4	0.89	1.78	2.67
1 1/8	1.125	4	0.99	1.98	2.97
1 3/16	1.188	4	1.11	2.22	3.33
1 1/4	1.250	4	1.23	2.46	3.69
1 5/16	1.313	4	1.35	2.70	4.05
1 3/8	1.375	4	1.48	2.96	4.44
1 7/16	1.438	4	1.62	3.24	4.86
1 1/2	1.500	4	1.77	3.54	5.31
1 9/16	1.563	4	1.92	3.84	5.76
1 5/8	1.625	4	2.07	4.14	6.21
1 11/16	1.688	4	2.24	4.48	6.72
1 3/4	1.750	4	2.41	4.82	7.23
1 13/16	1.813	4	2.58	5.16	7.74
1 7/8	1.875	4	2.76	5.52	8.28
1 15/16	1.938	4	2.95	5.90	8.85
2	2.000	4	3.14	6.28	9.42
n = Number of columns of perforations					
Minimum steel plate thickness			1/4"	5/16"	3/8"
* Designer may interfere to the nearest 32nd inch to better match the needed area if desired.					

Rectangular Perforation sizing

Use only one rectangular column whenever two 2;inch diameter circular perforations cannot provide needed outlet area.

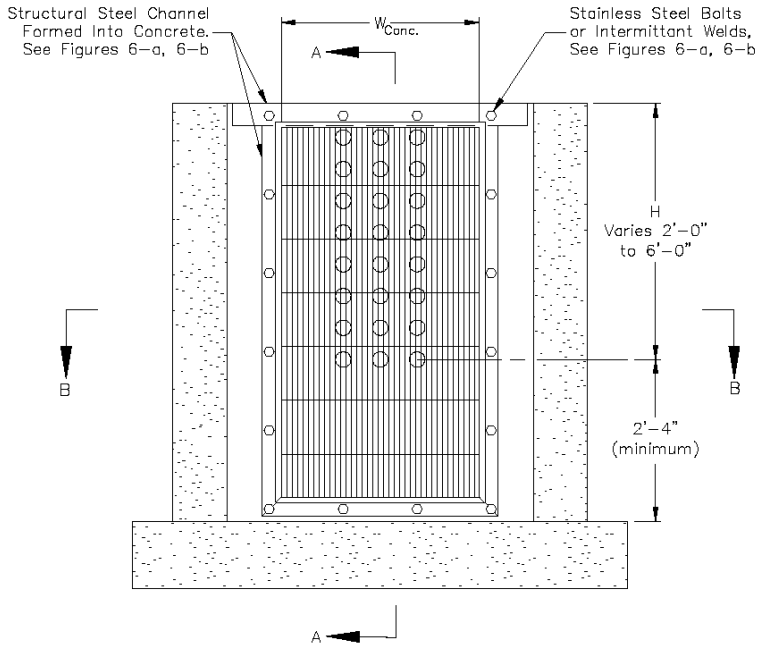
Rectangular Height = 2-inches

Rectangular Width = Required Area per Row / 2"

Rectangular hole Width	Min. Steel Thickness
5"	1/4 "
6"	1/4 "
7"	5/32 "
8"	5/16 "
9"	11/32 "
10"	3/8 "
> 10"	1/2 "

Figure 5—WQCV Outlets Orifice Perforation Sizing.

Note: Vertical WQCV Trash Racks are shown in Figures 6, 6–a, and 6–b for suggested standardized outlet design. Adverse–Slope Trash Rack design may be used for non–standardized designs, but must meet minimum design criteria.



Elevation

WQCV Trash Racks:

1. Well–screen trash racks shall be stainless steel and shall be attached by intermittant welds along the edge of the mounting frame.
2. Bar grate trash racks shall be aluminum and shall be bolted using stainless steel hardware.
3. Trash Rack widths are for specified trash rack material. Finer well–screen or mesh size than specified is acceptable, however, trash rack dimensions need to be adjusted for materials having a different open area/gross area ratio (R value)
4. Structural design of trash rack shall be based on full hydrostatic head with zero head downstream of the rack.

Overflow Trash Racks:

1. All trash racks shall be mounted using stainless steel hardware and provided with hinged and lockable or boltable access panels.
2. Trash racks shall be stainless steel, aluminum, or steel. Steel trash racks shall be hot dip galvanized and may be hot powder painted after galvanizing.
3. Trash Racks shall be designed such that the diagonal dimension of each opening is smaller than the diameter of the outlet pipe.
4. Structural design of trash rack shall be based on full hydrostatic head with zero head downstream of the rack.

Urban Drainage and Flood Control District Drainage Criteria Manual (V.3) File: V3–Outlet Details.dwg	Figure 6 Suggested WQCV Outlet Standardized Trash Rack Design

Figure 6—Suggested WQCV Outlets Standardized Trash Rack Design.

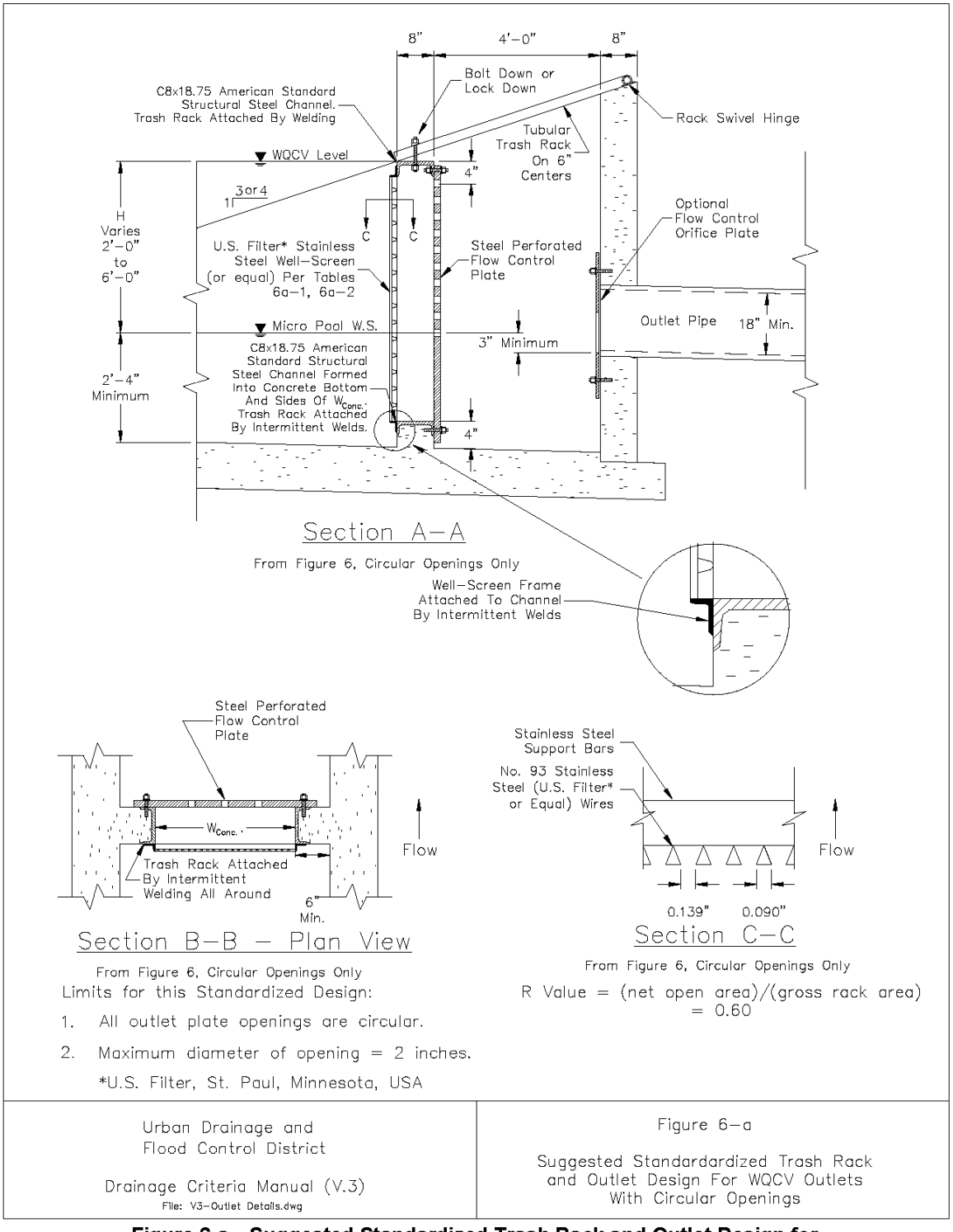


Figure 6-a—Suggested Standardized Trash Rack and Outlet Design for WQCV Outlets With Circular Openings.

Table 6a-1—Trash Rack Mounting Opening Widths per Column of Circular Perforations

(2" diameter maximum)

Minimum Width ($W_{opening}$) of Opening for a VEE Wire™ Screen Trash Rack.

Requires a minimum water depth below the lowest perforation of 2'-6".

See Figure 6-a for Explanation of Terms.

Maximum Dia. of Circular Opening (inches)	Width of Trash Rack Opening ($W_{conc.}$) Per Column of Holes as a Function of Water Depth H Above Lowest Perforation					
	H=2.0'	H=3.0'	H=4.0'	H=5.0'	H=6.0'	Maximum Number of Columns
≤ 0.25	3 in.	3 in.	3 in.	3 in.	3 in.	14
≤ 0.50	3 in.	3 in.	3 in.	3 in.	3 in.	14
≤ 0.75	3 in.	6 in.	6 in.	6 in.	6 in.	7
≤ 1.00	6 in.	9 in.	9 in.	9 in.	9 in.	4
≤ 1.25	9 in.	12 in.	12 in.	12 in.	15 in.	2
≤ 1.50	12 in.	15 in.	18 in.	18 in.	18 in.	2
≤ 1.75	18 in.	21 in.	21 in.	24 in.	24 in.	1
≤ 2.00	21 in.	24 in.	27 in.	30 in.	30 in.	1
NOTE: Minimum width of opening in the concrete shall not be less than 9 inches whenever above table indicated otherwise. Always minimize number of columns of perforations used.						

Table 6a-2—Standardized WQCV Outlet Design Using Circular Openings

(2" diameter maximum)

Johnson VEE Wire™ Stainless Steel Screen[1] (or equal) Trash Rack Design Specifications.

Max. Width of Opening	Screen #93 VEE Wire Slot Opening	Support Rod Type	Support Rod, On-Center, Spacing	Total Screen Thickness	Carbon Steel Frame Type
9"	0.139"	#156 VEE	3/4"	0.31"	3/8" x 1.0 flat bar
18"	0.139"	TE .074"x.50"	1"	0.655"	3/4" x 1.0 angle
24"	0.139"	TE .074"x.75"	1"	1.03"	1.0" x 1 1/2" angle
27"	0.139"	TE .074"x.75"	1"	1.03"	1.0" x 1 1/2" angle
30"	0.139"	TE .074"x1.0"	1"	1.155"	1 1/4" x 1 1/2" angle
36"	0.139"	TE .074"x1.0"	1"	1.155"	1 1/4" x 1 1/2" angle
42"	0.139"	TE .074"x1.0"	1"	1.155"	1 1/4" x 1 1/2" angle

[1] Johnson Screens, St. Paul, Minnesota USA (1-800-833-9473)

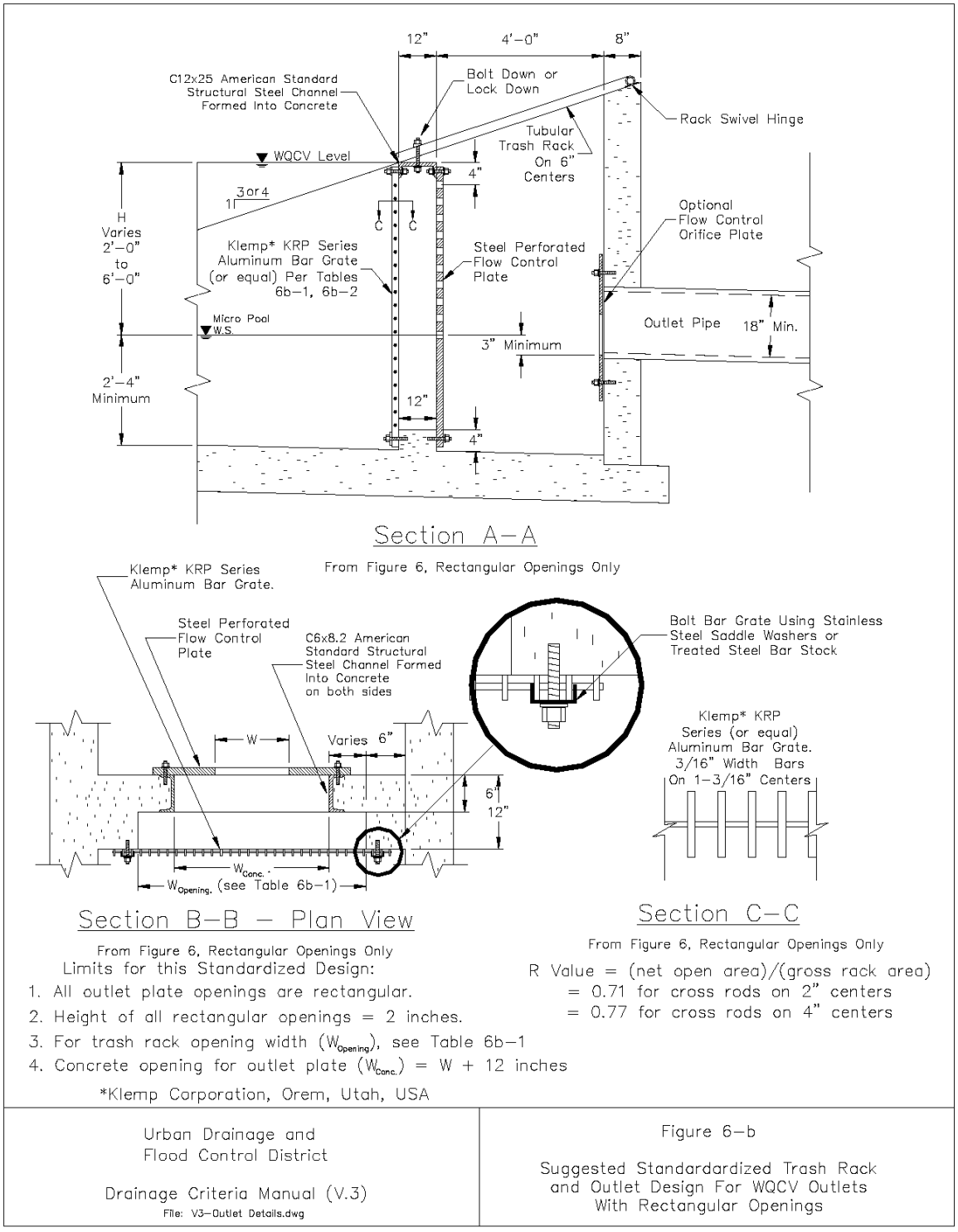


Figure 6-b—Suggested Standardized Trash Rack and Outlet Design for WQCV Outlets With Rectangular Openings.

Table 6b-1—Standardized WQCV Outlet Design Using 2" High Rectangular Openings.

Minimum Width ($W_{opening}$) of Opening for an Aluminum Bar Grate Trash Rack.

Requires a minimum water depth below the lowest perforation of 2'-4".

See Figure 6-b for Explanation of Terms.

Maximum Width W of 2" Height Rectangular Opening (inches)	Minimum Width of Trash Rack Opening ($W_{opening}$) as a Function of Water Depth H Above Lowest Perforation					
	H=2.0 ft.	H=3.0 ft.	H=4.0 ft.	H=5.0 ft.	H=6.0 ft.	Spacing of Bearing Bars, Cross Rods
2.0	2.0 ft.	2.5 ft.	2.5 ft.	2.5 ft.	3.0 ft.	1-3/16", 2"
≤ 2.5	2.5 ft.	3.0 ft.	3.0 ft.	3.5 ft.	3.5 ft.	1-3/16", 2"
≤ 3.0	3.0 ft.	3.5 ft.	3.5 ft.	4.0 ft.	4.0 ft.	1-3/16", 2"
≤ 3.5	3.5 ft.	4.0 ft.	4.5 ft.	4.5 ft.	5.0 ft.	1-3/16", 2"
≤ 4.0	3.5 ft.	4.5 ft.	5.0 ft.	5.0 ft.	5.5 ft.	1-3/16", 2"
≤ 4.5	4.0 ft.	4.5 ft.	5.0 ft.	5.5 ft.	5.5 ft.	1-3/16", 4"
≤ 5.0	4.0 ft.	5.0 ft.	5.5 ft.	6.0 ft.	6.0 ft.	1-3/16", 4"
≤ 5.5	4.5 ft.	5.5 ft.	6.0 ft.	6.5 ft.	7.0 ft.	1-3/16", 4"
≤ 6.0	5.0 ft.	6.0 ft.	6.5 ft.	7.0 ft.	7.5 ft.	1-3/16", 4"
≤ 6.5	5.5 ft.	6.5 ft.	7.0 ft.	7.5 ft.	8.0 ft.	1-3/16", 4"
≤ 7.0	6.0 ft.	7.0 ft.	7.5 ft.	8.5 ft.	8.5 ft.	1-3/16", 4"
≤ 7.5	6.0 ft.	7.5 ft.	8.5 ft.	9.0 ft.	9.5 ft.	1-3/16", 4"
≤ 8.0	6.5 ft.	8.0 ft.	9.0 ft.	9.5 ft.	10.0 ft.	1-3/16", 4"
≤ 8.5	7.0 ft.	8.5 ft.	9.5 ft.	10.0 ft.	N/A	1-3/16", 4"
≤ 9.0	7.5 ft.	9.0 ft.	10.0 ft.	N/A	N/A	1-3/16", 4"
≤ 9.5	8.0 ft.	9.5 ft.	N/A	N/A	N/A	1-3/16", 4"
≤ 10.0	8.5 ft.	10.0 ft.	N/A	N/A	N/A	1-3/16", 4"
≤ 10.5	8.5 ft.	N/A	N/A	N/A	N/A	1-3/16", 4"
≤ 11.0	9.0 ft.	N/A	N/A	N/A	N/A	1-3/16", 4"
≤ 11.5	9.5 ft.	N/A	N/A	N/A	N/A	1-3/16", 4"
≤ 12.0	10.0 ft.	N/A	N/A	N/A	N/A	1-3/16", 4"

Table 6b-2—Standardized WQCV Outlet Design Using 2" High Rectangular Openings.

Klemp™ KRP Series Aluminum Bar Grate[1] (or equal) Trash Rack Design Specifications.

Water Depth Above Lowest Opening, H	Minimum Bearing Bar Size, Bearing Bars Aligned Vertically
2.0 ft.	1" x 3/16"
3.0 ft.	1-1/4" x 3/16"
4.0 ft.	1-3/4" x 3/16"
5.0 ft.	2" x 3/16"
6.0 ft.	2-1/4" x 3/16"

[1] Klemp Corporation, Orem, Utah, USA

DESIGN EXAMPLE:

Given: A WQCV outlet plate with one column of 2 inch high by 6.5 inch wide rectangular openings.

Water Depth H = 4.5 feet above the lowest opening of and 2.5 feet below the lowest perforation.

Find: The dimensions for an aluminum bar grate trash rack.

Solution: Using Table 6b-1 for openings having a width of 6.5 inches and Water Depth H = 5 feet (i.e., rounded up from 4.5 feet). The minimum width of the concrete opening at the trash rack, $W_{opening}$, is 7'-6".

From Fig's 4 and 5, the total width of concrete opening at the orifice plate, $W_{conc.}$, is 6.5" + 12" = 18.5 inches (say 19 inches). Suggest setting the total width of the orifice plate at 26 inches.

Total minimum height of the rack structure (adding the 2-feet below the lowest row of openings to the water depth of 4.5 feet and adding 3 inches for all support channel flanges around the perimeter of the grate gives us the following total dimensions for the trash rack:

Width = 8'-0"

Height = 7'-0"

From Tables 6b-1 and 6b-2, select the ordering specifications for W = 6.5" and H = 5.0 feet or less, a 8'-0" wide by 7'-0" high trash rack using Klemp Corporation aluminum bar grate (or equal) with 2"x3/16" bearing bars spaced on 1-3/16" centers and cross rods spaced on 4" centers. **Bearing bars are to be aligned vertically.**

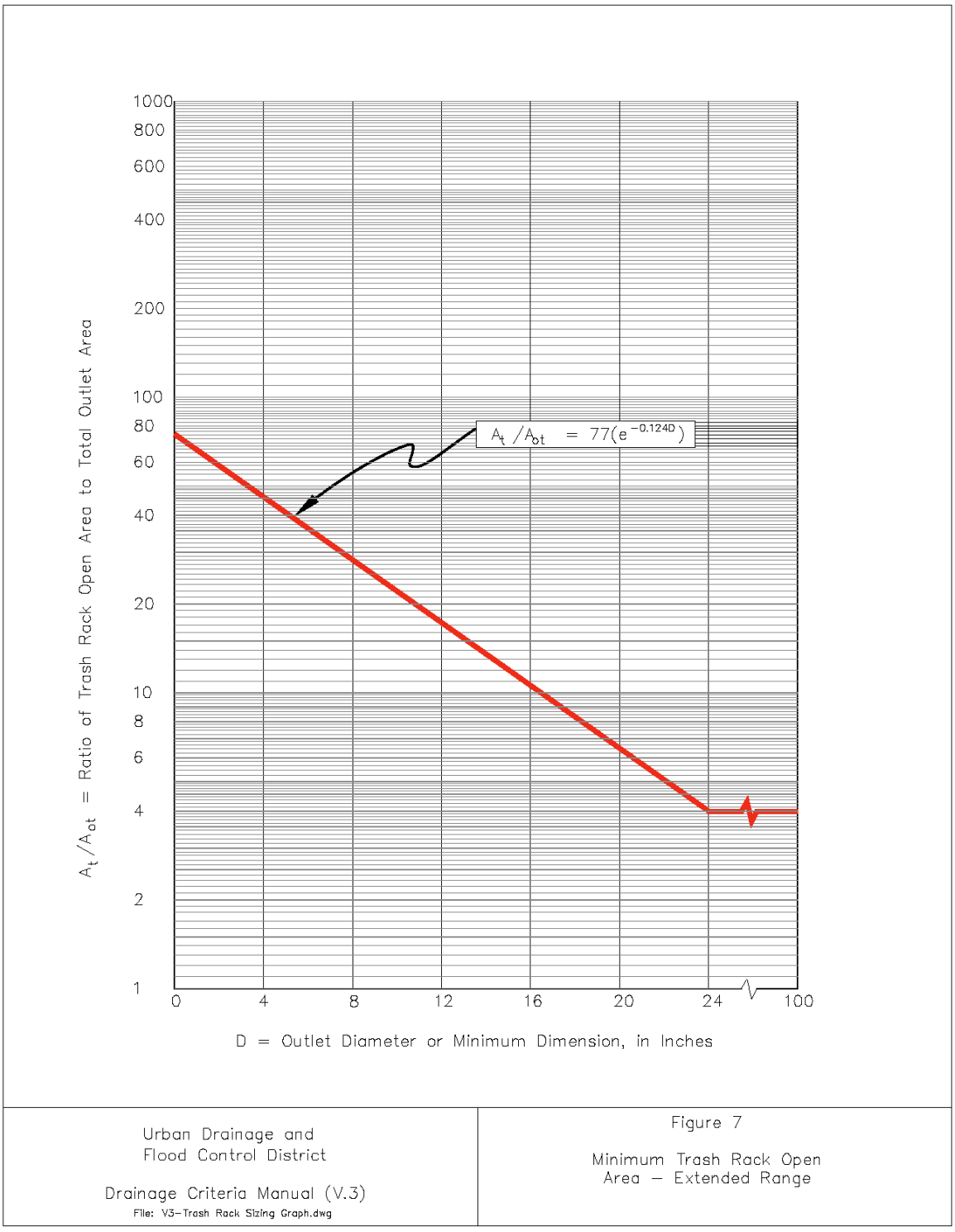


Figure 7—Minimum Trash Rack Open Area – Extended Range.

SUGGESTED TECHNICAL SPECIFICATIONS

This section contains suggested technical specifications for some of the designs contained in this *Manual*. These specifications may not contain many of the provisions typically seen in construction specifications such as pay item definitions and bid items. The intent that these suggested technical specifications is for the engineer to incorporate the technical portions into specific project specifications after reviewing and, if the site conditions dictate, modify them to best fit the specific site conditions of the project. When modifying these suggested specifications the engineer should maintain the general technical requirements recommended in these technical specifications.

Special Note and Disclaimer:

This information is intended for use by the design professional competent to evaluate its significance and limitation and who will accept the responsibility for its proper application. The Urban Drainage and Flood Control District and its employees disclaim any and all responsibility for any use of the information supplied herein and it is the responsibility of the user to apply and modify these guidelines as needed to meet specific site and design needs.

December 2004

Table 1—Typical Notes For EDB, RP and CWB Outlet Structures

1.	**The details shown herein** are conceptual design in nature. Preparation of final design plans that address details of structural adequacy, excavation, foundation preparation, concrete work, reinforcing steel, backfill, metalwork, and appurtenances, including preparation of technical specifications, are the responsibility of the design engineer in charge of the project.
2.	**Alternate designs** to the typical outlet structures shown herein may be considered; however, alternate designs must address the hydraulic and trash handling functional features and intent for the structures shown in this *Manual*.
3.	**Wingwalls** shown herein are designed to have the structure to be backfilled to be flush with the side slopes of the basin. The use of this geometry is recommended and permits the structure to blend into the landscape most aesthetically. Other geometries may be considered, however they need to be developed with full consideration of public safety, aesthetics, maintainability, and function. The superiority of these designs should be demonstrated to be equal to or better than the design concepts shown in this *Manual*.
4.	**Permanent Water Surface** refers to the water surface of the micro-pool for Extended Detention Basins and the permanent pool for Constructed Wetland Basins and Retention Ponds.
5.	**Perforated orifice plate** shown herein is used to provide the specified drain time of the WQCV. To reduce clogging potential, it is recommended that the largest possible circular opening be selected to minimize the number of columns. The intent is to have an outlet that empties the WQCV in the time specified (e.g., 12-, 24- or 40-hours), and being within –3% to 5% of this time is considered acceptable. See Figure 4 for orifice design information.
6.	**Vertical Trash Rack** option is preferred; however, an Adverse-Slope Trash Rack is also acceptable. Both help to shed the accumulated trash as the water level after the storm recedes. The use of a Continuous-Slope Trash Rack for WQCV outlets is not recommended. See Figure 6 for trash rack design information.
7.	**Drainage or flood control detention** above the WQCV may be sized for any storm event specified by local stormwater criteria and not only to the 2- or 10-year events shown herein.
8.	**Underdrains** along the perimeter of the permanent pool, including a shutoff valve, are recommended for Constructed Wetland Basins and Retention Ponds to help dewater the pool for rehabilitative maintenance.
9.	**When the outlet designs differ from those shown herein:**
	a) Provide needed orifices that are distributed over the vertical height of the WQCV, with the invert of the lowest orifice located at 2' 6", or more above the bottom of the micro-pool and above the bottom of Retention Ponds and Constructed Wetland Basins.
	b) Provide full hydraulic calculations demonstrating that the outlet will provide the minimum required drain time of the Water Quality Capture Volume for the BMP type being used.
	c) Outlet openings (orifices) shall be protected by trash racks having a minimum net open area specified in Fig 7. All opening dimensions shall be less than any dimension of outlet openings.
	d) Trash racks shall be manufactured from stainless steel or aluminum alloy structurally designed to not fail under a full hydrostatic load on the upstream side and assuming zero backwater depth on the downstream side.
Urban Drainage and Flood Control District Drainage Criteria Manual (V.3)	**Typical Outlet Structure General Notes for Extended Detention Basin, Retention Pond and Constructed Wetland Basin Outlets**

(Res. 40-08 (Appx. B), 3-19-08)

Chapter 28.84

CROSS-REFERENCE TABLE

Sections:
28.84.010 Cross-reference table.

28.84.010 Cross-reference table.

The following table provides cross-references section numbers of the adopted stormwater manual with their current GJMC citations. Thus, Section 101 of the stormwater manual appears in this code as GJMC 28.04.010.

Stormwater Manual Section	GJMC
101	28.04.010
102	28.04.020
103	28.04.030
104	28.04.040
105	28.04.050
106	28.04.060
201	28.08.010
202	28.08.020
203	28.08.030
204	28.08.040
205	28.08.050
206	28.08.060
207	28.08.070
208	28.08.080
209	28.08.090
300	28.12.010
301	28.12.020
302	28.12.030
302.1	28.12.040
302.2	28.12.050
303	28.12.060
303.1	28.12.070
303.2	28.12.080
303.3	28.12.090
303.4	28.12.100
303.5	28.12.110
304	28.12.120
305	28.12.130

Stormwater Manual Section	GJMC
401	28.16.010
402	28.16.020
403.1	28.16.030
403.2	28.16.040
403.3	28.16.050
403.4	28.16.060
403.5	28.16.070
403.6	28.16.080
403.7	28.16.090
403.8	28.16.100
403.9	28.16.110
403.10	28.16.120
403.11	28.16.130
404.1	28.16.140
404.2	28.16.150
404.3	28.16.160
404.4	28.16.170
404.5	28.16.180
404.6	28.16.190
405	28.16.200
405.1	28.16.210
405.2	28.16.220
405.3	28.16.230
406	28.16.240
601	28.24.010
601.1	28.24.020
601.2	28.24.030
602.1	28.24.040
602.2	28.24.050
602.3	28.24.060
603	28.24.070
604	28.24.080
605	28.24.090
701	28.28.010
702	28.28.020
703	28.28.030
703.1	28.28.040

Stormwater Manual Section	GJMC
703.2	28.28.050
704	28.28.060
704.1	28.28.070
704.2	28.28.080
704.3	28.28.090
705	28.28.100
706	28.28.110
707	28.28.120
708	28.28.130
801	28.32.010
802	28.32.020
803	28.32.030
803.1	28.32.040
803.2	28.32.050
803.3	28.32.060
803.4	28.32.070
803.5	28.32.080
803.6	28.32.090
804	28.32.100
805	28.32.110
805.1	28.32.120
805.2	28.32.130
806	28.32.140
806.1	28.32.150
806.2	28.32.160
806.3	28.32.170
806.4	28.32.180
806.5	28.32.190
806.6	28.32.200
806.7	28.32.210
806.8	28.32.220
806.9	28.32.230
806.10	28.32.240
806.11	28.32.250
806.12	28.32.260
807	28.32.270
808	28.32.280

Stormwater Manual Section	GJMC
809	28.32.290
810	28.32.300
811	28.32.310
812	28.32.320
813	28.32.330
814	28.32.340
815	28.32.350
901	28.36.010
901	28.36.020
902.1	28.36.030
902.2	28.36.040
902.3	28.36.050
902.4	28.36.060
903	28.36.070
903.1	28.36.080
903.2	28.36.090
903.3	28.36.100
904	28.36.110
904.1	28.36.120
904.2	28.36.130
905	28.36.140
905.1	28.36.150
905.2	28.36.160
905.3	28.36.170
1001	28.40.010
1002	28.40.020
1002.1	28.40.030
1002.2	28.40.040
1002.3	28.40.050
1002.4	28.40.060
1003	28.40.070
1003.1	28.40.080
1003.2	28.40.090
1003.3	28.40.100
1004	28.40.110
1004.1	28.40.120
1004.2	28.40.130

Stormwater Manual Section	GJMC
1004.3	28.40.140
1004.4	28.40.150
1005	28.40.160
1005.1	28.40.170
1005.2	28.40.180
1005.3	28.40.190
1101	28.44.010
1102	28.44.020
1103	28.44.030
1103.1	28.44.040
1103.2	28.44.050
1103.3	28.44.060
1103.4	28.44.070
1103.5	28.44.080
1104	28.44.090
1105	28.44.100
1106	28.44.110
1106.1	28.44.120
1106.2	28.44.130
1106.3	28.44.140
1106.4	28.44.150
1106.5	28.44.160
1201	28.48.010
1202	28.48.020
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1203	28.48.060
1203.1	28.48.070
1203.2	28.48.080
1203.3	28.48.090
1203.4	28.48.100
1203.5	28.48.110
1203.6	28.48.120
1203.7	28.48.130
1203.8	28.48.140
1203.9	28.48.150

Stormwater Manual Section	GJMC
1203.10	28.48.160
1204	28.48.170
1204.1	28.48.180
1204.2	28.48.190
1204.3	28.48.200
1205	28.48.210
1205.1	28.48.220
1205.2	28.48.230
1205.3	28.48.240
1205.4	28.48.250
1205.5	28.48.260
1206	28.48.270
1207	28.48.280
1301	28.52.010
1302	28.52.020
1302.1	28.52.030
1302.2	28.52.040
1401	28.56.010
1402	28.56.020
1403.1	28.56.030
1403.2	28.56.040
1404	28.56.050
1404.1	28.56.060
1404.2	28.56.070
1405	28.56.080
1406.1	28.56.090
1406.2	28.56.100
1406.3	28.56.110
1406.4	28.56.120
1406.5	28.56.130
1406.6	28.56.140
1406.7	28.56.150
1406.8	28.56.160
1406.9	28.56.170
1406.10	28.56.180
1406.11	28.56.190
1406.12	28.56.200

Stormwater Manual Section	GJMC
1407	28.56.210
1407.1	28.56.220
1407.2	28.56.230
1407.3	28.56.240
1407.4	28.56.250
1408	28.56.260
1501	28.60.010
1502	28.60.020
1503.1	28.60.030
1503.2	28.60.040
1503.3	28.60.050
1504	28.60.060
1505	28.60.070
1506.1	28.60.080
1506.2	28.60.090
1506.3	28.60.100
1507	28.60.110
1507.1	28.60.120
1507.2	28.60.130
1507.3	28.60.140
1507.4	28.60.150
1507.5	28.60.160
1507.6	28.60.170
1507.7	28.60.180
1508	28.60.190
1509	28.60.200
1601	28.64.010
1602.1	28.64.020
1602.2	28.64.030
1602.3	28.64.040
1602.4	28.64.050
1602.5	28.64.060
1603	28.64.070
1604	28.64.080
1604.1	28.64.090
1604.2	28.64.100
1605.1	28.64.110

Stormwater Manual Section	GJMC
1605.2	28.64.120
1606	28.64.130
1607	28.64.140
1607.1	28.64.150
1607.2	28.64.160
1700	28.68.010
1700	28.68.020
1800	28.72.010
Appx. A § A101	28.76.010
Appx. A § A102	28.76.020
Appx. A § A103	28.76.030
Appx. A § A104	28.76.040
Appx. A § A105	28.76.050
Appx. A § A106.1	28.76.060
Appx. A § A106.2	28.76.070
Appx. A § A106.3	28.76.080
Appx. A § A106.4	28.76.090
Appx. A § A106.5	28.76.100
Appx. A § A106.6	28.76.110
Appx. A § A106.7	28.76.120
Appx. A § A106.8	28.76.130
Appx. A § A106.9	28.76.140
Appx. B	28.80.010

(Res. 40-08, 3-19-08)

Title 29

TRANSPORTATION ENGINEERING DESIGN STANDARDS (TEDS)

Chapters:

29.01 Introduction
29.04 Street Classifications and Standards
29.08 Transportation Impact Studies
29.12 Access Management
29.16 Access Design and Site Circulation
29.20 Residential and Commercial Streets, Landscaping and Traffic Calming
29.24 Fire Department Access
29.28 Arterial and Collector Geometric Design, Including Roundabouts
29.32 Pavements and Truck Routes
29.36 Street Lighting, Utilities and Mailboxes
29.40 Striping and Signing
29.44 Traffic Signals and Construction Zones
29.48 Transit, Bicycle and Pedestrian Facilities
29.52 Transit Design Standards and Guidelines
29.56 Alley Standards
29.60 Private Streets, Shared Driveways and Loop Lanes
29.64 Design Exceptions
29.68 Alternate Residential Street Standards

Prior legislation – Resos. 111-01 and 86-03.

Chapter 29.01

INTRODUCTION

Sections:

29.01.010 Foreword.
29.01.020 Companion documents and software recommended for use with the Transportation Engineering Design Standards.

29.01.010 Foreword.

The standards contained herein regulate all transportation improvements within the public right-of-way and all private work to be dedicated to the public, either as right-of-way or as an easement. The standards are to be treated as law. To that extent they are imposed to provide for coordinated, modern development with safe and efficient transportation facilities for the benefit of and to serve and protect users. The standards apply within the City limits and the urban area of Mesa County as defined by the Persigo Agreement. The standards for transportation, engineering and design shall be known as TEDS.

All facilities and improvements within the public right-of-way shall be designed by or under the direct supervision of a registered professional engineer licensed to practice in the State of Colorado. All drawings, designs, sections, detail and supporting data submitted to the City or County for approval must bear the engineer's seal and signature and a statement that:

> This design complies with the current TEDS manual dated _____.

All designs submitted shall be in accordance with the latest edition of the TEDS manual.

Some projects financed wholly or in part with state or federal funds are subject to the standards prescribed by agencies other than the City and County. Such standards may be more or less restrictive than the City of Grand Junction and Mesa County standards. The City and County shall require that the more restrictive standards shall be met.

The TEDS address frequent construction and development problems and questions. The standards by adoption and application ensure consistent transportation engineering design practices for new development and redevelopment of land in the City of Grand Junction and Mesa County. They are supplementary to the City and County development codes. Some of the material contained in this document has been drawn from standards of other cities and states and nationally established texts and publications.

The TEDS apply to new developments and as noted, limited and defined herein apply to existing improvements and infill development unless wholly constrained. Infill development in an urban area may be constrained by existing improvements, which if such condition exists shall require an affirmative waiver of TEDS in accordance with Chapter 29.64 GJMC. The City and County may deviate from these standards only when and if deviation is shown to be warranted.

On Colorado highways within the City of Grand Junction and urbanized Mesa County, the Colorado Department of Transportation (CDOT) Roadway Design Manual, and the State Access Code shall apply but only if more restrictive than TEDS.

(Res. 39-04, 4-21-04)

29.01.020 Companion documents and software recommended for use with the Transportation Engineering Design Standards.

(a) Publications.

(1) Local.

(i) City of Grand Junction *Zoning and Development Code*.

(ii) City of Grand Junction *Standard Contract Documents*.

(iii) Mesa County *Road and Bridge Standards*.

(2) State.

(i) CDOT *Roadway Design Manual*.

(ii) CDOT *State Highway Access Code*.

(3) Federal.

(i) Transportation Research Board *Highway Capacity Manual*.

(ii) Federal Highway Administration *Roundabouts: An Informational Guide*.

(iii) Federal Highway Administration *Manual on Uniform Traffic Control Devices*.

(4) Professional Organizations.

(i) Institute of Transportation Engineers *Trip Generation*.

(ii) AASHTO *A Policy on Geometric Design of Highways and Streets*.

(iii) AASHTO *Guide for Bicycle Facilities*.

(iv) AASHTO *Roadside Design Guide*.

(v) AASHTO *A Guide for Erecting Mailboxes on Highways*.

(vi) APA *Bicycle Facility Planning*.

(vii) Colorado Asphalt Pavement Association *Guideline for the Design and Use of Asphalt Pavements for Colorado*.

(b) Software.

(1) *TEAPAC Signal2000* from Strong Concepts, Inc. (signal timing and analysis).

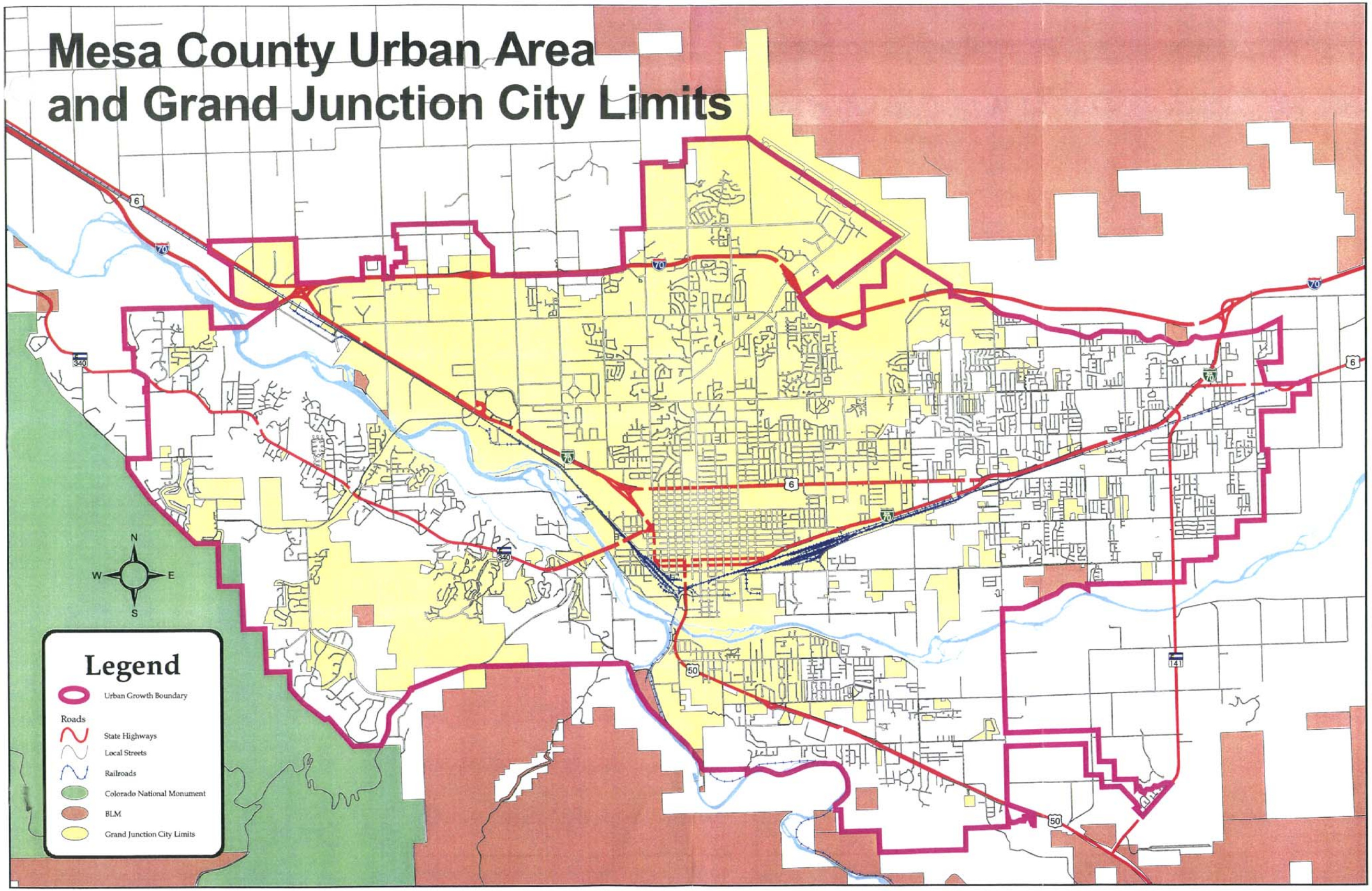
(2) *AaSIDRA* from Akcelik and Associates (roundabout analysis).

(3) *Darwin* from AASHTO (asphalt pavement design).

(4) *WinPAS* from American Concrete Pavement Association.

(Res. 39-04 (§ 1.0), 4-21-04)

Mesa County Urban Area and Grand Junction City Limits



Chapter 29.04

STREET CLASSIFICATIONS AND STANDARDS

Sections:
29.04.010 Street classifications and standards.
29.04.020 Access management plan.

29.04.010 Street classifications and standards.

All streets have different functions. Some are to serve land uses directly while others are intended to move vehicles quickly and efficiently from one point to another. Ensuring that each street type can meet or maintain its function is crucial to the overall operation of the street system.

Major streets in the Grand Junction urbanized area are classified according to their function in the transportation network. These streets include principal arterials, minor arterials, major collectors, and minor collectors. All others are local streets. The functionally classified streets have been identified on a functional classification map that has been adopted by the City of Grand Junction and accepted by Mesa County.

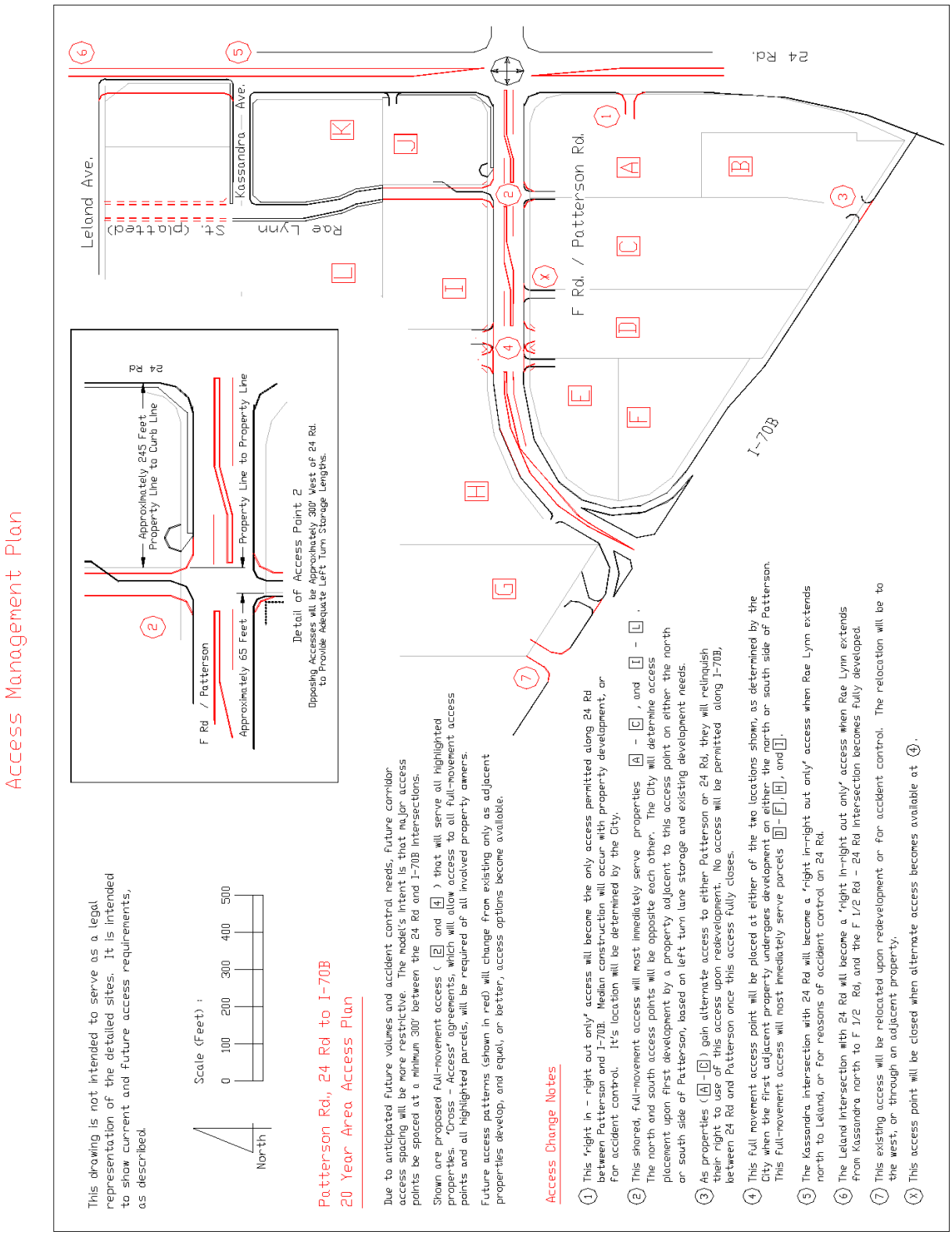
Reference to the Grand Junction Circulation Plan is made throughout the TEDS manual. Different access controls and design standards apply to different roadway classifications. The purpose is to preserve or enhance safety and traffic flow. The Grand Junction Circulation Plan is also referenced throughout this manual for compliance with the adopted plan.

The City Council and County Commission have adopted standard drawings and details for the construction of streets and location for utilities. These standards include minimum right-of-way and street width requirements, and include construction details for major and local streets. These will be referenced throughout the following document.

The adopted Grand Junction Circulation Plan as well as the street and utility standard drawings are available in various formats including AutoCAD Files on 3.5-inch or CD-ROM disks. These may be purchased at the administrative office of the Department of Public Works and Utilities, City Hall, 250 North Fifth Street, Grand Junction, Colorado, 81501.

(Res. 39-04 (§ 1.0), 4-21-04)

29.04.020 Access management plan.



(Res. 39-04 (§ 1.0), 4-21-04)

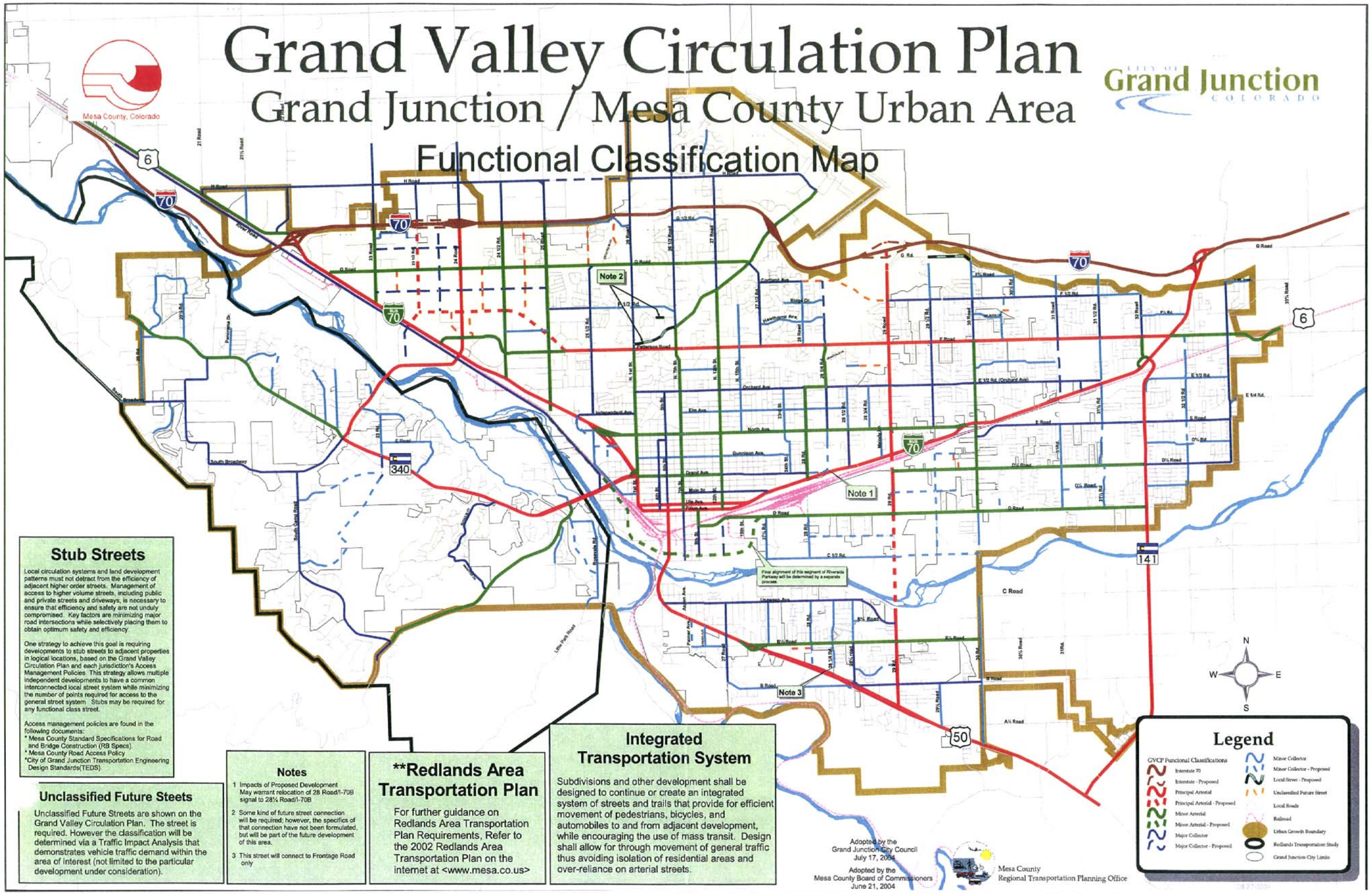
Grand Valley Circulation Plan

Grand Junction / Mesa County Urban Area

Functional Classification Map

Mesa County, Colorado

City of Grand Junction Colorado



Stub Streets

Local circulation systems and land development patterns must not detract from the efficiency of adjacent higher order streets. Management of access to higher volume streets, including public and private streets and driveways, is necessary to ensure that efficiency and safety are not unduly compromised. Key factors are minimizing major road intersections while selectively placing them to obtain optimum safety and efficiency.

One strategy to achieve this goal is requiring developments to stub streets to adjacent properties in logical locations, based on the Grand Valley Circulation Plan and each jurisdiction's Access Management Policies. This strategy allows multiple independent developments to have a common interconnected local street system while minimizing the number of points required for access to the general street system. Stubs may be required for any functional class street.

Access management policies are found in the following documents:
* Mesa County Standard Specifications for Road and Bridge Construction (RB Specs).
* Mesa County Road Access Policy
*City of Grand Junction Transportation Engineering Design Standards(TEDS).

Unclassified Future Steets

Unclassified Future Streets are shown on the Grand Valley Circulation Plan. The street is required. However the classification will be determined via a Traffic Impact Analysis that demonstrates vehicle traffic demand within the area of interest (not limited to the particular development under consideration).

Notes

1 Impacts of Proposed Development May warrant relocation of 28 Road/I-70B signal to 28¼ Road/I-70B

2 Some kind of future street connection will be required; however, the specifics of that connection have not been formulated, but will be part of the future development of this area.

3 This street will connect to Frontage Road only

**Redlands Area Transportation Plan

For further guidance on Redlands Area Transportation Plan Requirements, Refer to the 2002 Redlands Area Transportation Plan on the internet at <www.mesa.co.us>

Integrated Transportation System

Subdivisions and other development shall be designed to continue or create an integrated system of streets and trails that provide for efficient movement of pedestrians, bicycles, and automobiles to and from adjacent development, while encouraging the use of mass transit. Design shall allow for through movement of general traffic thus avoiding isolation of residential areas and over-reliance on arterial streets.

Legend

GVCP Funcional Classifications

- Interstate 70
- Interstate - Proposed
- Principal Arterial
- Principal Arterial - Proposed
- Minor Arterial
- Minor Arterial - Proposed
- Major Collector
- Major Collector - Proposed
- Minor Collector
- Minor Collector - Proposed
- Local Street - Proposed
- Unclassified Future Street
- Local Roads
- Railroad
- Urban Growth Boundary
- Redlands Transportation Study
- Grand Junction City Limits

Adopted by the Grand Junction City Council July 17, 2004

Adopted by the Mesa County Board of Commissioners June 21, 2004

Mesa County Regional Transportation Planning Office

Chapter 29.08

TRANSPORTATION IMPACT STUDIES

Sections:

29.08.010 Transportation impact study.
29.08.020 Procedure.
29.08.030 General meeting or pre-application conference.
29.08.040 Determination of base assumptions.
29.08.050 Pedestrian analysis.
29.08.060 Submittal.
29.08.070 Review agency comments and recommendations.
29.08.080 Transportation impact study report contents.
29.08.090 Project description.
29.08.100 Existing conditions.
29.08.110 Description of existing transportation system.
29.08.120 Capacity analysis and quality of service.
29.08.130 Future traffic projections.
29.08.140 Project traffic.
29.08.150 Total traffic projections.
29.08.160 Site design and circulation evaluation.
29.08.170 Transportation impact analysis.
29.08.180 Calculations for capacity and quality of service.
29.08.190 Mitigation measures.
29.08.200 Transportation demand management (TDM) measures.
29.08.210 Transit capacity and access improvements.
29.08.220 Traffic signal operational improvements.
29.08.230 Street widening and other physical improvements.
29.08.240 Neighborhood transportation impact analysis.
29.08.250 Conclusions.
29.08.260 Recommendations.

29.08.010 Transportation impact study.

The transportation impact study (TIS) will assess the impacts of proposed development on the existing and planned street system. Comprehensive and coordinated transportation planning is critical to providing a balanced transportation system. The application of sound design principles for new streets, preserving street capacities in existing areas, ensuring smooth traffic flow, accommodating all transportation modes, and preserving or increasing safety are part of the TIS. To evaluate the impacts of development proposals on the transportation system, a professionally prepared TIS shall be required. This chapter provides standards for the preparation of a TIS. In addition, the following documents shall be referenced for more detailed information:

(a) Grand Junction Circulation Plan.

(b) City standard details.

(c) Transit Design Standard Guidelines (Chapter 29.52 GJMC).

(d) Corridor guidelines.

The primary responsibility for assessing the transportation impacts associated with a proposed development rests with the developer, and but not limited to the City, County, CDOT or RTPO serving in a review capacity.

(Res. 39-04 (§ 2.0), 4-21-04)

29.08.020 Procedure.

The following required steps describe the procedures required for the preparation and submittal of a TIS:

(a) General meeting or pre-application conference.

(b) Determination of base assumptions.

(c) Submittal.

(d) Review agency comments and recommendations.

(Res. 39-04 (§ 2.1), 4-21-04)

29.08.030 General meeting or pre-application conference.

(a) As a general rule, a TIS shall be required for all land use applications for new development in the City and as required by the Mesa County Land Development Code. The requirement to prepare a TIS – or portions of a TIS – may be waived by the Transportation Engineer if the peak hour trip generation of the proposed project is less than 100 trips. If the applicant can demonstrate to the satisfaction of the Transportation Engineer that no other concerns exist with the transportation aspects of the proposed project, then a memo shall be prepared by the transportation consultant documenting the trip generation of the project and conclusions of the TIS.

(b) The 100 peak hour trip threshold is consistent with the Colorado Department of Transportation thresholds for requiring impact studies on State highways. The following are examples of developments that produce approximately 100 trips in the peak hour:

(1) One hundred single-family homes.

(2) Forty thousand square foot office building.

(3) Fast food restaurant.

(4) Twenty thousand square foot shopping center.

These thresholds are found in the Institute of Transportation Engineers' *Trip Generation*. The latest edition of *Trip Generation* is adopted and incorporated by this reference.

(c) At the pre-application meeting the applicant shall provide information regarding:

(1) The project including type of land use (single-family, townhomes, multifamily, office, retail, etc.) and size (number of dwelling units, square footage, etc.).

(2) The project site plan showing all proposed access locations and proposed land uses in relation to the accesses.

(3) Anticipated project completion date and project phasing.

(4) Any other information necessary or required to evaluate the project.

(d) The appropriate agencies shall review the project information and provide comment regarding transportation issues including, but not necessarily limited to, accesses (locations/type), impacts on adjacent neighborhoods, the size of the study area and the study methodology.

(Res. 39-04 (§ 2.1.1), 4-21-04)

29.08.040 Determination of base assumptions.

(a) After the pre-application meeting, the Transportation Engineer will evaluate the TIS – Base Assumptions. The consultant preparing the TIS shall complete the base assumptions form. The assumptions once approved shall confirm the base parameters and assumptions to be utilized by the traffic consultant in preparation of the TIS.

(b) A base assumptions form shall specify:

(1) Study area boundaries;

(2) Period of study;

(3) Growth rates;

(4) Study intersections;

(5) Time periods for study;

(6) Trip generation rates;

(7) Trip adjustment factors;

(8) Overall trip distribution;

(9) Mode split assumptions;

(10) Committed roadway improvements by other projects, CDOT, Grand Junction and Mesa County;

(11) Other relevant transportation impact studies;

(12) Areas requiring special study.

Transportation Impact Study
Base Assumptions

Project Information				
Project Name				
Project Location				
TIS Assumptions				
Study Area Boundaries	North:		South:	
	East:		West:	
Study Years				
Future Traffic Growth Rate				
Study Intersections	1.All Access Drives		2.	
	3.		4.	
	5.		6.	
	7.		8.	
Time Period For Study	AM PM Sat Noon			
Trip Generation Rates				
Trip Adjustment Factors	Pass by:		Captive Market:	
Overall Trip Distribution	North	South	East	West
Mode Split Assumptions				
Committed Roadway Improvements				
Other Traffic Studies				
Areas Requiring Special Study				

DATE:
TRANSPORTATION ENGINEER:

(Res. 39-04 (§ 2.1.2), 4-21-04)

29.08.050 Pedestrian analysis.

The Transportation Engineer shall complete the Pedestrian Analysis Worksheet. This form will be used to identify origin and destination pairs for analysis by the consultant of pedestrian quality of service measurements for directness, continuity, street crossings, visual interest/amenity, and security. Based upon the project's land use classification, consideration shall be given to the noted destinations that are located within one-quarter mile of the project site. Destinations farther than one-quarter mile may be specified, for example a school walking area boundary.

Pedestrian Analysis Worksheet

Pedestrian Destinations
(within ¼ mile of project site)

Origin (Project Site)	Rec.				Com.	Ind.	Other (Specify)
Recreation							
Residential							
Institution (school, church, civic)							
Office/ Business							
Commercial							
Industrial							
Other (Specify)							

Based upon the project's land use classification, the pedestrian quality of service analysis for directness, continuity, street crossings, visual interest/amenity, and security shall consider the applicable destinations which are located within one quarter mile of the project site.

DATE:
TRANSPORTATION ENGINEER:

(Res. 39-04 (§ 2.1.3), 4-21-04)

29.08.060 Submittal.

Copies of the TIS shall be delivered to the appropriate City or County Community Development Department, to be submitted as part of the required planning information. Revisions to the TIS shall be made as required if the revisions are necessary to have a complete TIS or where changes to the site's access necessitate additional revisions to the study. Electronic files of capacity analyses must be submitted with the TIS.

(Res. 39-04 (§ 2.1.4), 4-21-04)

29.08.070 Review agency comments and recommendations.

The review agency or designee shall analyze, evaluate and/or review TIS according to the adopted standards. Evaluative comments concerning the TIS shall be forwarded to the project planner. The project planner shall provide all review agency comments to the applicant. As a result of the engineering review the applicant may be required to perform and submit supplemental analyses of and/or address specific

transportation issues or prepare, perform and submit a new study. Engineering review shall, to the extent practicable, cite by reference to this manual, the code, laws, rules or regulations deficiencies in the TIS.

Review and evaluation of TISs are and shall be initially and principally based on local conditions and community expectations as articulated by local government and its officials. An example of such a local expectation is that signal operations will not be optimized by eliminating existing left-turn phasing.

If the TIS is based on assumptions that conflict with local conditions and/or community expectations which may affect the usefulness or predictive proven by the TIS, the TIS will be rejected.

(Res. 39-04 (§ 2.1.5), 4-21-04)

29.08.080 Transportation impact study report contents.

A Colorado licensed professional engineer shall prepare the TIS. The engineer shall have experience in the area of traffic and transportation engineering. A statement of qualifications must be included in the submitted study. Certification as a Professional Traffic Operations Engineer by the Institute of Transportation Engineers is preferred. Each TIS shall address:

(a) Project description;

(b) Existing conditions;

(c) Future background traffic projections;

(d) Project traffic;

(e) Total traffic projections;

(f) Future total traffic projections;

(g) Site circulation and design evaluation;

(h) Transportation impact analysis;

(i) Mitigation measures;

(j) Neighborhood transportation impact analysis;

(k) Conclusions;

(l) Recommendations;

(m) Any other information necessary or required to evaluate the project.

(Res. 39-04 (§ 2.2), 4-21-04)

29.08.090 Project description.

A description of the proposed project shall be prepared and include the type of land use and size of the proposed project, generally known as density and intensity. Intensity may be described in terms of floor area ratio or square footage of proposed development. Phasing plans shall be proposed, including the anticipated completion date. The proposed site plan shall be included; the site plan shall include all proposed vehicular access locations, dimensions and movements shall be described. The project description shall include a description of how pedestrian and bicycle travel shall be accommodated. This shall include a discussion of types of sidewalks (attached/detached), pathways, and connections to local and perimeter destinations.

(Res. 39-04 (§ 2.2.1), 4-21-04)

29.08.100 Existing conditions.

The TIS shall identify the existing transportation system conditions. Existing conditions shall include a description of the surrounding roadway network, bicycle facilities, and pedestrian facilities; an evalua-

tion of the peak hour capacity and level quality of service at the study intersections and traffic accident history.

(Res. 39-04 (§ 2.2.2), 4-21-04)

29.08.110 Description of existing transportation system.

(a) The study description of the existing roadway network shall include, but not necessarily be limited to, the number of travel lanes, presence or lack of pedestrian and bicycle facilities, posted speed limits, and adjacent land use(s). Traffic and intersection data compiled by the City and/or County Engineering Departments may be available. All recent (within two years) average daily traffic data that is available for the roadway network shall be shown on a figure in the study. Intersection peak hour traffic data shall be no older than one year; if new counts are necessary this is the sole responsibility of the applicant. The applicant may, at the direction of the Transportation Engineer, be required to collect data at a shorter interval. All traffic count data shall be included in an appendix to the TIS.

(b) The TIS shall describe the existing bicycle and pedestrian facilities and shall include any facilities directly adjacent to the project site and within one-quarter mile or as described in GJMC 29.08.050, Pedestrian analysis. The Grand Junction Circulation Plan shall be referenced and complied with for planned pedestrian and bicycle facilities within the study area boundaries.

(c) Bicycle facilities are defined by AASHTO *Guide for Bicycle Facilities* as:

(1) *Bicycle route* means a street which is officially designated and marked (by signage) as a bicycle route, but which is open to motor vehicle travel and upon which no bicycle lane is designated.

(2) *Bike lane* means a portion of street which has been designated (by paint stripe, pavement markings, and signage) for use by bicyclists.

(3) *Bike path* means a separate trail or path from which motor vehicles are prohibited and which is for the exclusive use of bicycles or the shared use of bicycles and pedestrians.

(d) Special attention shall be given to the bicycle and pedestrian connections to specific uses including but not limited to: schools, parks, employment centers, commercial areas, shopping, and adjacent land uses.

(Res. 39-04 (§ 2.2.3), 4-21-04)

29.08.120 Capacity analysis and quality of service.

(a) The procedures set forth in the latest edition of the *Highway Capacity Manual* (HCM) shall be used in analyzing the capacity and operational characteristics of: vehicular (at the study intersections), pedestrian facilities, and bicycle facilities.

(b) HCM delay and queuing worksheets shall be included in the appendices to the TIS report.

(c) Roundabout analyses shall use SIDRA software or approved methodology. All worksheets shall be included in the appendices of the TIS report.

(Res. 39-04 (§ 2.2.4), 4-21-04)

29.08.130 Future traffic projections.

(a) The future traffic projections shall be determined for each of the study years identified earlier as part of the base assumptions. Future traffic projections for the TIS analysis shall include:

(1) Planned system improvements – capital projects;

(2) Planned or in process development projects;

(3) Background traffic growth.

(b) A description of project-specific planned transportation system improvements identified in City, County or CDOT capital improvement plans shall be provided. This shall include, but not be limited to: signalization, intersection improvements, roadway widening, bicycle/pedestrian projects, and transit capital and operating/service improvements.

(c) The future traffic analysis shall include known development projects that are within the study area and would impact the study intersections. Projects outside the study area currently being developed shall also be considered. Every project(s) and the cumulative effect shall be listed in the TIS and include location, size and proposed land use.

(d) The background traffic growth within the study area shall also be accounted for when determining future traffic projections. Growth factors suggested by the consultant in the base assumptions form will be reviewed by the appropriate agency prior to use in the TIS.

(e) The resulting future peak hour traffic projections at the study intersections shall be depicted on a figure in the TIS.

(Res. 39-04 (§ 2.2.5), 4-21-04)

29.08.140 Project traffic.

(a) The transportation impacts of the project shall be generally determined based upon the following three-step process:

(1) Determination of trip generation;

(2) Determination of trip distribution;

(3) Assignment of project traffic.

(b) Trip Generation.

(1) The trips generated by the project shall be determined and provided in tabular form. The trip generation shall be determined for total build-out conditions and for any development phases. The trip generation table shall indicate the number of average daily trips and peak hour trips.

(2) The development of trip generation estimates for the project shall be based upon data from the latest edition of the Institute of Transportation Engineers *Trip Generation*. However, other data sources or trip generation rate studies may be utilized if the manual does not contain data for the type of project or other reliable data exists which better reflects the trip generation characteristics of the project. The use of other trip generation sources shall be discussed with the Transportation Engineer before being used, and if agreed, shall be memorialized in writing signed by the Transportation Engineer.

(3) Adjustments to the standard trip generation of the proposed project may be made to account for internal site trips, pass-by trips, or other site-specific/project-specific characteristics of the proposed project. Adjustments for these characteristics shall be discussed with the City or County Transportation Engineer before use; in most cases the TIS shall follow guidelines set forth in documents such as the ITE *Trip Generation*. The adjusted trip generation for the proposed project shall be provided in tabular form or illustrated on figures.

Allowable Pass-by Factors

LAND USE	PASS-BY COMPONENT
Bank/S & L	15.0%
Regional Shopping Center	20.0%
Grocery Store/Community Shopping	30.0%
Hardware Store	10.0%
Strip Commercial	20.0%
Neighborhood/Convenience Center	60.0%
Fast Food Restaurant	45.0%
Gas Station	55.0%

(c) Trip Distribution. The trip distribution for the proposed project shall be identified in the TIS. The distribution pattern shall be based upon: the project's location within the urban area, the traffic model maintained by the MPO, existing traffic volume data, project marketing data, and engineering judgment. A figure showing the percentage of site traffic on each street shall be provided as part of the traffic study graphic material.

(d) Trip Assignment. The project traffic shall be assigned to the roadway system according to the established trip distribution. The resulting project site generated traffic shall be depicted on figures for build-out conditions and any project phases. Daily and peak hour traffic volume information shall specifically be included.

(Res. 39-04 (§ 2.2.5), 4-21-04)

29.08.150 Total traffic projections.

The total traffic projections shall be determined for each of the study years identified in the base assumptions. The project-related traffic shall be added to the existing peak hour traffic. The resulting total traffic projections shall be depicted on a figure in the TIS. For each of the study years, the total traffic projections shall include the future traffic plus the project-generated traffic. The future total traffic projections shall be depicted on figures for each study year.

(Res. 39-04 (§ 2.2.6), 4-21-04)

29.08.160 Site design and circulation evaluation.

The project shall be analyzed to determine if the proposed circulation serves pedestrians, bicyclists and vehicles. The site design shall be evaluated to determine if facilities for vehicles, pedestrians and bicycles meet design standards and/or codes. The project shall comply with the adopted Grand Junction Circulation Plan.

The project shall be evaluated to determine if traffic flows are properly designed. Proper design shall minimize areas where motorists would tend to speed, minimize potential conflict areas between vehicles and pedestrians/bicyclists, and to establish circulation patterns that avoid unnecessary traffic congestion, cut-through traffic and conflict points. Adequate throat lengths for on-site stacking at exit points is required. At signalized driveways, the HCM ninetieth percentile worst lane queue model shall determine the necessary storage.

(Res. 39-04 (§ 2.2.7), 4-21-04)

29.08.170 Transportation impact analysis.

(a) The TIS shall determine if the project creates any significant impacts at the study intersections and/or corridors within the study area boundaries. The peak hour capacity and quality of service at each of the study intersections and/or corridors shall be evaluated for:

(1) Future background traffic conditions for each study year; and

(2) Total existing traffic conditions; and

(3) Future total traffic conditions for each study year.

(b) The capacity and quality of service analysis for each traffic scenario and each study year needs to include mode split assumptions, if any. The findings shall be shown in the TIS in tabular form or illustrated on figures.

(Res. 39-04 (§ 2.2.8), 4-21-04)

29.08.180 Calculations for capacity and quality of service.

(a) HCM delays and queues shall be calculated for signalized intersections using the latest version of the Highway Capacity Manual. The City of Grand Junction uses the TEAPAC signal analysis software and requires its usage and methodologies for design and analysis of signal timing. The HCM delay and queues shall be calculated for the identified peak hours for existing conditions, the projected traffic with build-out of the project, or at completion of phases of larger projects. An appropriate 15-minute peak hour factor shall be used. The performance evaluation of signalized intersections shall include the following:

(1) Critical movements shall be identified and must meet or exceed the threshold requirement of 35 seconds of delay or less;

(2) No movements shall have an adverse effect on the coordinated progression of the street system as determined by an approved coordination model consistent with the methods of HCM;

(3) HCM ninetieth percentile worst lane queues shall be calculated and shall not obstruct upstream intersections or major driveways;

(4) The analysis of a signalized corridor must show a reasonable progression band, identified as a usable (unblocked) band for major traffic movements.

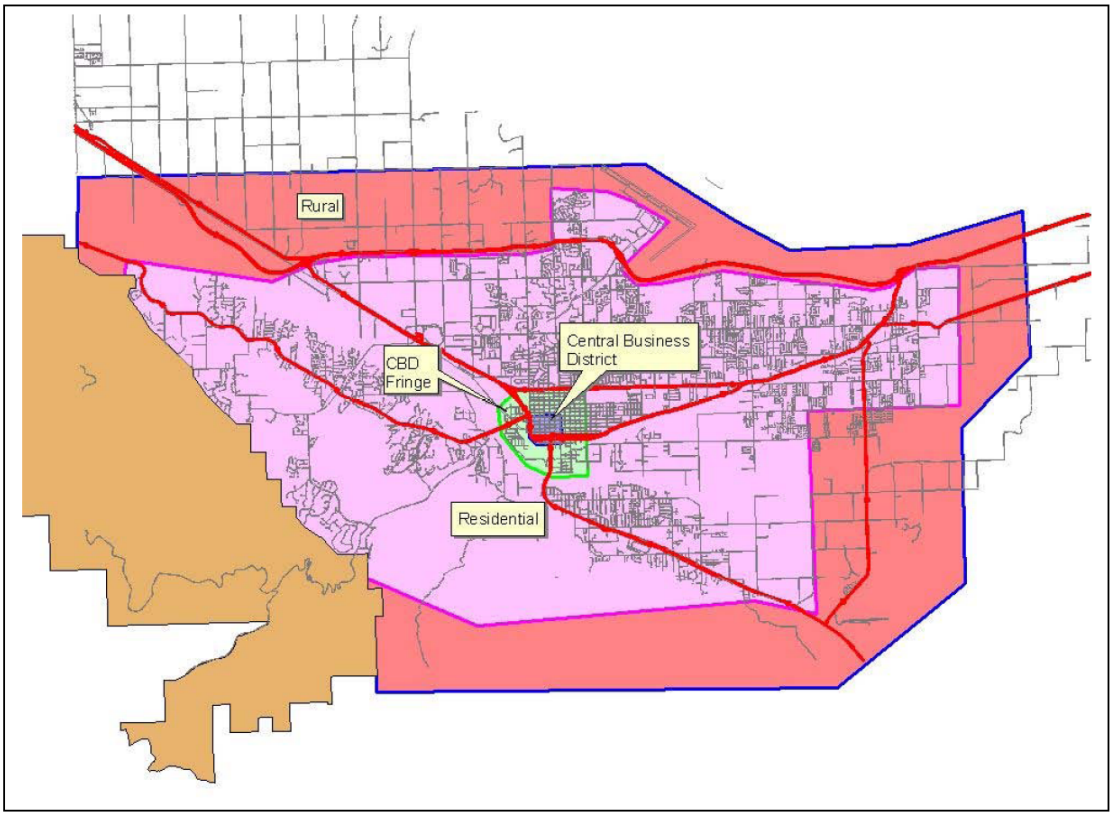
(b) Unsignalized intersections shall be analyzed using the latest Highway Capacity Manual methods. In the performance evaluation of stop controlled intersections, measures of effectiveness to consider include the delay, volume/capacity ratios for individual movements, average queue lengths and ninety-fifth percentile queue lengths to make appropriate traffic control recommendations. The Highway Capacity Manual recognizes that the delay equation used in the capacity analysis procedure will predict quality of service “F” for many urban intersections that allow minor-street left-turn movements, regardless of the volume of minor-street left-turning traffic. In recognition of this, the TIS should evaluate the results of the intersection capacity analysis in terms of all of the measures of effectiveness.

(c) Roundabouts shall be analyzed using the latest version of SIDRA or approved methodology.

(d) Street segment capacities shall be calculated using the following tables. The highest directional peak hour volume shall be used to calculate the segment quality of service.

Functional Classification	Area Type			
	CBD	CBD Fringe	Residential	Rural
	Vehicles per Lane per Hour			
Principal Arterial	600	700	850	1,000
Minor Arterial	550	650	750	850
Three-Lane Collector	500	600	700	800
Two-Lane Collector	450	550	650	600

Quality of Service	Volume to Capacity Ratio
A/B	0.00 – 0.90
C	0.91 – 1.00
D	1.01 – 1.10
E	1.11 – 1.20
F	Over 1.20



(Res. 39-04 (§ 2.2.8.1), 4-21-04)

29.08.190 Mitigation measures.

The TIS shall include feasible measures that would mitigate the project's vehicular traffic impacts. The mitigation measures shall be in addition to the required improvements necessary to preserve corridor and intersection capacity. The acceptable mitigation measure(s) shall minimize the demand for trips by single occupant vehicles and increase the use of alternative modes. Mitigation listed in order of priority includes:

(a) Transportation demand management measures;

(b) Transit capacity and access improvements;

(c) Traffic signal operation improvements;

(d) Street widening and other physical improvements.

(Res. 39-04 (§ 2.2.9), 4-21-04)

29.08.200 Transportation demand management (TDM) measures.

(a) Transportation demand management measures are designed to facilitate the use of alternate transportation modes in order to decrease demand on the roadway system by single occupant vehicles. Examples of TDM measures include:

  (1) Vehicle trip reduction incentives and services offered by employers to encourage employees to utilize alternative modes of travel such as carpooling, vanpooling, riding public transit, bicycling, walking and telecommuting.

  (2) Provision of a mix of land uses in close proximity, facilitating walking, bicycling or transit trips.

(b) A detailed description of the proposed TDM measures and implementation plan shall be included in the TIS for any project seeking TDM-related trip reductions. If the proposed TDM program is acceptable to the Transportation Engineer, the applicant shall be allowed to reduce total project vehicle trips by an amount commensurate with applicable trip reduction policies.

(c) The intersection capacity and quality of service shall be calculated to reflect the application of the proposed mitigation measures; the calculation shall show that the project-related impacts have been reduced to an acceptable delay for all movements and transportation modes (vehicle, bicycles, pedestrians). The findings shall be shown in tabular form.

(Res. 39-04 (§ 2.2.9.1), 4-21-04)

29.08.210 Transit capacity and access improvements.

Projects seeking transit credit shall document the proposed transit capacity credit and related reduction in total project vehicle trips. Examples of transit credits may include:

(a) Contributions of equipment or funds to increase the capacity of existing transit systems;

(b) Transit shuttles provided by applicant (e.g., bus, taxicab, van);

(c) Contributions toward transit stations or centers.

(Res. 39-04 (§ 2.2.9.2), 4-21-04)

29.08.220 Traffic signal operational improvements.

Required traffic signal operational improvements may include upgrading signals with additional signal phases and/or signalization of an unsignalized intersection, addition of turn lanes and/or construction of a roundabout.

The need for new traffic signals shall be based on warrants established in the Manual on Uniform Traffic Control Devices, MUTCD. In determining the location of a new signal, traffic progression is of paramount importance. On arterial streets a spacing of one-half mile for all signalized intersections is necessary to achieve reasonable operating speed, capacity and optimum signal progression. Pedestrian movements shall be considered in the evaluation and adequate pedestrian clearance provided in the signal cycle split assumptions.

The applicant shall submit an analysis addressing proposed access, proposed signals and capacity and quality of service based on the City's operational practices. All assumptions shall be documented in the TIS. An approved traffic engineering analysis must be made to properly locate all proposed accesses that may require signalization. The roadway to be analyzed for signal progression shall be established by the City or County and shall include all existing and proposed signalized intersections.

(a) The progression pattern calculations must use a cycle length at least as long as current signal timing on the corridor under analysis.

(b) Cycle split assumptions must relate to traffic volumes in the capacity analysis of individual intersections.

(c) Approved computerized progression analysis techniques must be of the type which utilize turning movement volume data and pedestrian clearance times in the development of timing plans.

(d) The green time allocated to the cross street shall be considered no less than the time which is required for a pedestrian to clear the main street using MUTCD standards.

(e) Existing timing and phasing data for City and/or County signals on the corridor(s) being analyzed will be provided to the consultant on written request.

(f) Elimination of or substantial changes to existing phases and/or changing cycle splits will not be allowed without written approval of the Transportation Engineer.

(g) Existing signal operations shall be presumed to reflect the local conditions and community expectations as determined and directed by the Transportation Engineer.

(h) If optimum usable bandwidth, as that term is defined by the Transportation Engineer, would be reduced if a traffic signal were installed then the intersection shall remain unsignalized and turning movements shall be limited.

(Res. 39-04 (§ 2.2.9.3), 4-21-04)

29.08.230 Street widening and other physical improvements.

Mitigation measures that include street widening and other physical improvements must be physically feasible and must meet minimum standards and code(s) for both on-site and off-site improvements.

(Res. 39-04 (§ 2.2.9.4), 4-21-04)

29.08.240 Neighborhood transportation impact analysis.

(a) The TIS shall analyze the project impacts on adjacent residential areas. The need for this study shall be identified as part of the base assumptions. If it is determined that a neighborhood TIS is required the following procedure shall be followed:

The applicant shall examine existing transportation conditions within the defined neighborhood. This shall follow the same procedure as set forth for the TIS. Daily and peak hour traffic volumes shall be collected for the local streets to be included in the analysis. Furthermore, the applicant shall:

(1) Determine project-generated traffic for all modes within the neighborhood and show on a figure in the TIS.

(2) Determine total traffic projections for the streets in the study area.

(3) Determine if the impacts created by the proposed project are significant to the residential streets.

(4) Develop measures, including but not limited to traffic calming techniques to mitigate impacts.

(b) The neighborhood TIS shall also discuss how pedestrians and bicyclists would access the proposed project to/from the adjacent neighborhood(s), and the need for special facilities to enhance pedestrian and bicycle connectivity.

(Res. 39-04 (§ 2.2.10), 4-21-04)

29.08.250 Conclusions.

The findings of the TIS shall be provided in a summary report.

(Res. 39-04 (§ 2.2.11), 4-21-04)

29.08.260 Recommendations.

Recommended improvements/mitigation measures to achieve standards and safety improvements shall be stated. The recommendation section of the report shall describe the location, nature, and extent of proposed improvements. A sketch of each improvement shall be provided showing the length, width, and other pertinent geometric features of the proposed improvement.

(Res. 39-04 (§ 2.2.12), 4-21-04)

Chapter 29.12

ACCESS MANAGEMENT

Sections:

29.12.010 Access management.
29.12.020 State highways.
29.12.030 City or County streets.
29.12.040 Backing into the right-of-way.
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29.12.010 Access management.

Access management is a means to protect the safety, traffic operations and the assigned functional purpose of the street system while considering the access needs of the various elements of the system. Access management addresses the problems of congestion, capacity loss and accidents. Providing access to land development while simultaneously preserving the flow of traffic on the surrounding road system in terms of safety, capacity needs and speed is the goal of access management. "Access" is defined as any driveway or other point of ingress/egress such as a driveway, alley, street, road or highway that connects to the public street system.

The street system serves two distinct purposes. The first is to provide mobility to the traveling public. The second is to provide direct access to properties. These two purposes may conflict such that multiple access points along a road restrict both the speed and capacity at which vehicles may travel. A properly designed system provides a balance such that certain streets, such as principal arterial highways, have a greater emphasis on facilitating mobility while other streets, such as local streets, can have a greater role in providing direct access to properties.

The existing and future function of each street is critical in determining the number, location, and design of access points and access control. Access management extends beyond simply specifying the number and separation of driveways and access points. Included are roadway design, such as auxiliary lanes, medians, stopping sight distance, channelization, and land development issues such as sign standards, internal site circulation, driveway layout, and alternative travel modes.

Appropriate access management strikes a balance in preserving the functional integrity of the street and providing access. Speed, capacity and safety are the significant reasons for instituting access management. With proper access management, the speed differential between vehicles can be minimized or separated and proper access management will reduce the number of conflict points, resulting in fewer accidents. When the traffic on the street system can travel safely and efficiently, capacity is preserved. Access management recognizes the interests of both landowners and roadway users in providing a transportation system that better meets the needs of all interests.

(Res. 39-04 (§ 3.0), 4-21-04)

29.12.020 State highways.

The State Highway Access Code 2, CCR 601-1, was amended. The most current document is: State of Colorado State Highway Access Code, Volume 2, Code of Colorado Regulations 601-1. Under that code, all accesses constructed on a State highway require an access permit approved by the State. The Access

Code requires owners of land adjacent to a State highway that is being developed or redeveloped to apply for an access permit for each access to the State highway if the use of the property is being changed or the existing access modified. The definition of property change is included in Section 2.6 of the Code.

(Res. 39-04 (§ 3.1), 4-21-04)

29.12.030 City or County streets.

Local jurisdictions approve the design, number, and location of access points. When changes in land use occur which result in changes in the type or nature of access operation, the access shall be approved with the development plans and constructed to meet current standards.

(Res. 39-04 (§ 3.2), 4-21-04)

29.12.040 Backing into the right-of-way.

Driveways, parking or loading areas that require backing maneuvers in a public street shall not be approved except for single-family or duplex residential uses on local streets. Exceptions may also be made in the downtown area, defined as the area between Pitkin Avenue to Grand Avenue, First Street to Eighth Street.

Backing into alleys will be allowed from normal parking stalls, regardless of land use, under the following conditions:

(a) The parking is designed so the parking stall and aisle meet the requirements in GJMC 29.16.230. The needed aisle width can include the existing alley.

(b) A maximum of four spaces in a row will be allowed, with a five-foot landscape area on each end of the spaces. This standard is designed for perpendicular parking spaces and a 50-foot-wide lot. Wider lots can create more spaces, up to a maximum of eight spaces without intermediate landscaping but the end landscaping is still required. Angle parking will be addressed on a case-by-case basis to achieve the intent of this standard.

(Res. 39-04 (§ 3.2.1), 4-21-04)

29.12.050 Provision of access.

If a property has frontage on more than one street, access will be permitted only on those street frontages where design and safety standards can be met. The primary access shall be on the lower-order street. Additional access points may be allowed based on traffic safety as determined by a TIS as described in Chapter 29.08 GJMC.

(Res. 39-04 (§ 3.2.2), 4-21-04)

29.12.060 Restriction of turning movements.

Turning movements may be limited where necessary for the safe and efficient movement of traffic, both on- and off-site.

(Res. 39-04 (§ 3.2.3), 4-21-04)

29.12.070 Number of access points and joint access.

Each development applying for access to a collector or arterial street shall analyze its own internal circulation system and access points, as well as impacts to the surrounding properties and street system as part of the required TIS.

Cross-access easements or stub streets to abutting properties may be required when it is determined that such abutting properties may be unable to meet access spacing standards. The project site design shall include a circulation and access system that will safely and efficiently accommodate traffic from adjacent

properties. The site plan shall include the site frontage for a minimum distance of 200 feet from the site property boundaries.

One access point per property ownership will be permitted, unless an approved site plan or TIS shows that additional access points are required to adequately handle driveway volumes and that the additional access points will not be detrimental to safety and traffic flow on adjacent public streets. Temporary access may be granted to accommodate phased development of a site. Temporary accesses are subject to removal, relocation, redesign or reconstruction after permanent approved access is constructed.

(Res. 39-04 (§ 3.2.4), 4-21-04)

29.12.080 Cross-access corridors.

Cross-access corridors shall be designed to provide common access and circulation among parcels, in order to assist in local traffic movement. Cross-access should be designed to include the following elements:

(a) Sufficient separation between the public street and the cross-access corridor to allow storage and circulation to occur within the site.

(b) Sufficient width to accommodate two-way travel aisles designed to accommodate automobiles, service and delivery vehicles.

(c) Stub-outs to the abutting properties that will be tied in to provide cross-access.

(d) Linkage to other cross-access corridors in the area, if applicable.

Wherever a cross-access corridor is designated on a subdivision plat, site plan or other development application, the property owner shall grant and record an easement allowing cross-access to and from the other properties in the area.

(Res. 39-04 (§ 3.2.5), 4-21-04)

29.12.090 Stub streets.

A stub street is an existing or planned street that is or will be extended to the property line(s) of a development for the purpose of future extension onto adjacent property. A stub street may be for access and/or as a part of the comprehensive circulation system.

(Res. 39-04 (§ 3.2.6), 4-21-04)

29.12.100 Abandoned accesses.

Existing driveways shall not be abandoned, relocated, altered, or reconstructed without a permit from the appropriate agency.

(Res. 39-04 (§ 3.2.7), 4-21-04)

29.12.110 Exclusive turn lanes.

Exclusive turn lanes are described in detail in the CDOT Access Management Code and in Chapter 29.28 GJMC.

(Res. 39-04 (§ 3.2.8), 4-21-04)

29.12.120 Field access.

“Field access” is defined as access used solely for agricultural purposes and traffic generation does not exceed one vehicle (two trip ends) per day when averaged over one calendar year. When an agricultural property changes to a new or more intensive land use, all field accesses to the property shall be considered

abandoned and access points for the new or more intensive use will be determined by the standards contained within this document.

(Res. 39-04 (§ 3.2.9), 4-21-04)

29.12.130 Access exceptions.

Exceptions to these standards shall be allowed only as set forth in Chapter 29.64 GJMC.

(Res. 39-04 (§ 3.3), 4-21-04)

Chapter 29.16

ACCESS DESIGN AND SITE CIRCULATION

Sections:

29.16.010 Access and site design.
29.16.020 Access locations.
29.16.030 Spacing.
29.16.040 Offsets.
29.16.050 Corner clearance.
29.16.060 Access design – Types of access.
29.16.070 Design vehicles.
29.16.080 Curb radii.
29.16.090 Driveway width.
29.16.100 Throat lengths and vehicle storage.
29.16.110 Accesses serving off-street parking lots.
29.16.120 Commercial uses.
29.16.130 Grades.
29.16.140 Sight distance.
29.16.150 Channelization islands.
29.16.160 Pedestrians and bicycles.
29.16.170 Transit.
29.16.180 Emergency vehicles.
29.16.190 Utilities and lighting.
29.16.200 Site circulation.
29.16.210 Delivery and service.
29.16.220 Transit and pedestrians.
29.16.230 Inter-parcel circulation.
29.16.240 Landscaping.

29.16.010 Access and site design.

"Access" is defined as any driveway or other point of ingress/egress such as a street, road, highway or driveway that connects to the public street system. This chapter defines the types of access, their locations, and geometric requirements.

Acceptable site design is achieved when three major elements – access location and design, site circulation and parking, building footprint and location – are integrated. Site circulation can directly affect the safety, traffic operations and the assigned functional purpose of the street system. Good site circulation is necessary to protect the integrity of the public streets as well as public safety within the site.

(Res. 39-04 (§ 4.0), 4-21-04)

29.16.020 Access locations.

All entrances and exits to vehicular traffic areas shall be located and constructed to minimize traffic congestion on the public street system.

(Res. 39-04 (§ 4.1), 4-21-04)

29.16.030 Spacing.

On local residential streets, single-family residential driveways shall be spaced a minimum of five feet measured from the property line to allow for maneuvering to occur without trespass. In locations where the five-foot minimum spacing cannot be met due to limited lot frontage or other field constraint, the Development Engineer may permit a variance from the spacing standard.

On local commercial and industrial streets, driveways shall be spaced a minimum of 50 feet, measured from edge of access to edge of access. On collector streets, driveways shall be spaced a minimum of 150 feet apart. On arterial streets where no other access to lower order streets is available, commercial driveways may be allowed where spaced a minimum of 300 feet and may be restricted to right-in, right-out movements. No new residential driveways shall be allowed on arterial streets.

(Res. 39-04 (§ 4.1.1), 4-21-04)

29.16.040 Offsets.

Where properties are not large enough to allow accesses on opposite sides of the street to be aligned, the center of accesses and intersections not in alignment shall be offset a minimum of 50 feet on local commercial streets, offset 150 feet or greater on all collector streets and offset 300 feet or greater on all arterial streets. Greater distances may be required for left-turn storage lanes. Shared accesses shall be encouraged wherever possible to minimize the number of access points along a street. Shared access provides for safer and more efficient operation of the flow of traffic on the street and shall meet the above requirements.

(Res. 39-04 (§ 4.1.2), 4-21-04)

29.16.050 Corner clearance.

"Corner clearances" are defined as the distance between a driveway and the nearest intersecting street. The clearance is necessary so that accesses do not interfere with street intersection operations and should provide drivers with adequate perception-reaction time to avoid potential conflicts. On corner lots, the access location shall be on the street of lowest functional classification.

Minimum Corner Clearance (ft.)
Measured from Flowline to Near Edge of Access

Street Classification	Clearance from Unsignalized Intersections	Clearance from Signalized Intersections	Single-Family Residential Driveways
Local	50′	150′	50′
Collector	150′	150′	100′
Minor Arterial	150′ *	300′ *	100′ *
Major Arterial	300′ *	300′ *	150′ *

*May be restricted to right-in, right-out only access. Single-family access to arterial streets is not acceptable practice and will be permitted only in extreme hardship cases.

(Res. 39-04 (§ 4.1.3), 4-21-04)

29.16.060 Access design – Types of access.

Generally, all new private property access shall be designed as curb cuts. Radii-type curb returns with handicap ramps will be required for accesses when the peak hour right turn entering volume exceeds 20 vehicles in the peak hour. Auxiliary lanes shall be constructed when turn volumes meet the minimum criteria in the right-turn warrant chart.

(Res. 39-04 (§ 4.2.1), 4-21-04)

29.16.070 Design vehicles.

All accesses shall be designed to accommodate the turning characteristics of the largest vehicle that will most commonly utilize the proposed access. Most residential and small commercial driveways only need

to accommodate passenger cars; other commercial or industrial developments will usually require at least one access that can accommodate the efficient entry or exit of larger vehicles.

(Res. 39-04 (§ 4.2.2), 4-21-04)

29.16.080 Curb radii.

The radius at the flowline of gutter shall be 20 feet for multifamily residential access and 25 feet for commercial access. Radii for industrial uses or truck delivery accesses shall be individually designed for the type of truck that will frequently use the access, with a maximum required radius of 50 feet.

(Res. 39-04 (§ 4.2.3), 4-21-04)

29.16.090 Driveway width.

Single-family residential driveway widths shall be between 12 feet and 33 feet. All other access drive widths shall be between 28 feet and 40 feet. Multi-lane driveways shall be designed to accommodate a standard ingress lane of 16 feet and egress lanes of 12 feet.

(Res. 39-04 (§ 4.2.4), 4-21-04)

29.16.100 Throat lengths and vehicle storage.

Adequate vehicle storage capacity shall be provided for both inbound and outbound vehicles. Adequate storage facilitates the safe and efficient movement of vehicles between the street and the development.

The access throat shall be of sufficient length to prevent vehicles from spilling onto the public street system. Inbound vehicle storage areas shall be of sufficient size to ensure that vehicles will not obstruct the adjacent street, sidewalk, or circulation within the facility. The throat shall be of sufficient length to provide adequate storage of outbound vehicles without them interfering with on-site circulation. Outbound vehicle storage areas shall be provided to eliminate backup and delay of vehicles within the development. At signalized intersections, adequate storage for the outbound movement must be provided to enable vehicles to exit efficiently on green.

The requirements for vehicle storage in parking lots and at drive-up type facilities are generally based on a typical vehicle spacing of 20 feet, but may be increased where larger vehicles can be expected.

(Res. 39-04 (§ 4.2.5), 4-21-04)

29.16.110 Accesses serving off-street parking lots.

On-site storage is measured from the flowline of the street to the first parking stall or aisle of a parking lot. Vehicle storage equivalent to or greater than the minimum distances shall be provided at accesses serving the site. The recommended distance for accesses with two approach lanes may be adjusted, subject to the TIS findings, roadway geometry, traffic volumes, and site layout.

On-Site Driveway Vehicle Storage Lengths (Feet)

Parking Spaces per Exit Lane	Storage Length Required			
	Multifamily Residential	Retail	Office	Industrial
0 – 200	25	50	25	50
201 – 400	25	75	100	150
401 – 600	50	150	200	More Lanes
601 – 700	100	200	More Lanes	More Lanes
> 700	200	More Lanes	More Lanes	More Lanes

Vehicle Storage Requirements for Drive-Up Facilities

Type of Facility	Vehicle Storage
Automated Tellers	4 spaces per machine
Drive-In Bank	6 spaces per window
Drive-In Restaurant	10 spaces per window[1]
Automatic Car Wash	10 spaces per wash line
Self-Service Car Wash	2 spaces per wash line
Drive-In Theater	15% of the total parking capacity
Service Stations	1 space per nozzle + 1 space/island/direction
Drive-In Liquor Store	3 spaces per window[1]
Drive-In Dry Cleaners	2 spaces per window[1]

[1]Measured from the pick-up window.

Adapted from Table 9-4, NCHRP 348 *Access Management Guidelines for Activity Centers.*

(Res. 39-04 (§ 4.2.5.1), 4-21-04)

29.16.120 Commercial uses.

The vehicle storage area that shall be provided for various drive-through commercial uses shall be:

(a) Based on a 20-foot length vehicle and a 12-foot-wide lane.

(b) Separated from normal parking circulation aisles.

(c) Designed using the appropriate design vehicle turning template.

(Res. 39-04 (§ 4.2.5.2), 4-21-04)

29.16.130 Grades.

Access grades shall meet the City Standard Contract Documents.

(Res. 39-04 (§ 4.2.6), 4-21-04)

29.16.140 Sight distance.

Adequate sight distance and sight zones shall be provided at all access intersections.

(Res. 39-04 (§ 4.2.7), 4-21-04)

29.16.150 Channelization islands.

Channelizing islands may be incorporated into the access design for purposes of limiting movements into or out of accesses. Use of medians to control turning movements is preferred and will be required where physical conditions allow.

When allowed, the islands shall not be smaller than 100 square feet and shall provide vertical curb and colored exposed aggregate or patterned concrete treatment. Patterns and color shall match those of any nearby islands or medians. Additional right-of-way or easement may be required to accommodate these designs. The ends of the islands shall typically be constructed with two-foot flowline radii.

(Res. 39-04 (§ 4.2.8), 4-21-04)

29.16.160 Pedestrians and bicycles.

Pedestrians and bicyclists are especially vulnerable to turning vehicles at access drives. The consolidation of access points benefits pedestrians and bicyclists by reducing the number of conflict points along the roadway. Access designs for pedestrian and bicycle facilities shall conform to Chapter 29.28 GJMC requirements and with the City Standard Details.

(Res. 39-04 (§ 4.2.9), 4-21-04)

29.16.170 Transit.

Where applicable, accesses shall be designed to accommodate buses or other transit vehicles in accordance with Chapter 29.48 GJMC. These accommodations shall occur at shopping centers, malls, or other mixed use developments where transit vehicles may be frequent users of the on-site circulation system.

(Res. 39-04 (§ 4.2.10), 4-21-04)

29.16.180 Emergency vehicles.

All accesses shall be designed to readily accommodate emergency vehicles that would ordinarily respond at the particular establishment (Refer to Chapter 29.24 GJMC, Fire Department Access, regulations based on the Uniform Fire Code).

(Res. 39-04 (§ 4.2.11), 4-21-04)

29.16.190 Utilities and lighting.

Accesses shall be located to ensure that utility poles, electric boxes, and signs do not interfere with the visibility of the access or available sight distances. The design of site lighting shall maximize the visibility and location of the access.

(Res. 39-04 (§ 4.2.12), 4-21-04)

29.16.200 Site circulation.

On-site circulation shall be given the same attention as is given to the design of public street systems. Poor site design and circulation is detrimental to both the public investment in the street system and the private investment in the property. Access locations, building location, site circulation, and parking are highly interrelated as each one has a dramatic effect on the others. The design of the on-site circulation system shall be an integral part of the overall site and access design process.

(Res. 39-04 (§ 4.3), 4-21-04)

29.16.210 Delivery and service.

Proposed development that includes truck loading/unloading shall provide adequate space for all truck operations. Adequate space minimally means that all truck operations be performed entirely on-site and off the public street system. Sufficient apron space shall be provided at all loading/unloading areas. Sufficient apron space means the area required for truck backing maneuvers. Delivery areas shall be separated from general traffic areas. Separation of delivery vehicle traffic from customer traffic shall occur entirely on-site. On-site roadways used by delivery vehicles shall be designed to accommodate the heavier payloads and turning characteristics of the largest vehicle expected to use the site.

(Res. 39-04 (§ 4.3.3), 4-21-04)

29.16.220 Transit and pedestrians.

In larger mixed use developments, shopping centers and malls, on-site roadways shall be designed to accommodate transit. This includes the design of pick-up/drop-off areas as well as the circulating roadways. Transit stops shall be located within a reasonable walking distance of the main building entrance

while minimizing potential conflicts with circulating vehicles. Adequate pedestrian facilities must be designed on-site to reduce conflicts between pedestrians and vehicles.

(Res. 39-04 (§ 4.3.4), 4-21-04)

29.16.230 Inter-parcel circulation.

Where practical and where reasonable walking distances can be provided, inter-parcel circulation with shared access shall be implemented. This will reduce the number of curb cuts on public streets and will increase the safety and capacity of the street system.

(Res. 39-04 (§ 4.3.5), 4-21-04)

29.16.240 Landscaping.

Site landscaping requirements are detailed in the zoning and development code. Landscaping at access points must meet the requirements for sight distance and the sight zone. Landscaping islands shall also consider the same requirements.

(Res. 39-04 (§ 4.3.6), 4-21-04)

Chapter 29.20

RESIDENTIAL AND COMMERCIAL STREETS, LANDSCAPING AND TRAFFIC CALMING

Sections:

29.20.010 Street standards.
29.20.020 Residential and commercial streets.
29.20.030 Block and lot dimensions.
29.20.040 Right-of-way, street lane widths, and street lengths.
29.20.050 Cul-de-sacs and dead end streets.
29.20.060 Alignments.
29.20.070 Vertical alignment.
29.20.080 Cross section.
29.20.090 Stopping sight distance.
29.20.100 Bicycle treatments.
29.20.110 Intersections.
29.20.120 Unsignalized intersections.
29.20.130 Signalized intersections.
29.20.140 Angles.
29.20.150 Grades.
29.20.160 Spacing and offsets.
29.20.170 Intersection sight distance.
29.20.180 Sight zones.
29.20.190 Pedestrian treatments.
29.20.200 Landscaping – Sight distance at intersections.
29.20.210 Traffic calming.
29.20.220 Methods to divert traffic from residential streets.
29.20.230 Methods to slow traffic on residential streets.
29.20.240 Methods to slow traffic at intersections.
29.20.250 Traffic calming in new developments.

29.20.010 Street standards.

Geometric street standards have been developed to provide livability for residents, safety for both vehicular and pedestrian traffic and efficient movement. This chapter sets the minimum standards for geometric design of residential streets and commercial streets. These streets deserve special discussion because they are the most common streets built for development. “Local residential streets” and “commercial streets” are defined as streets whose primary function is to serve the abutting land use. Design criteria for both horizontal and vertical alignments are established in this chapter. Design criteria for collector and higher classification streets are discussed in Chapter 29.28 GJMC.

(Res. 39-04 (§ 5.0), 4-21-04)

29.20.020 Residential and commercial streets.

Streets shall conform with the adopted Grand Junction Circulation Plan. Minimally, the plan identifies locations where collector street connections are desired and identifies general alignments for residential streets. Street layouts shall continue streets in adjoining subdivisions or their anticipated locations when adjoining property is not yet developed to provide interconnectivity.

(Res. 39-04 (§ 5.1), 4-21-04)

29.20.030 Block and lot dimensions.

Blocks shall not exceed 1,200 feet in length between intersections (streets providing multiple access, not cul-de-sacs) except where topography, traffic, or other conditions require longer blocks.

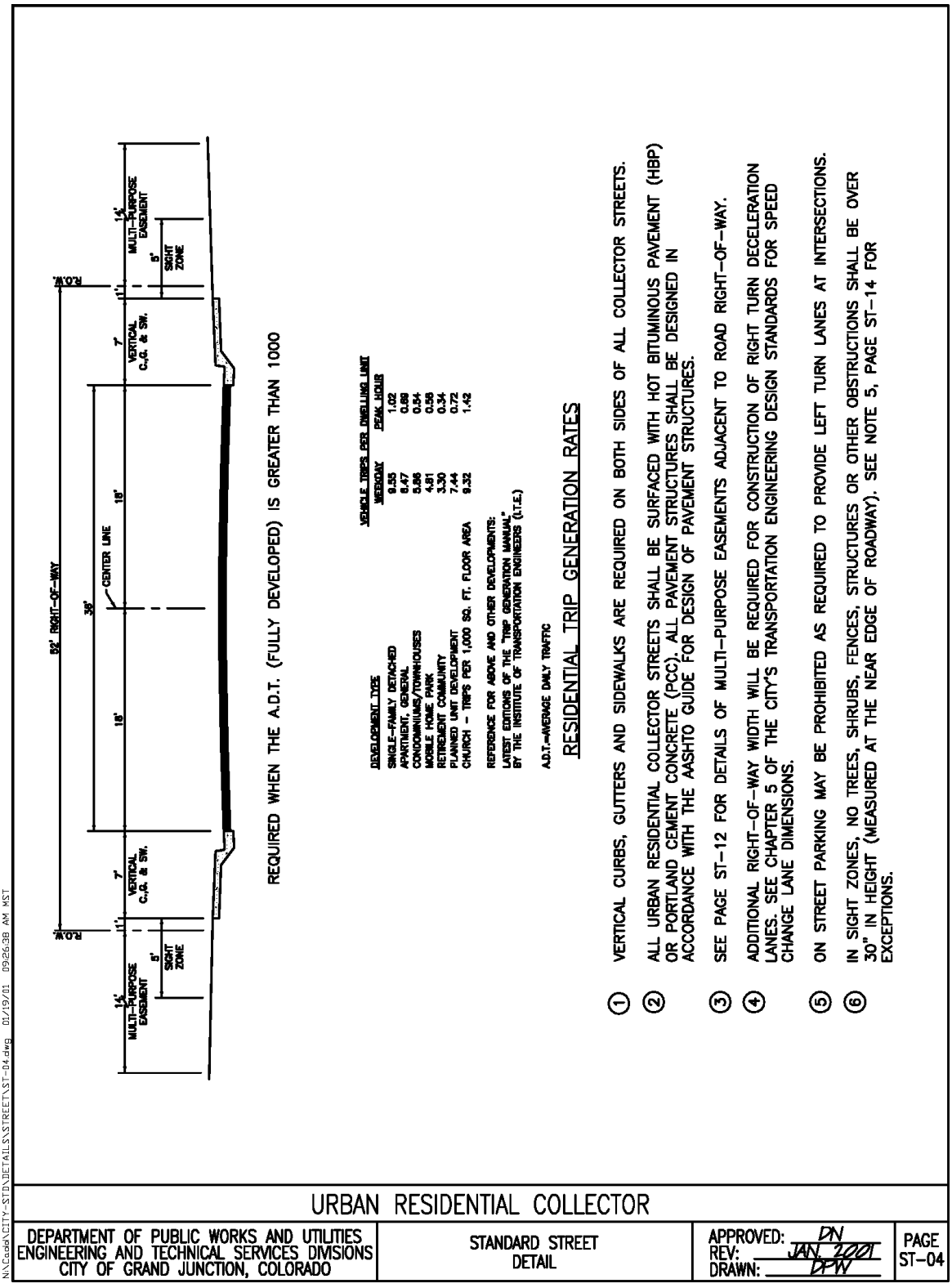
No lots shall be divided by street, alley, or any other thoroughfare or property, or by City boundary lines.

(Res. 39-04 (§ 5.1.1), 4-21-04)

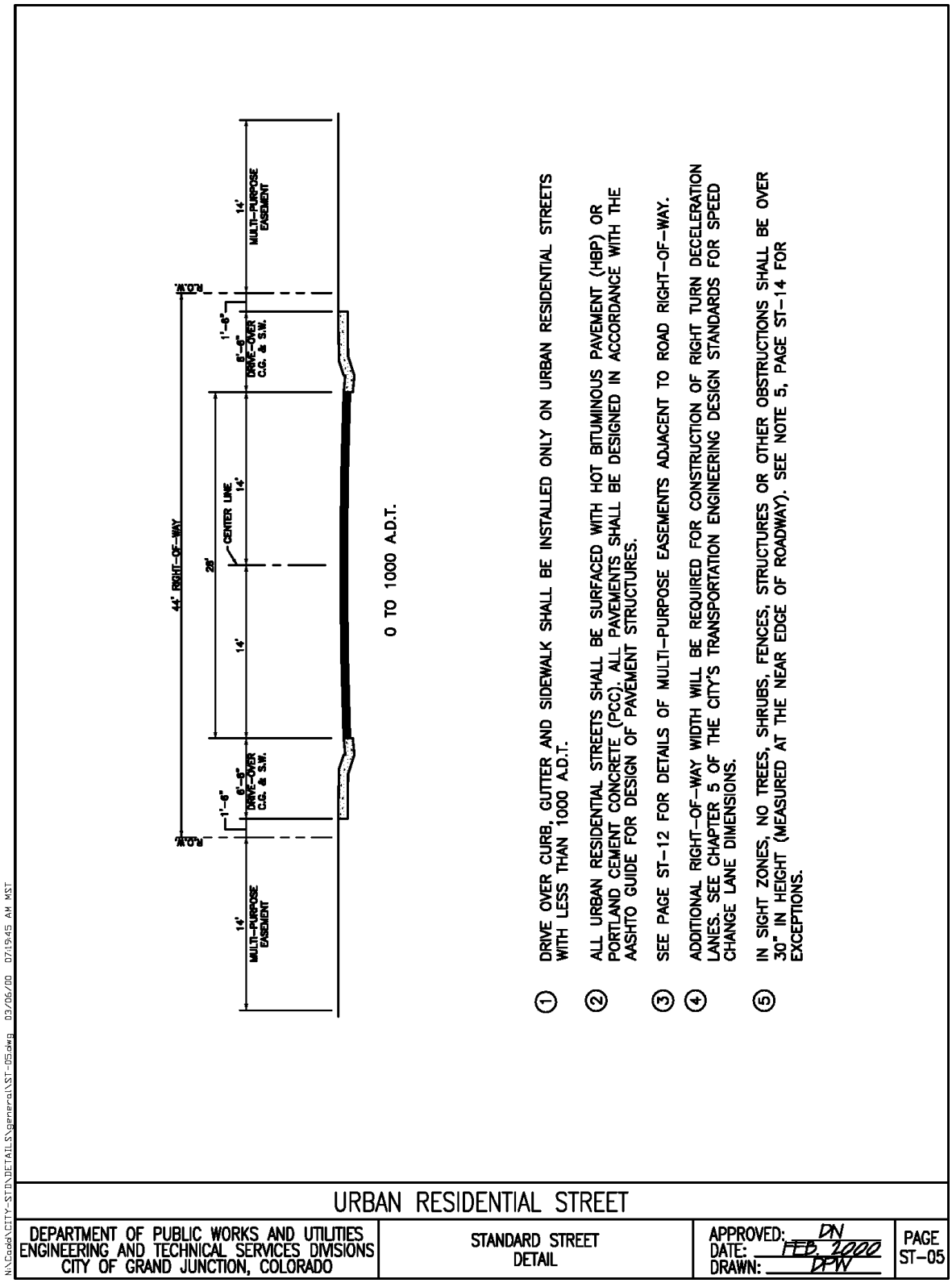
29.20.040 Right-of-way, street lane widths, and street lengths.

The required right-of-way width for a street is stated in the City Standard Details. Additional widths may be required for needed through lanes, turn lanes, speed change lanes, and where it is necessary to accommodate slopes, irrigation crossings and drainage structures.

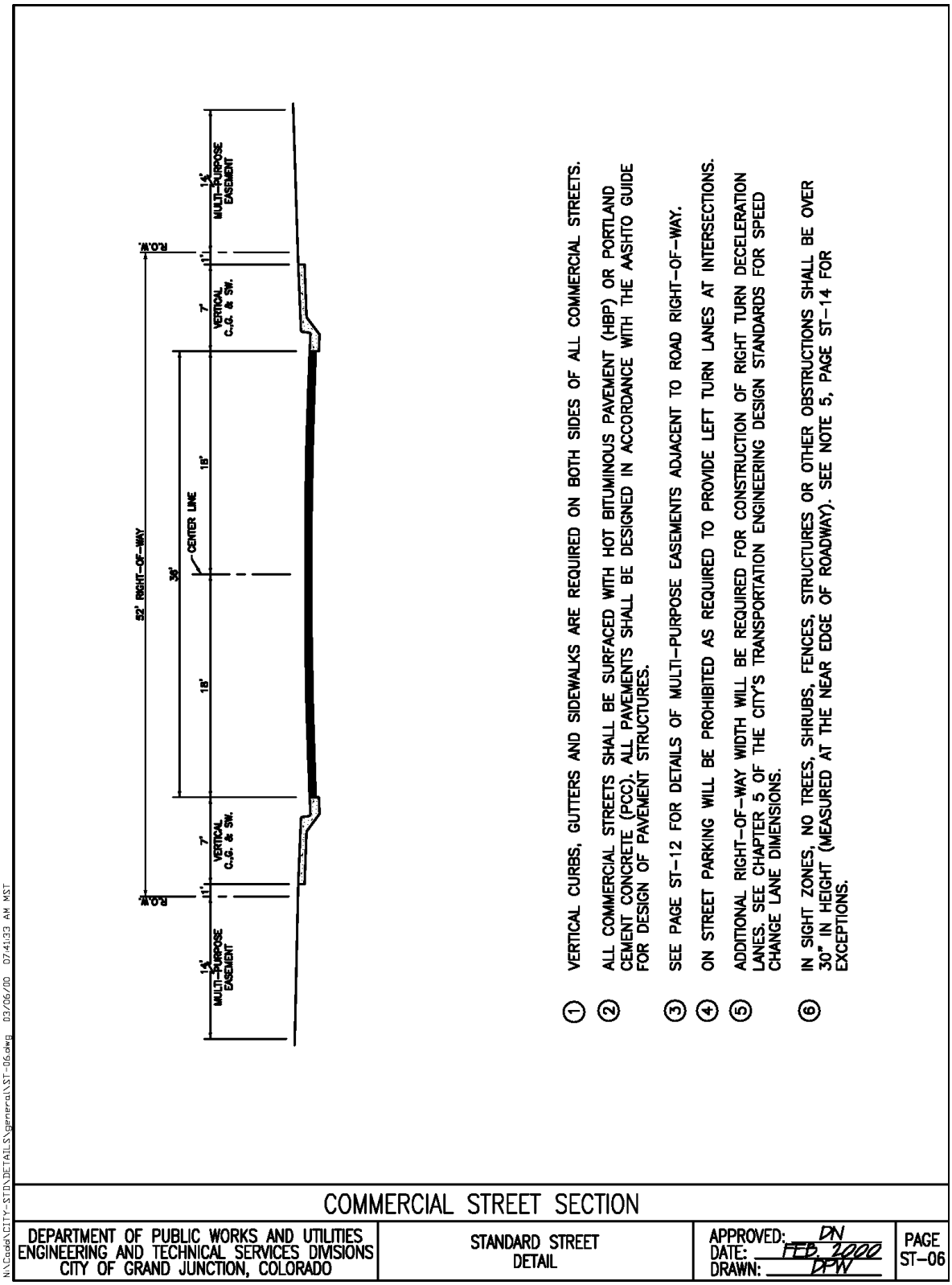
(a) Urban Residential Collector.



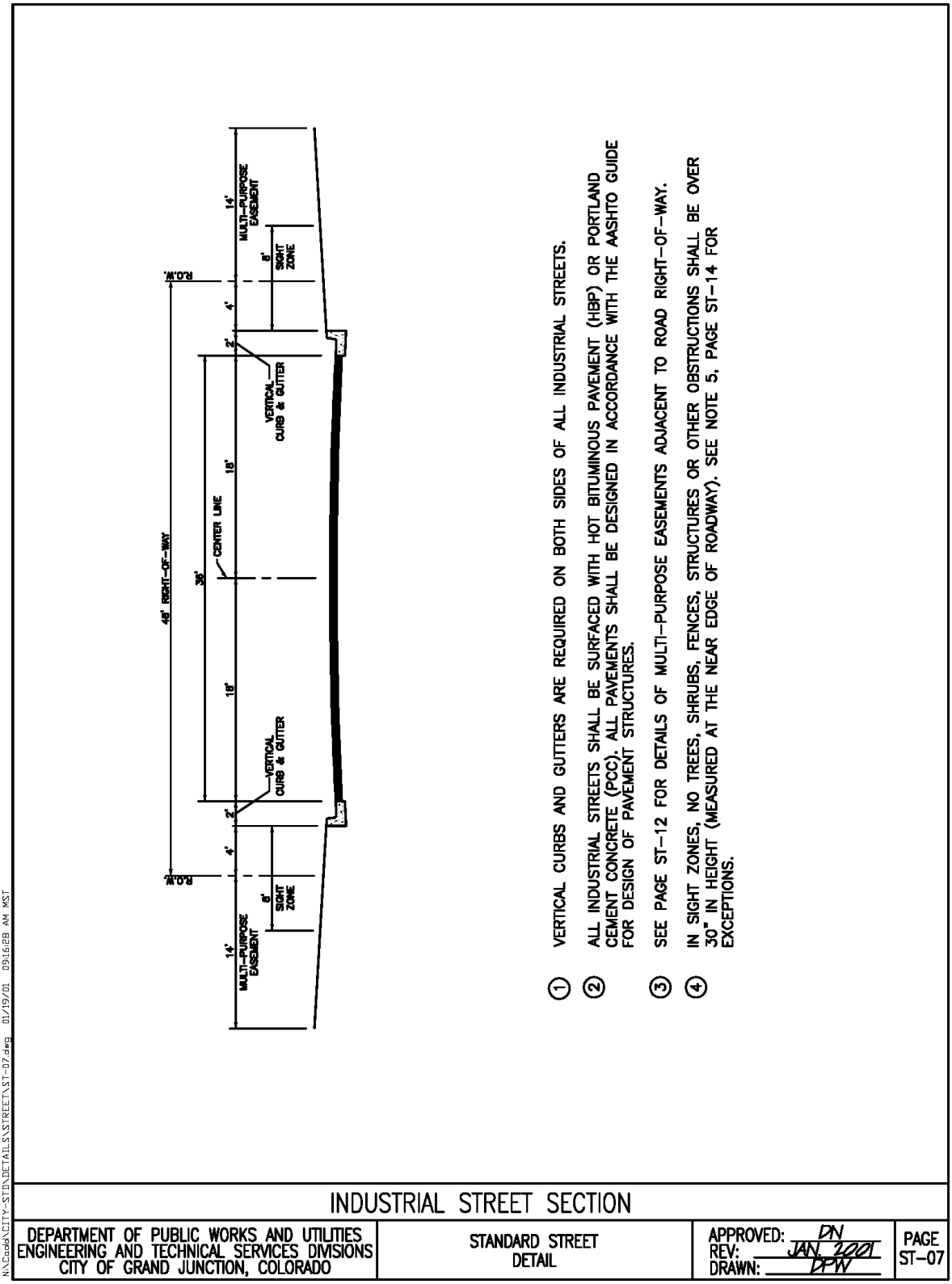
(b) Urban Residential Street.



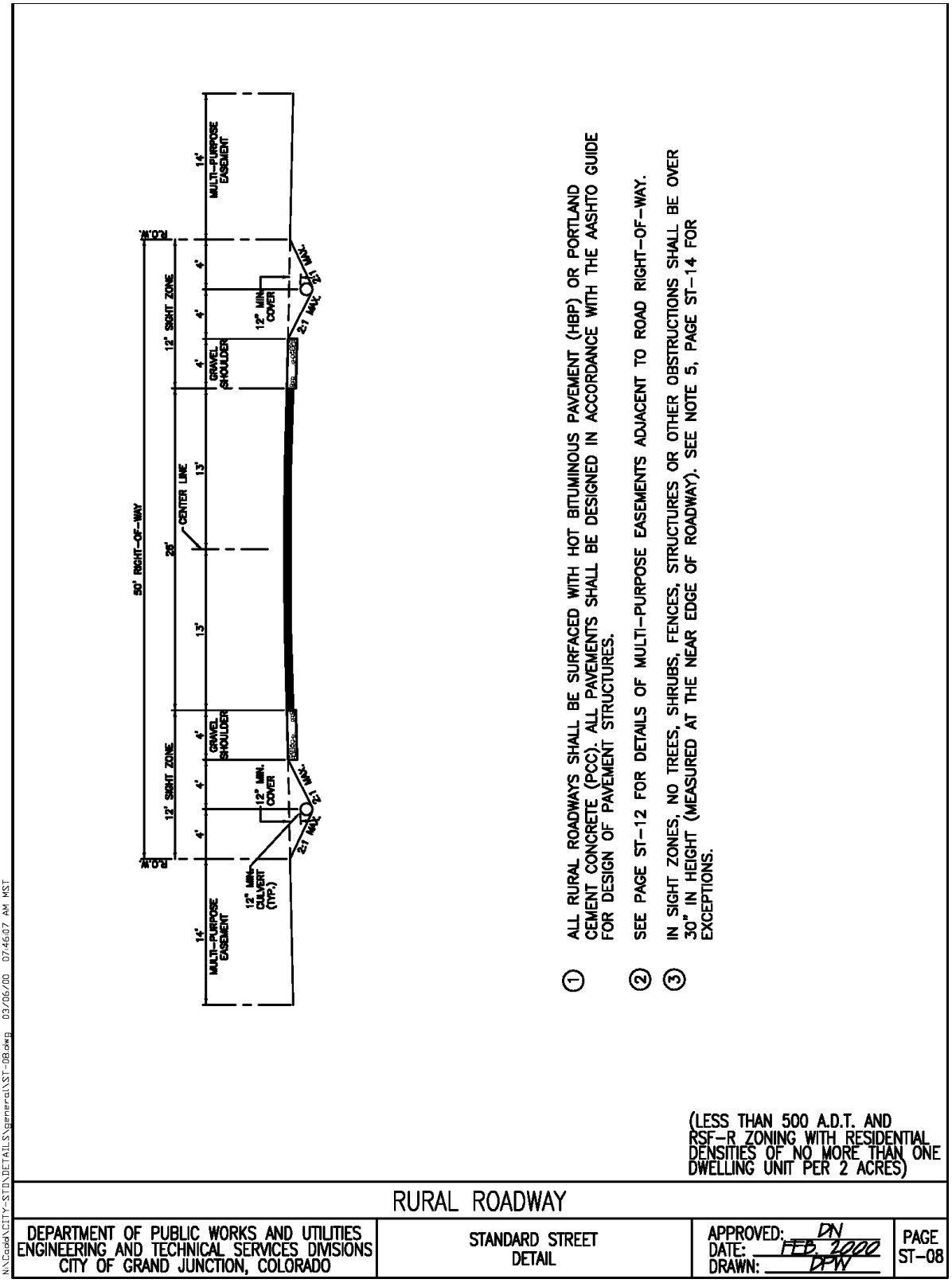
(c) Commercial Street Section.



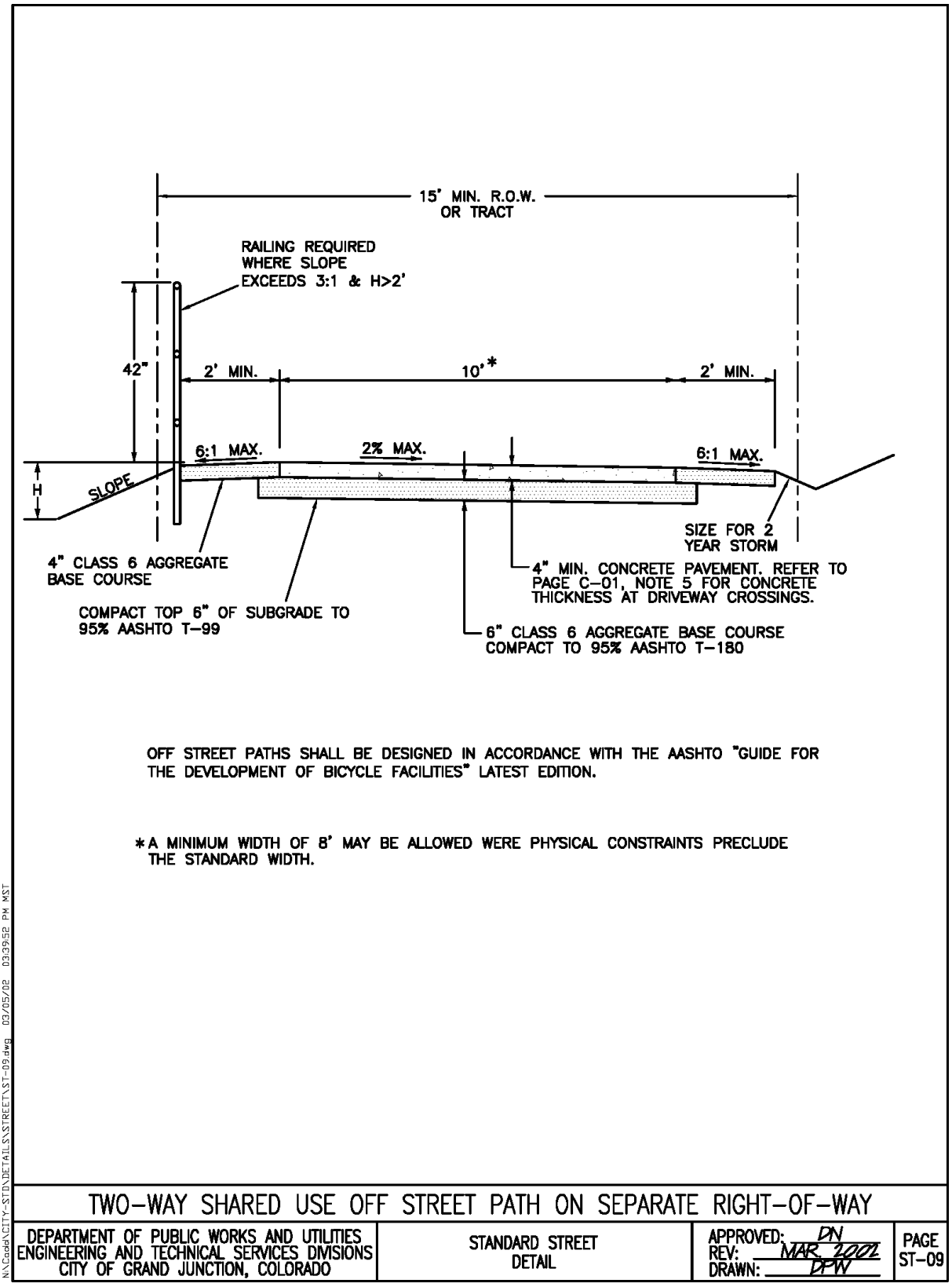
(d) Industrial Street Section.



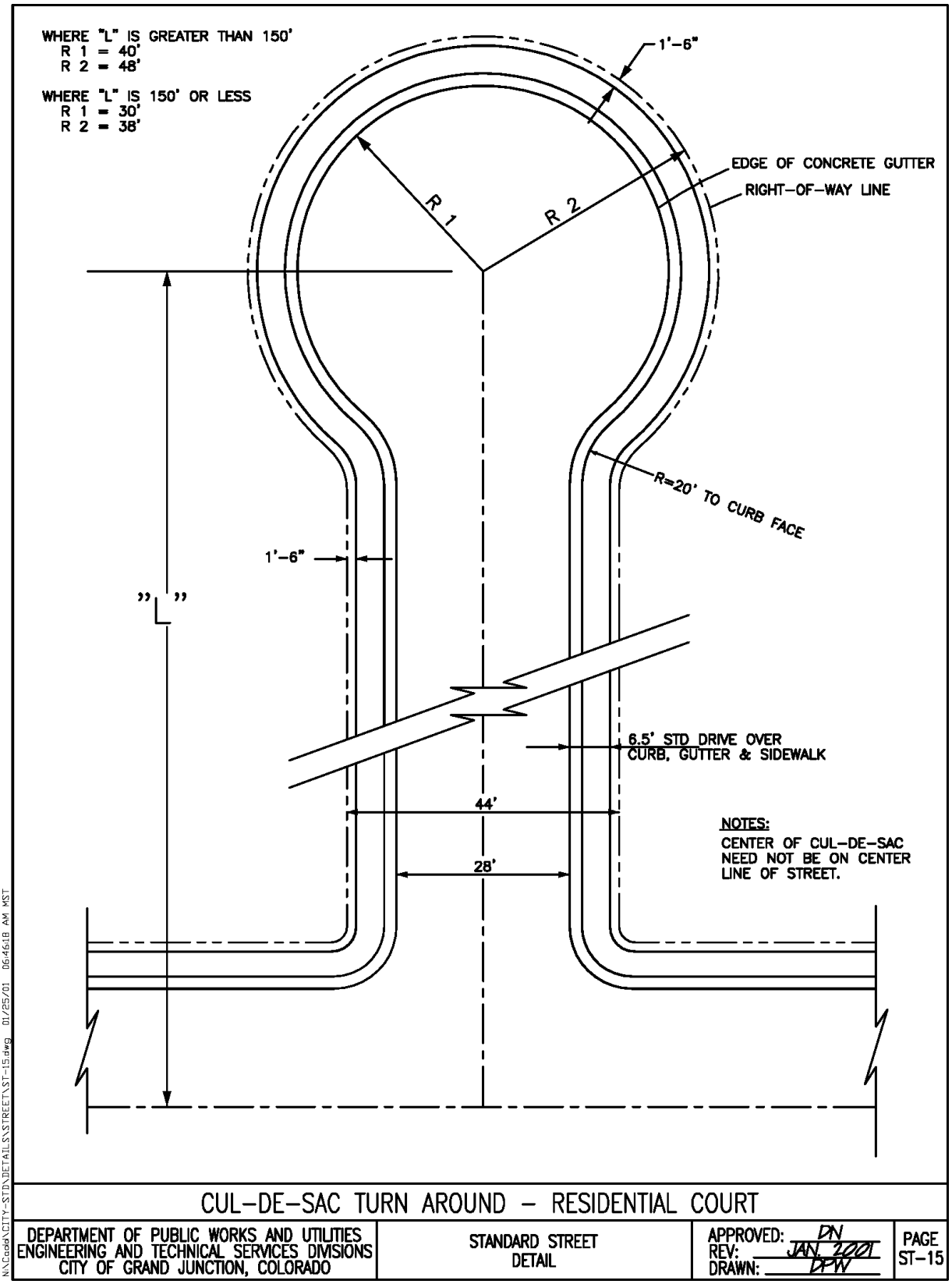
(e) Rural Roadway.



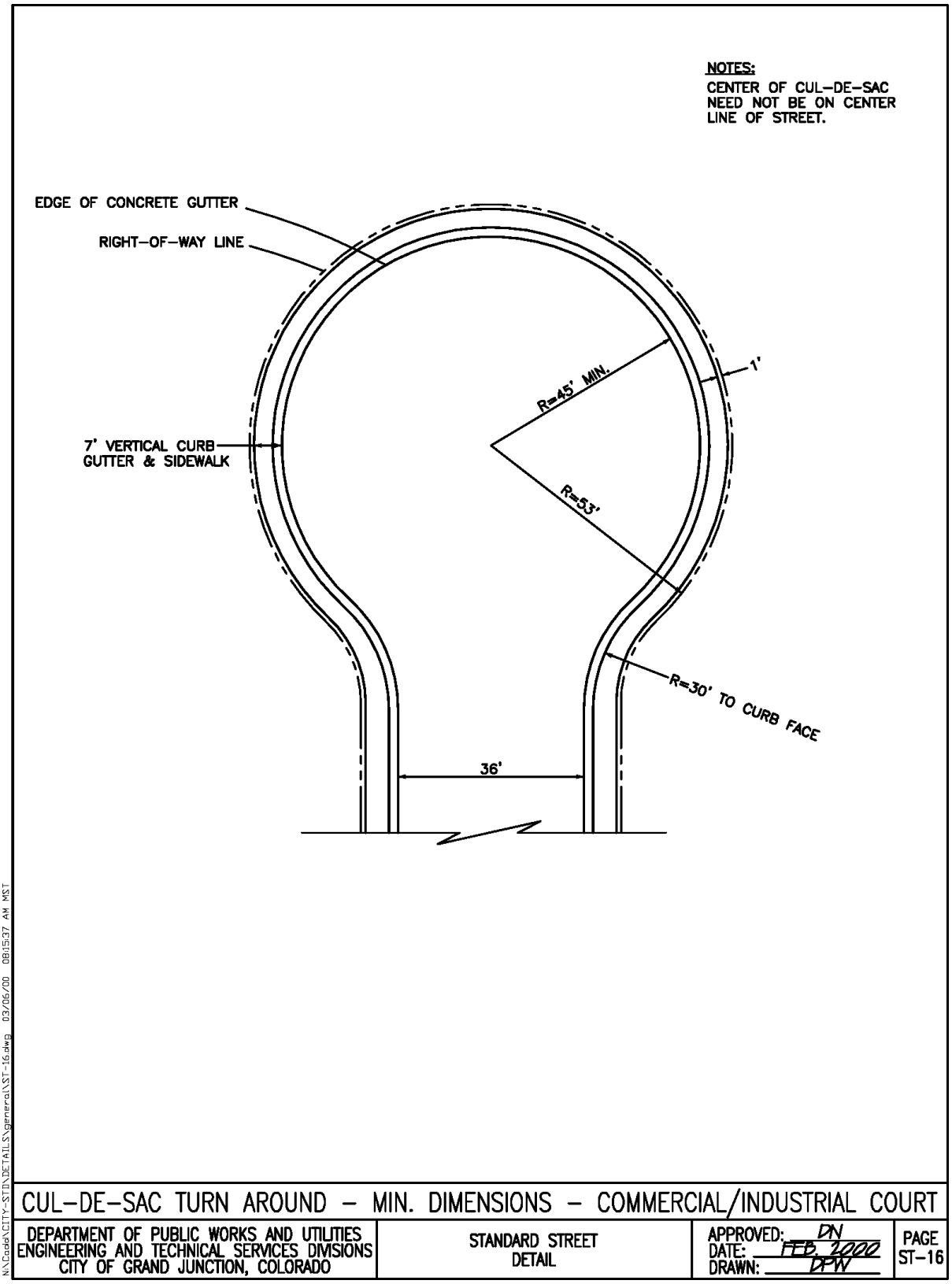
(f) Two-Way Shared Use Off-Street Path on Separate Right-of-Way.



(g) Cul-De-Sac Turnaround – Residential Court.



(h) Cul-De-Sac Turnaround – Minimum Dimensions – Commercial/Industrial Court.



(Res. 39-04 (§ 5.1.2), 4-21-04)

29.20.050 Cul-de-sacs and dead end streets.

No cul-de-sac shall be more than 750 feet long, measured from the center of the intersection to the center of the turnaround.

No more than 30 lots shall be located on a cul-de-sac street. All cul-de-sacs shall have a turnaround at the terminus point.

Surface drainage of a cul-de-sac shall be conveyed toward the intersecting street, if possible, and if not possible a drainage easement shall be provided leading out of the cul-de-sac.

Fire Department access standards contain additional details to assist developers and designers in meeting the requirements of the Fire Department.

Single access street systems shall be allowed for a maximum of 100 dwelling units. The layout of the subdivision shall meet sections D104.3 and D107 of the International Fire Code. A future secondary access is required to be platted as public right-of-way and constructed to public street standards to the property line of the subdivision. A temporary turnaround shall be constructed if the stub street access is longer than 150 feet.

(Res. 39-04 (§ 5.1.3), 4-21-04)

29.20.060 Alignments.

(a) Horizontal Alignment. Designs must conform to the pattern of thoroughfares designated in the Grand Junction Circulation Plan. Proposed streets align with existing or platted streets with which they are to connect.

Local streets (if not ending in a cul-de-sac) shall extend to the boundary lines of the project. A temporary turnaround area paved with asphalt surfacing shall be required at the end of the street improvement if a cul-de-sac is not provided. Proposed streets with widths different from existing streets to which they are being connected must be transitioned using the pavement transition taper standards.

(b) Curve Radii.

(1) All curve designs shall be based on the horizontal curve design criteria.

Horizontal Curve Design Criteria

Design Criteria	Local[1]		
	Hillside[2]	Residential	Industrial/ Commercial
Design Speed (mph)	20	25	30
Center[3] Line Radius (ft.)	100	150	300
Horiz. Sight Dist. (ft.)	150	200	200
Reverse Curve Tangent (ft.)	0	0	0
Approach[4] Tangent at Intersections	50	75	100

[1] These criteria are to be used without superelevation.

[2] Hillside is defined as having grades of 10 percent or greater, as defined in GJMC 21.07.020.

[3] Radii shown are based on the street having a crown section with a pavement cross-slope of two percent on each side of the crown.

[4] Where a curved road approaches an intersection, these tangent sections must be provided on the approach to the intersection to provide for adequate sight distance for traffic control devices at the intersection. The distance shall be measured from the flowline of the through street.

(2) Intersections shall meet minimum flowline radii at public street intersections.

Minimum Intersection Flowline Radii

Through Street[2]	Intersecting Street				
	Arterial	Collector	Local Residential	Local Commercial	Local Industrial[1]
Local Residential	Not Allowed	25′	20′		
Local Commercial	30′	30′	20′	30′	30′
Local Industrial		30′		30′	30′

[1] Radii at intersections with industrial streets shall be designed on a case-by-case basis considering the turning requirements for the type of truck that will most commonly use the street.

[2] At signalized intersections where right-turn channelization islands are provided or high truck and bus volumes may use the access, a larger flowline radius may be required.

(c) Tangent Distance Between Curve. There is no minimum tangent distance between curves for residential or commercial street design.

(d) Superelevation. Superelevation is not allowed on residential street curves.

(Res. 39-04 (§ 5.1.4), 4-21-04)

29.20.070 Vertical alignment.

(a) Grades. Design grades and vertical sight distance address drainage and/or safety concerns for vehicles and pedestrians. Grades of streets shall not be less than 0.5 percent, nor more than eight percent. In hilly terrain (defined as having grades of 10 percent or greater, as defined in GJMC 21.07.020), the maximum grade for local residential streets is 12 percent for a maximum distance of 500 feet.

(b) At unsignalized intersections, the maximum grade in the intersection shall be four percent, and extends a minimum of 50 feet in each direction from flowline of the intersecting street. At signalized intersections, the maximum grade shall be two percent within the intersection and extend for 200 feet in each direction. When intersecting with State highways, refer to Section 4 of the State Access Code.

(Res. 39-04 (§ 5.1.5), 4-21-04)

29.20.080 Cross section.

(a) Street Cross Slopes. The typical cross slope is two percent crown to provide for adequate drainage to the pavement edge. The maximum cross slope shall not exceed four percent. The minimum cross slope shall be one percent. Typical sections are shown in the City Standard Details.

(b) Roadside Barrier and Bridge Rails. Roadside barriers shall be required in accordance with warrants, design criteria and standards for roadside barriers and bridge rails as defined in the AASHTO Roadside Design Guide, 1989 Edition or latest.

(Res. 39-04 (§ 5.1.6), 4-21-04)

29.20.090 Stopping sight distance.

"Stopping sight distance" is defined as the length of roadway ahead visible to the driver. The minimum stopping sight distance available on a roadway must be sufficiently long to enable a vehicle traveling at or near the roadway design speed to stop before reaching a stationary object in its path or react to a traffic control device such as a stop sign.

The appropriate stopping sight distance shall be provided. The distances shown assume vehicles traveling on wet pavement on flat grades. Factors that take into account the effect of grade on stopping sight distance shall be used in determining appropriate stopping sight distance where the grades are three percent or higher.

(Res. 39-04 (§ 5.1.7), 4-21-04)

29.20.100 Bicycle treatments.

Bicycle facilities shall be provided in accordance with the adopted Grand Junction Circulation Plan. Provisions for bicycle facilities shall be in accordance with the AASHTO Guide for Development of New Bicycle Facilities 1999.

The standard cross-section of off-street bicycle paths is shown in the City Standard Details.

(Res. 39-04 (§ 5.1.8), 4-21-04)

29.20.110 Intersections.

There are two general types of intersections: unsignalized and signalized. Each of these shall have several different configurations and levels of traffic control. A roundabout is a form of an unsignalized intersection and is specifically discussed in GJMC 29.28.220. All intersection design shall conform to the guidelines set forth in AASHTO and the MUTCD.

(Res. 39-04 (§ 5.2), 4-21-04)

29.20.120 Unsignalized intersections.

There are two appropriate levels of traffic control at unsignalized intersections: two-way stop controlled and all-way stop controlled. The appropriate use of each of these is discussed in the following sections.

(a) Two-Way Stop Controlled Intersections.

  (1) Two-way stop controlled intersections shall be installed in new subdivisions.

  (2) Stop signs shall be installed in accordance with the MUTCD.

  (3) At intersections of two different types of roadways, a stop sign shall be used on the minor street to stop the lesser flow of traffic. Stop signs will generally be used at all intersections that do not meet the all-way stop control or traffic signal warrants.

(b) All-Way Stop Controlled Intersections. An all-way or “multi-way” stop installation shall be used only as warranted in Part II of the MUTCD.

(Res. 39-04 (§ 5.2.1), 4-21-04)

29.20.130 Signalized intersections.

Signals will not normally be considered for residential streets or commercial streets. Where signals may be warranted, the criteria in GJMC 29.28.130 shall be followed, and documented in a transportation impact study.

(Res. 39-04 (§ 5.2.2), 4-21-04)

29.20.140 Angles.

Public streets shall intersect at 90-degree angles or as close to 90 degrees as topography permits, in any event no less than 80 degrees. Intersections on horizontal curves shall be avoided.

(Res. 39-04 (§ 5.2.3), 4-21-04)

29.20.150 Grades.

Intersections shall be on grades as flat as practical. At unsignalized intersections, the maximum allowable grade in the intersections is four percent and extends a minimum of 50 feet in each direction from the outside edge of the traveled way of the intersecting street. At signalized intersections, the maximum grade is two percent within the intersection and extends 200 feet in each direction. Grades above four percent will only be allowed on local and collector streets in areas with steep topography or other unusual circumstances that prevent a flatter grade, and must be documented as a design exception.

(Res. 39-04 (§ 5.2.4), 4-21-04)

29.20.160 Spacing and offsets.

(a) Commercial Streets. Four-legged intersections shall be spaced at least 150 feet apart. Where T-intersections are used, the centerlines of streets not in alignment shall be offset a minimum of 100 feet and be 100 feet from the nearest four-legged intersection. If the left-turn storage requirements for adjacent intersections overlap, the minimum spacing must be increased to provide adequate left-turn storage in both directions. If exclusive turn lanes are required, the design shall conform to the criteria in GJMC 29.28.170(b).

(b) Local Residential Streets. Four-legged intersections shall be spaced at least 300 feet apart. Where T-intersections are used, the centerlines of streets not in alignment shall be offset a minimum of 150 feet.

(Res. 39-04 (§ 5.2.5), 4-21-04)

29.20.170 Intersection sight distance.

Street intersections and private access to public streets shall be planned and located to provide as much sight distance as possible. At a minimum, there must be sufficient sight distance for the driver on the minor street or driveway to cross or turn onto the intersecting street. Minimum sight distance values are provided for passenger cars turning left or right from a minor street. When grades are steeper than three percent, adjustment factors must be applied.

The operating speed on each approach is assumed to be, in order of desirability, (a) the eighty-fifth percentile speed, (b) the speed limit if based on an engineering study, or (c) in the case of a new facility, 80 percent of the design speed.

(Res. 39-04 (§ 5.2.6), 4-21-04)

29.20.180 Sight zones.

Within the sight zone there shall be no sight-obscuring sign, wall, fence, berming, or other object higher than 30 inches, or in the case of trees, no foliage lower than eight feet. Vertical measurement shall be made from the flowline of the adjacent gutter or, if no gutter exists, from the edge of the nearest traveled way. Objects that may be located in the sight zones are items such as hydrants, utility poles, and traffic control devices. These shall be located to minimize visual obstruction.

(Res. 39-04 (§ 5.2.6.1), 4-21-04)

29.20.190 Pedestrian treatments.

In order to provide pedestrian safety, accommodations for pedestrians shall be designed into all intersections where pedestrians are expected to be present. This includes sidewalks, crosswalks, pedestrian refuge islands and accessible ramps. The design shall meet the details specified in the City Standard Details.

(Res. 39-04 (§ 5.2.7), 4-21-04)

29.20.200 Landscaping – Sight distance at intersections.

Any landscaping in the sight distance triangles at intersections shall be low growing, and shall meet the sight distance requirements in GJMC 29.20.180.

(Res. 39-04 (§ 5.3), 4-21-04)

29.20.210 Traffic calming.

According to the Institute of Traffic Engineers (ITE), "Traffic calming is the combination of mainly physical measures that reduce the negative effects of motor vehicle use, alter driver behavior and improve conditions for non-motorized street users." This differs from standard traffic control devices such as stop signs, which are regulatory. Traffic calming strategies are engineered to be self-enforcing physical measures.

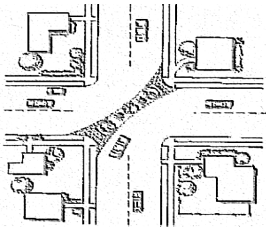
GJMC 29.20.210 through 29.20.250 provide guidance for appropriate applications of traffic calming on the existing street system, as well as the application of traffic calming measures during the planning and design stages of new subdivisions.

(Res. 39-04 (§ 5.4), 4-21-04)

29.20.220 Methods to divert traffic from residential streets.

Residents frequently complain that their residential street is being used by high speed and/or cut-through traffic. One treatment of the traffic is the use of closures, diverters, and one-way treatments.

(a) Street Closure. Streets may be closed to give drivers no choice but to travel another route; residents are given access only. A street closure is the most drastic form of traffic calming and shall be carefully considered before implementation. Street closures can very often lead to traffic problems on nearby streets as drivers are re-routed to other routes. One of the benefits of this type of method of calming is a fully walkable neighborhood.



(b) Street Diverters. A street diverter can also be considered a partial street closure. With a diverter, traffic traveling in one direction is not given access to a street. This drawing shows the most common form of street diversion, where vehicles are allowed ingress and egress through single access points rather than from either direction. As with street closures, implementation of diverters may shift traffic to another street where access is not regulated.

(c) One-Way Streets. One-way streets may be effective in decreasing the number of vehicles traveling on a given roadway. Traffic patterns shall be assessed to determine the effects of a one-way street on a given circulation pattern. Although traffic volumes are generally decreased by one-way treatments, speeds can often increase as drivers are channelized through the street.

(Res. 39-04 (§ 5.4.1), 4-21-04)

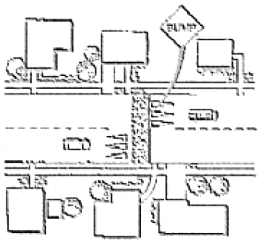
29.20.230 Methods to slow traffic on residential streets.

Where speed is the recognized problem, the following methods can be effective in slowing existing traffic on residential and collector streets:

(a) Chokers. Research has shown that traffic moves slower on more narrow roads. Chokers reduce the width of a street by narrowing the road at a "choke point." Depending on the road segment length, one or several chokers can be used.

(b) Medians. A median can be installed on a street where width tends to encourage speed. Medians narrow the lanes, reducing the comfort of the driver while driving at higher speeds. Median treatments are particularly effective with landscaping.

(c) Chicanes. A chicane is essentially half of a choker. A chicane is placed on one side of the road to narrow a lane of traffic. A chicane can be used singly but is usually placed as a series on both sides of the road.



(d) Speed Humps/Speed Tables. Speed humps or tables are vertical measures to slow traffic. Rather than speed bumps, speed humps are designed to unobtrusively get vehicles to slow down. While a speed bump jolts a vehicle at any speed, a speed hump allows the vehicle to travel the speed limit with little effect.

(Res. 39-04 (§ 5.4.2), 4-21-04)

29.20.240 Methods to slow traffic at intersections.

(a) Raised Intersections. Raised intersections are flat raised areas covering entire intersections, with ramps on all approaches and often with brick or other textured materials on the flat section.

(b) Realigned Intersections. Realigned intersections are changes in alignment that convert T-intersections with straight approaches into curving streets meeting at right angles – a straight shot along the top of the T becomes a turning movement.

(c) Traffic Circles. Traffic circles are set in the center of a four-way intersection to slow traffic coming from each direction. A traffic circle can be effective in creating a neighborhood gateway by providing a unique feature that can be creatively landscaped.

(Res. 39-04 (§ 5.4.3), 4-21-04)

29.20.250 Traffic calming in new developments.

Long, wide streets with limited parking will generally increase speeds. As new developments occur, traffic calming can be planned as a feature of the neighborhood to keep vehicle travel speed low for maximum livability and safety of all street users. In large developments and developments that connect to existing residential streets, designs to control speeds and volumes are required. Design features such as curvilinear streets, T-intersections and entry treatments can reduce the need for traffic calming devices such as speed humps and chokers. Generally, horizontal calming measures will provide greater efficiency and livability in new developments.

The design speed of residential streets shall be 25 miles per hour. The design of local streets shall include positive traffic calming measures and devices. Such measures and devices shall be sufficient to minimize the ability of the average motorist to exceed 25 miles per hour.

In general, traffic calming devices shall be required on new local streets with straight sections of street in excess of 300 feet in length or streets that connect to existing local street networks.

(Res. 39-04 (§ 5.4.4), 4-21-04)

Chapter 29.24

FIRE DEPARTMENT ACCESS

Sections:

29.24.010 Background.
29.24.020 Administrative interpretation – Defined terms.
29.24.030 Access guidelines.
29.24.040 Aerial apparatus roadway width.
29.24.050 Maintenance of access roads.
29.24.060 Divided entryway.
29.24.070 No parking signage.
29.24.080 Design standards.
29.24.090 Other fire department turnarounds and clearances.
29.24.100 Looped lane standards.
29.24.110 Shared driveway standards.

29.24.010 Background.

The Fire Department is required to respond to a multitude of emergencies in various types of buildings and occupancies. These include single-family dwellings, apartment buildings, shopping malls, business complexes, industrial complexes, hospitals, and nursing homes. To provide effective fire fighting operations, the Fire Department must be able to reach all structures by way of approved access roadways, streets, or driveways.

This directive shall assist developers and designers in meeting the requirements for Fire Department access, by defining terms and listing minimum design standards considered necessary for effective fire fighting operations.

Residential Looped Lane

Residential Cul-de-Sac

(Res. 39-04, 4-21-04)

29.24.020 Administrative interpretation – Defined terms.

Fire Department access means an approved route that is always available for use by fire trucks and is designed to meet fire equipment load requirements. Except for loop lanes, shared driveways, and private driveways, all access routes must be at least 20 feet wide. When a dead-end access route exceeds 150 feet in length, an approved turnaround area must be provided.

Public street access means a Fire Department access route on a public right-of-way. Public street access routes must comply with the City or County road design standards and also must comply with the Uniform Fire Code.

Private street access means a Fire Department access route on private land. Private street access routes must comply with the Uniform Fire Code.

Grades. Street grades shall comply with City or County design standards for both public and private street access routes. Maximum grade shall not exceed eight percent.

Grades on turnaround areas. Maximum grades on turnaround areas shall not exceed four percent.

Height. All Fire Department access routes shall have at least 13 feet, six inches of vertical clearance for the entire required width.

Looped lane means a Fire Department access route in a public right-of-way, consisting of a looped road that must be at least 16 feet wide. Looped lanes may be approved for residential subdivisions and must be designed to approved standards (see design pages).

Private driveway means a driveway designed for the use of occupants of no more than two single-family dwelling units or one two-family dwelling unit. If the dwelling units are located more than 100 feet from an approved Fire Department access route, the private driveway must meet our minimum design standards, which are: access routes must be at least 12 feet wide; grades do not exceed City/County grade requirements; adequate turnarounds provided if over 150 feet long; width to be increased if sharp curves are included; constructed with an all-weather surface and able to support the weight of a fire truck.

Shared driveway means a Fire Department access route on private property, serving three or more single-family units. A shared driveway must be at least 16 feet wide and be designed to approved standards (see design pages).

Residential cul-de-sac, commercial/industrial cul-de-sac means an approved turnaround area for public rights-of-way or private property, designed to Fire Department standards (see design pages).

Tee turnaround, alternative turnarounds means an approved turnaround area for private property designed to Fire Department standards (see design pages).

(Res. 39-04, 4-21-04)

29.24.030 Access guidelines.

The following guidelines represent the Fire Department's efforts to maintain consistency concerning Fire Department emergency access. It is the Department's responsibility to ensure adequate access for Fire Department emergency responders. The City therefore reserves the right to require modifications to established requirements if, in its opinion, the access cannot be provided or may be compromised.

(a) Type of Surface. All access roadways shall be finished by application of an all-weather driving surface of hot mix asphaltic concrete or concrete pavement over a flexible base capable of supporting a design wheel load of 18,000 pounds (GVW 80,000 pounds minimum; H-20 loading). The roadway design must be prepared and certified by an engineer registered by the State of Colorado. Any required Fire Department access within 100 feet of any building must meet the same wheel-loading criteria. All required access roadways must be properly maintained and kept clear for emergency use at all times.

Any alternatives to these specifications must be reviewed and approved by the Grand Junction Fire Department prior to construction.

(b) Two Points of Access. Providing two points of fire apparatus access has the following benefits:

(1) If one access route is blocked, emergency responders have a second route to the property.

(2) If an emergency requires evacuation of an area, the public will have an alternative exit route should one route be blocked by the emergency incident.

When two points of access are required, they shall be placed a distance apart equal to not less than one-half of the length of the maximum overall diagonal dimension of the property or area to be

served, measured in a straight line between accesses. The Grand Junction Fire Department does not allow the second access point limited to use by emergency responders only. The second access must always be available for public use in case the other access is blocked.

(c) Commercial and Industrial Developments.

(1) Buildings or facilities exceeding 30 feet or three stories in height shall have at least two means of fire apparatus access.

(2) Buildings or facilities having a gross building area of more than 62,000 square feet shall have at least two means of fire apparatus access. If the buildings or facilities are provided with an approved automatic fire sprinkler system, the gross building area can be increased to 124,000 square feet with one access road.

(d) Multifamily Residential Developments.

(1) Multifamily residential projects having more than 100 dwelling units shall be provided with at least two means of fire apparatus access.

(2) Multifamily residential projects of up to 200 dwelling units, which are provided with an approved fire sprinkler system, may have one means of fire apparatus access.

(e) One- or Two-Family Residential Developments.

(1) Developments where the number of dwelling units exceeds 30 shall be provided with separate and approved fire apparatus access roads.

(2) Developments where the number of dwelling units is 60 or less may be served by a single fire apparatus access road, provided all dwelling units are provided with approved residential fire sprinkler systems.

(Res. 39-04, 4-21-04)

29.24.040 Aerial apparatus roadway width.

Fire apparatus access roadways shall have a minimum unobstructed width of 26 feet in the immediate vicinity of any building or portion of building more than 30 feet in height. At least one of the required access routes meeting this condition shall be located within a minimum of 15 feet and a maximum of 30 feet from the building, and shall be positioned parallel to one entire side of the building.

(Res. 39-04, 4-21-04)

29.24.050 Maintenance of access roads.

Maintenance of the required access shall be considered during the planning stages and installation of Fire Department access roadways, fire hydrants, or connections. This includes the potential growth of trees and/or other vegetation over the years.

(Res. 39-04, 4-21-04)

29.24.060 Divided entryway.

A divided entryway can present a challenge to emergency vehicles. The required width of the driveable surface in a divided entryway is based on the width of the entryway and that of the street fronting it.

(a) If the street fronting the divided entryway is 28 feet wide, each lane of the entryway must be at least 15 feet wide.

(b) If the street fronting the divided entryway is 34 feet wide, the entryway lanes may be less than 15 feet wide, but cannot be less than 12 feet wide.

(c) For fronting streets wider than 34 feet, entryway lanes must be at least 12 feet wide.

(Res. 39-04, 4-21-04)

29.24.070 No parking signage.

For access routes less than 28 feet wide and for fire apparatus turnaround areas, vehicle parking is not allowed. "No Parking" signs are required. An approved design for the signage is shown in the Transportation Engineering Design Standards (TEDS), available from the City of Grand Junction Department of Public Works.

(a) For access routes 16 to 22 feet wide, "No Parking" signs are required along both sides of the route.

(b) For access routes 22 to 28 feet wide, "No Parking" signs are required along one side of the route.

(c) For hammerhead tees and alternative turnarounds, "No Parking" signs are required along both sides of the area.

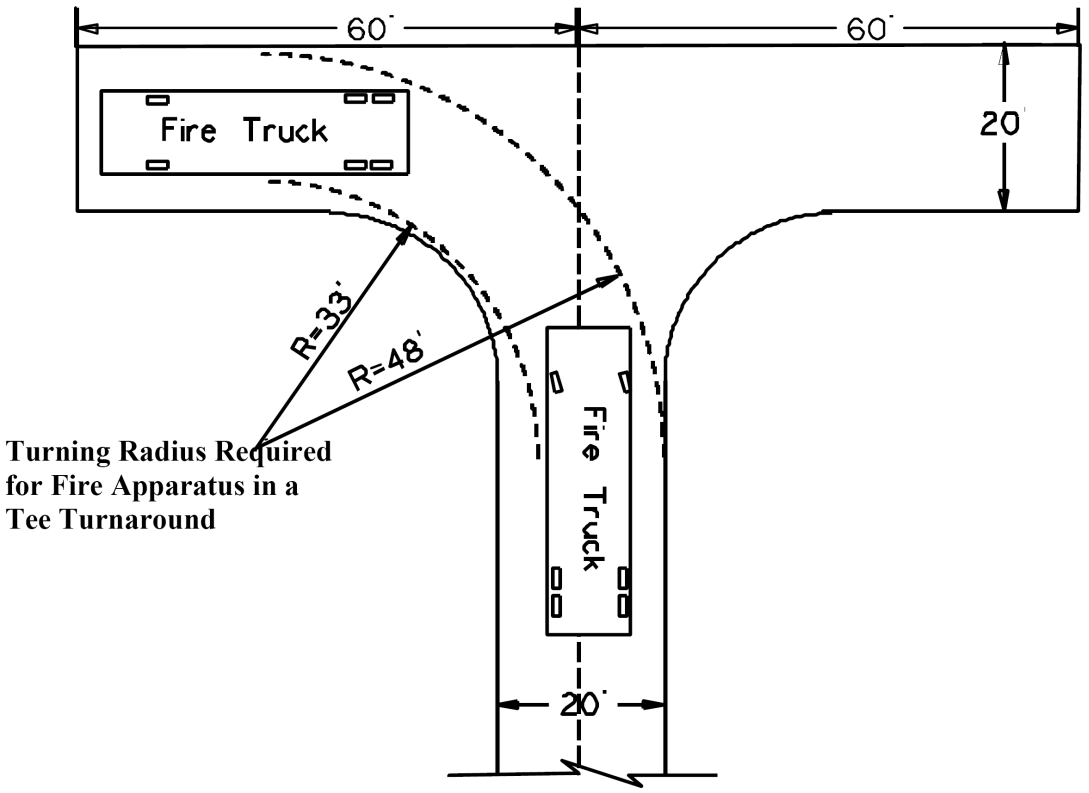
(d) For cul-de-sacs, "No Parking" signs should be placed along the outside of the turnaround area.

(Res. 39-04, 4-21-04)

29.24.080 Design standards.

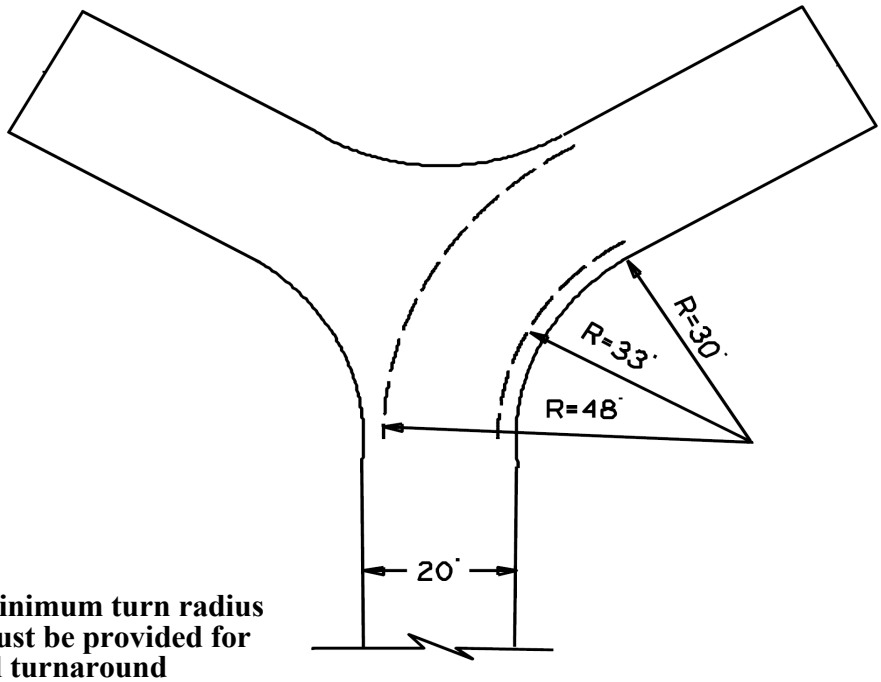
The following pages give examples of Grand Junction Fire Department approved roadway, turnaround, and turning radius specifications. The last of these pages may be photocopied onto a transparency as a template for Fire Department turn radius requirements. This is the template used by the Fire Prevention Bureau when reviewing plans to determine proper access and is based on the actual size of the Grand Junction Fire Department fire fighting apparatus.

Hammerhead Tee Turnaround



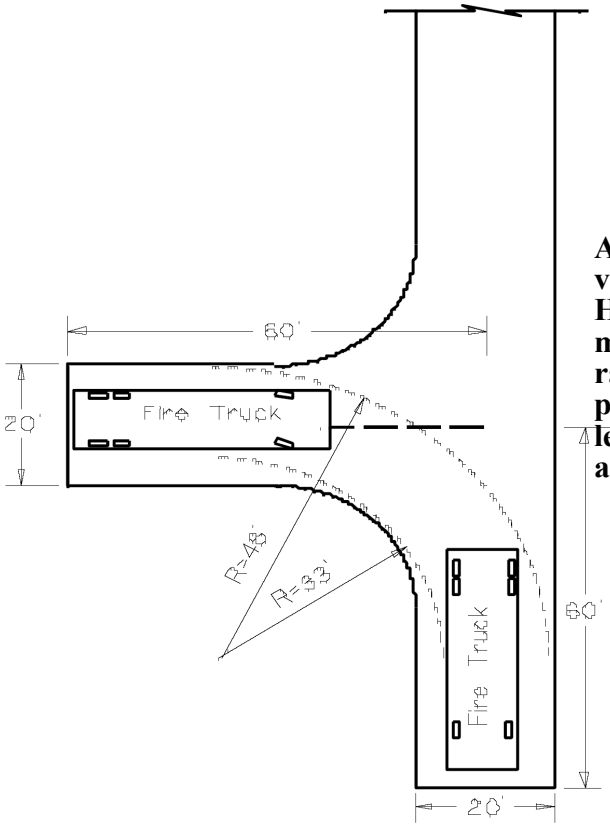
Turning Radius Required for Fire Apparatus in a Tee Turnaround

Alternative Tee Turnaround



Minimum turn radius must be provided for all turnaround designs.

Alternative Turnaround



Any proposed alternative or variation from a standard Hammerhead Tee must meet our minimum turn radius requirement and provide at least a 60′ length for the turning areas.

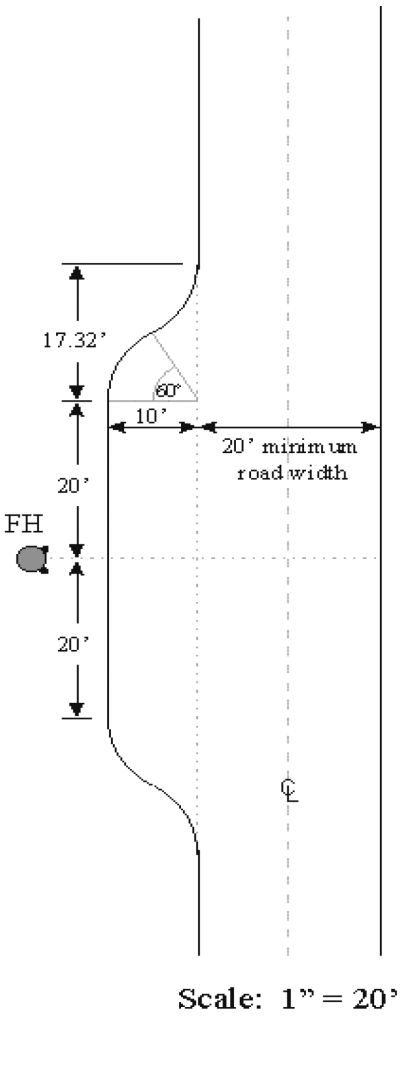
(Res. 39-04, 4-21-04)

29.24.090 Other fire department turnarounds and clearances.

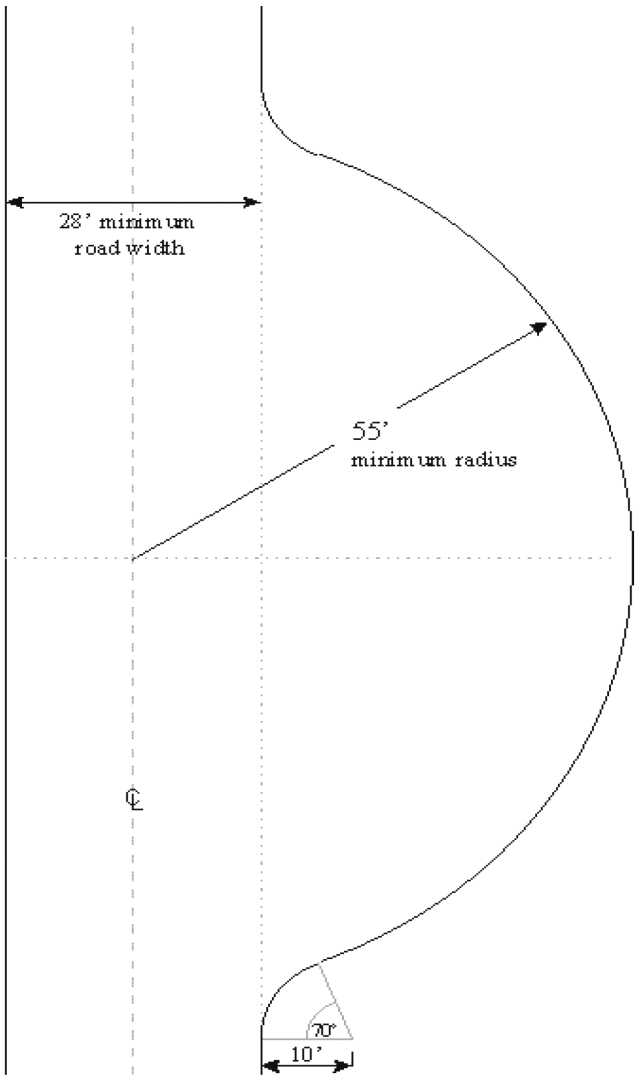
(a) Turnouts for Fire Hydrants. For emergency access routes less than 22 feet wide, where fire hydrants are required along the route, a turnout area for fire trucks is required. The width of the access road must be at least 20 feet in the area of the turnout. This turnout area is required so that when a fire truck utilizes the fire hydrant in an emergency, the access route will still be available for use by other emergency vehicles.

(b) Intermediate Turnaround Areas. In cases where a single point of access exceeds 600 feet in length, intermediate turnaround areas are required. The width of the access road must be at least 28 feet in the area of the turnaround. These areas allow emergency vehicles to turn around without having to drive to the end of a long dead-end road. The intermediate turnarounds must be provided at a maximum interval of every 500 feet.

Turnouts for Fire Hydrants



Intermediate Turnarounds



(Res. 39-04, 4-21-04)

29.24.100 Looped lane standards.

(a) Not more than seven single-family residences obtain access from the fire loop lane;

(b) The 16-foot-wide fire loop lane shall consist of an all-weather clear surface;

(c) No curve on any portion of the flow line of the fire loop lane shall have an inside radius of less than 33 feet and an outside radius of less than 48 feet. “Flow line” means the area between the curbs or equivalent if curbs are not present.

(d) No portion of the fire loop lane shall extend more than 250 feet from the abutting street right-of-way.

(e) A minimum of four parking spaces shall be constructed at the end of the fire loop lane, as indicated on the diagram.

(f) The fire loop lane and parking stalls, as indicated on the diagram, are dedicated to and maintained by the City;

(g) Two-way traffic is allowed;

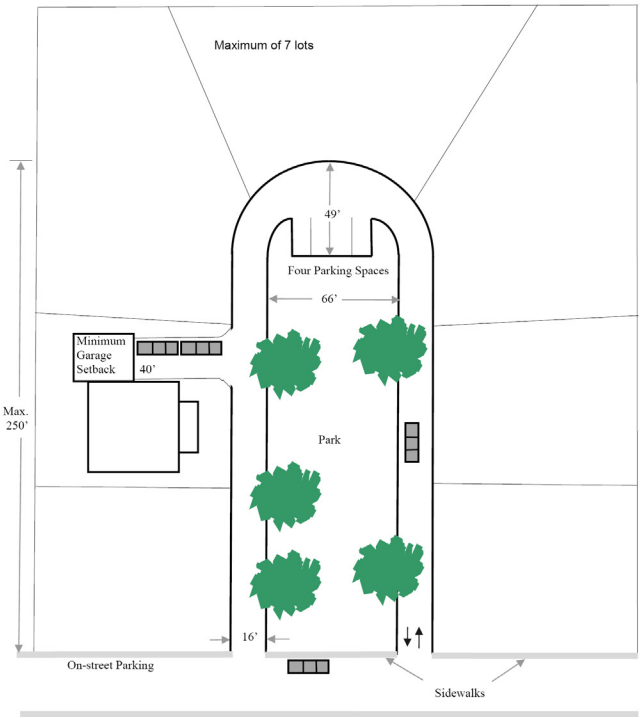
(h) “No parking” signs and markings, as required by the City, are installed and maintained so that no parking is allowed between the curbs on any traveled portion of the fire loop lane;

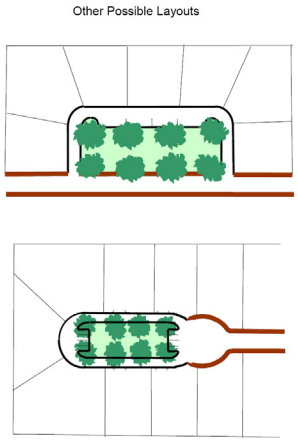
(i) Corner lots that front the fire loop lane and the abutting street shall be required to only obtain access from the fire loop lane;

(j) No garage or carport built on a lot obtaining access from the fire loop lane shall be constructed any portion of which is closer than 30 feet from any portion of the fire loop lane;

(k) Each residence obtaining access from the fire loop lane shall provide and maintain four parking spaces between the garage or carport and the fire loop lane; and

(l) The fire loop lane shall only connect to a street where on-street parking exists now and is expected to remain, according to the City Engineer, based on such factors as the City capital program and any adopted street plans.





(Res. 39-04, 4-21-04)

29.24.110 Shared driveway standards.

(a) A shared driveway shall be owned and maintained by the owners of the parcels or lots which abut the shared driveway;

(b) Not more than four single-family lots shall abut or touch any portion of the shared driveway and no more than four single-family units may access a shared driveway;

(c) A shared driveway shall be least 16 feet wide and not longer than 150 feet;

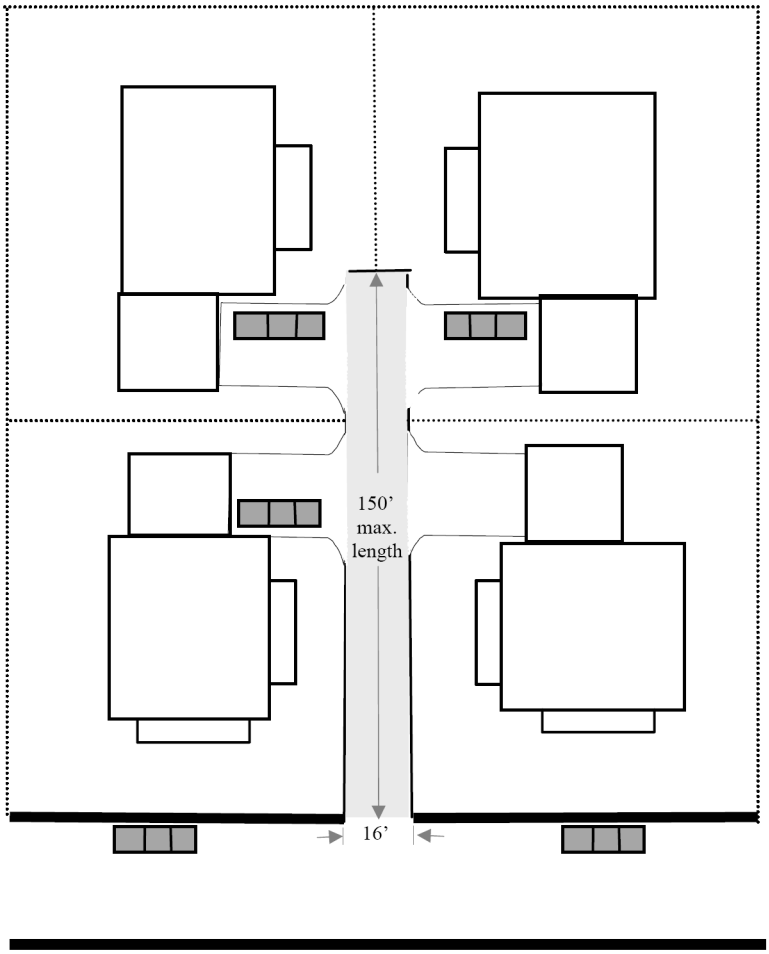
(d) No parking is allowed on the shared driveway;

(e) Each lot abutting a shared driveway must provide four on-site parking spaces;

(f) Each lot abutting a shared driveway must access off the shared driveway unless varied at time of subdivision approval; and

(g) A shared driveway may be used only where it intersects a street where on-street parking exists and is expected to remain, according to the City Engineer, based on such factors as the City capital program and any adopted street plans.

Example Layout



(Res. 39-04, 4-21-04)

Chapter 29.28

ARTERIAL AND COLLECTOR GEOMETRIC DESIGN, INCLUDING ROUNDABOUTS

Sections:

29.28.010 Geometric standards.
29.28.020 Arterial and collector streets.
29.28.030 Right-of-way, street lane widths, and street lengths.
29.28.040 Alignments – Horizontal alignment.
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29.28.060 Clearance of structures.
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29.28.160 Intersection radii.
29.28.170 Lane requirements.
29.28.180 Angles.
29.28.190 Grades.
29.28.200 Spacing and offsets.
29.28.210 Pedestrian treatments.
29.28.220 Roundabouts.
29.28.230 Landscaping – General requirements.

29.28.010 Geometric standards.

Geometric standards have been developed to provide adequate safety for the traveling public. This chapter sets the minimum standards for geometric design of streets classified as collector and above, as shown on the Grand Junction Circulation Plan. These streets are intended for higher volumes and faster traffic than the residential streets discussed in Chapter 29.20 GJMC. They function in transition from direct land use access to movement of traffic.

Roundabouts provide safety improvements, less delay than other forms of control, community enhancement and increased traffic circulation at some intersections. Roundabouts can efficiently handle many intersections with decreased delay and greater efficiency than traffic signals. This chapter defines the modern roundabout and provides a link to general design criteria.

(Res. 39-04 (§ 6.0), 4-21-04)

29.28.020 Arterial and collector streets.

(a) General Requirements. Major arterials shall be designed to provide a high degree of mobility and serve longer trips, implying a higher operating speed and level of service. These streets are designated on the Grand Junction Circulation Plan. Minor arterial streets interconnect with and augment the major arterial system. These streets accommodate trips of shorter lengths and may also serve more access functions than the major arterial streets.

(b) Collector streets provide both land access and movement within residential, commercial and industrial areas. Operating speeds are lower than arterial streets.

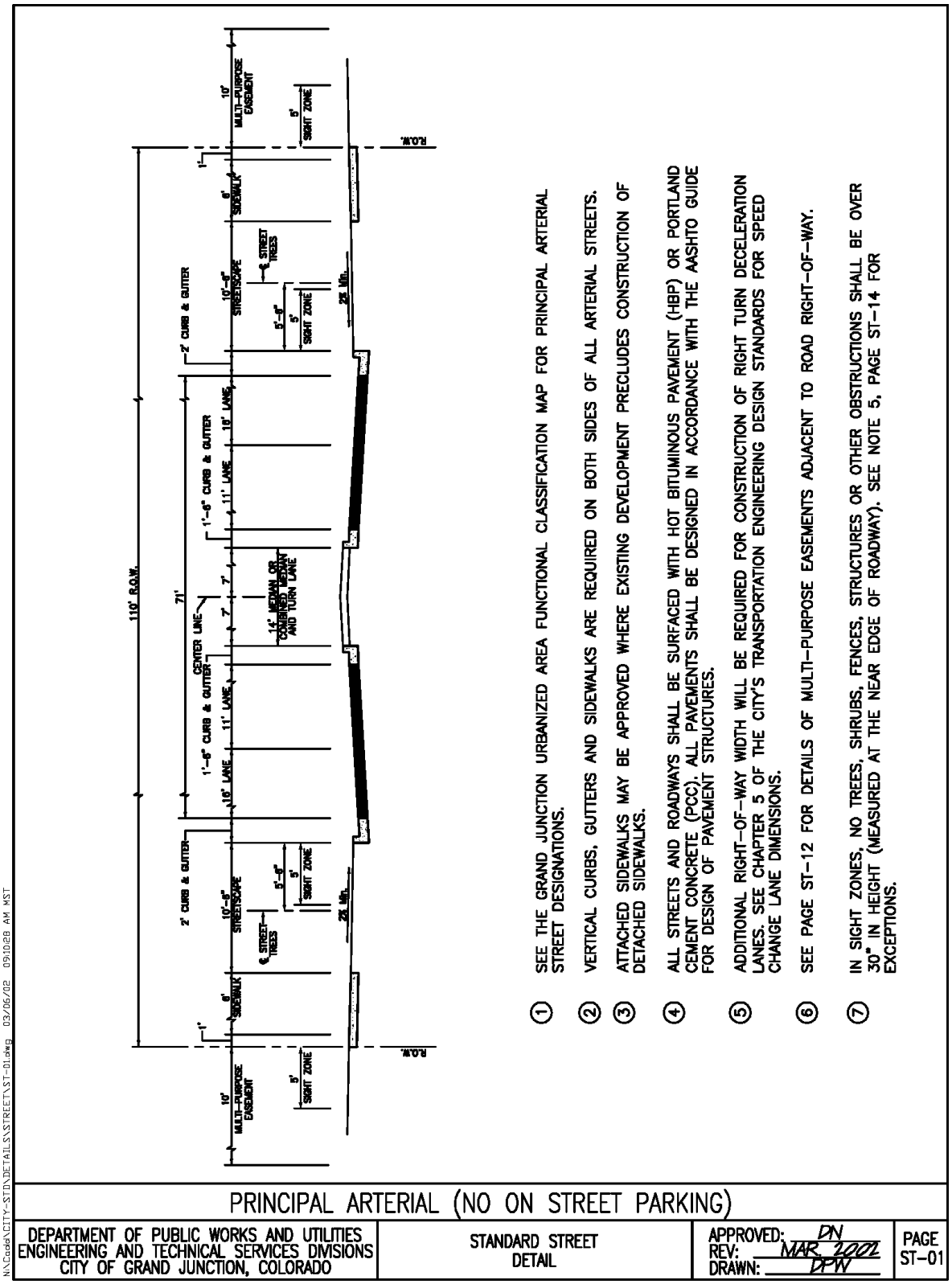
(c) Pedestrians and bicyclists are users of the street system and street design needs to include consideration for them. The adopted Grand Junction Circulation Plan shows existing and future pedestrian and bicycle facilities.

(Res. 39-04 (§ 6.1), 4-21-04)

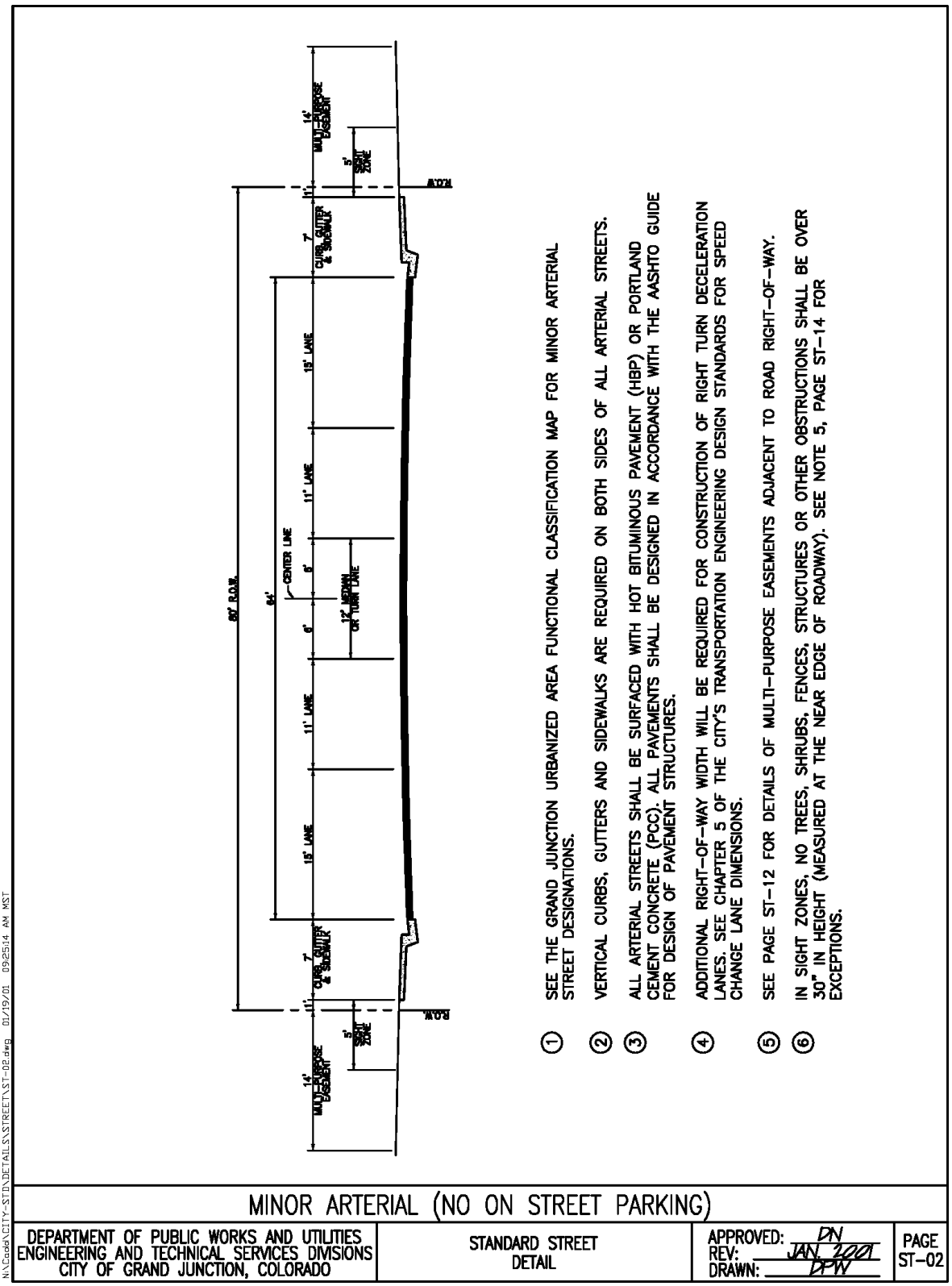
29.28.030 Right-of-way, street lane widths, and street lengths.

The required right-of-way width for a street is indicated in the City Standard Street Details. Additional widths may be required for needed through and turn lanes, and where it is necessary to accommodate slopes and drainage structures.

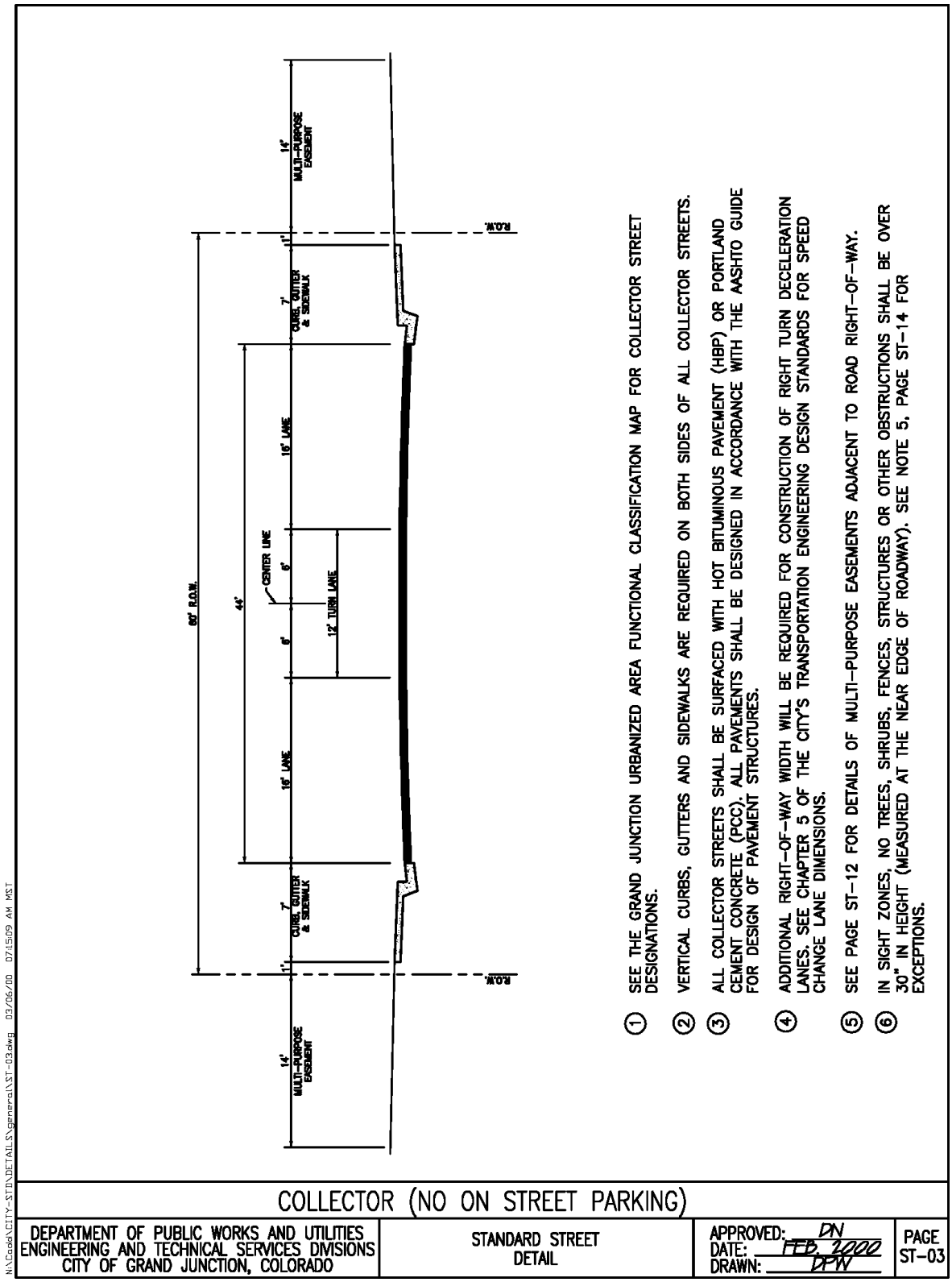
(a) Principal Arterial (No On-Street Parking).



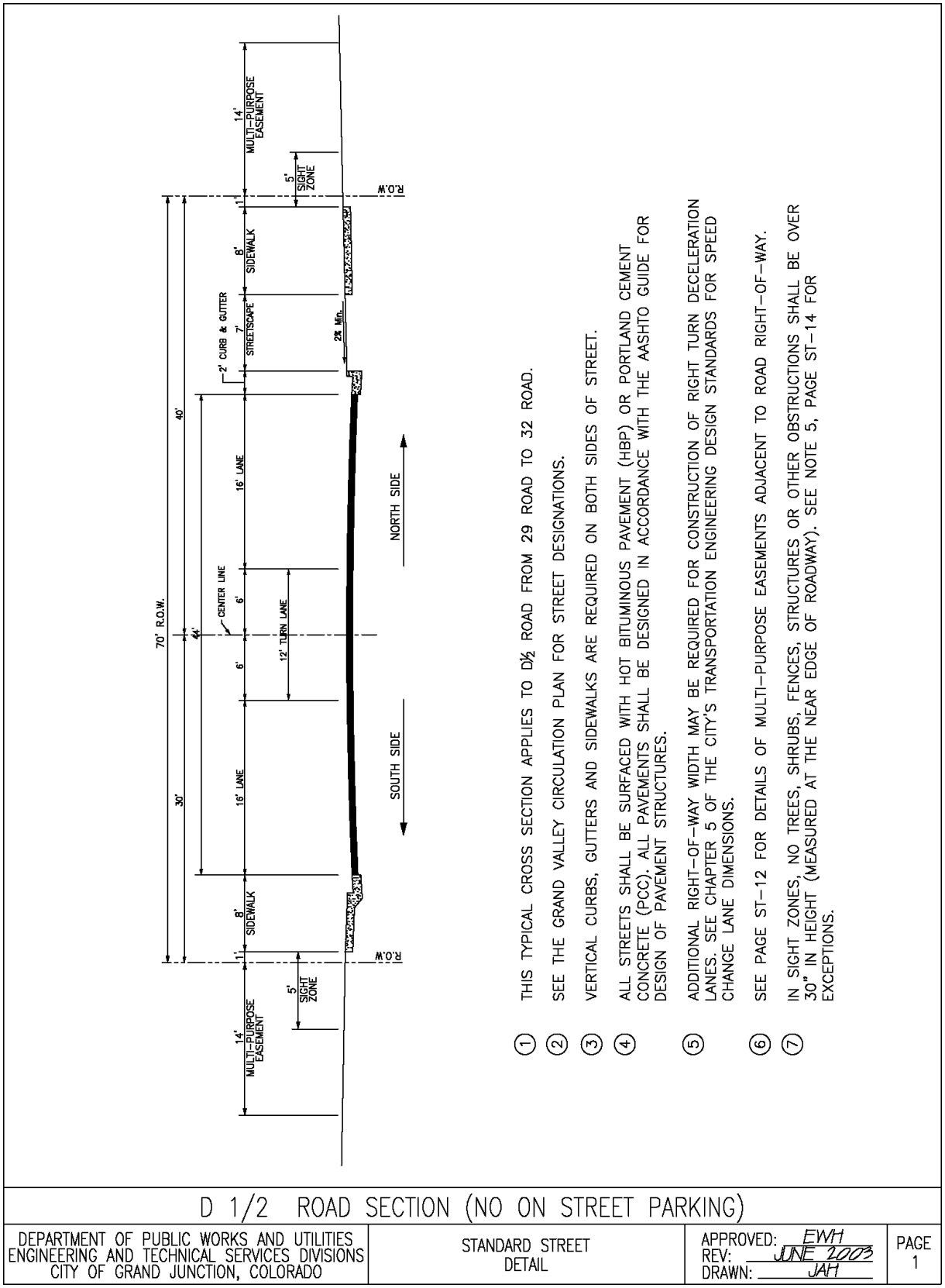
(b) Minor Arterial (No On-Street Parking).



(c) Collector (No On-Street Parking).



(d) D 1/2 Road Section (No On-Street Parking).



① THIS TYPICAL CROSS SECTION APPLIES TO D½ ROAD FROM 29 ROAD TO 32 ROAD.

② SEE THE GRAND VALLEY CIRCULATION PLAN FOR STREET DESIGNATIONS.

③ VERTICAL CURBS, GUTTERS AND SIDEWALKS ARE REQUIRED ON BOTH SIDES OF STREET.

④ ALL STREETS SHALL BE SURFACED WITH HOT BITUMINOUS PAVEMENT (HBP) OR PORTLAND CEMENT CONCRETE (PCC). ALL PAVEMENTS SHALL BE DESIGNED IN ACCORDANCE WITH THE AASHTO GUIDE FOR DESIGN OF PAVEMENT STRUCTURES.

⑤ ADDITIONAL RIGHT-OF-WAY WIDTH MAY BE REQUIRED FOR CONSTRUCTION OF RIGHT TURN DECELERATION LANES. SEE CHAPTER 5 OF THE CITY'S TRANSPORTATION ENGINEERING DESIGN STANDARDS FOR SPEED CHANGE LANE DIMENSIONS.

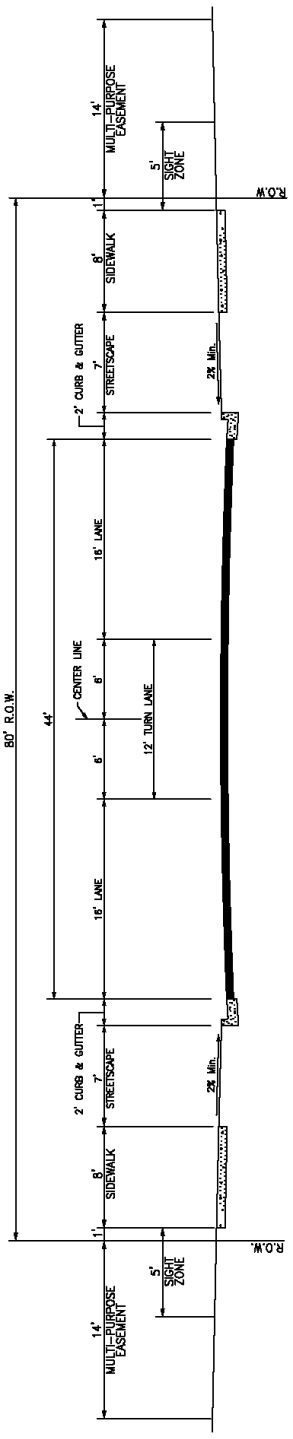
⑥ SEE PAGE ST-12 FOR DETAILS OF MULTI-PURPOSE EASEMENTS ADJACENT TO ROAD RIGHT-OF-WAY.

⑦ IN SIGHT ZONES, NO TREES, SHRUBS, FENCES, STRUCTURES OR OTHER OBSTRUCTIONS SHALL BE OVER 30" IN HEIGHT (MEASURED AT THE NEAR EDGE OF ROADWAY). SEE NOTE 5, PAGE ST-14 FOR EXCEPTIONS.

D 1/2 ROAD SECTION (NO ON STREET PARKING)

DEPARTMENT OF PUBLIC WORKS AND UTILITIES ENGINEERING AND TECHNICAL SERVICES DIVISIONS CITY OF GRAND JUNCTION, COLORADO	STANDARD STREET DETAIL	APPROVED: EWH REV: JUNE 2003 DRAWN: JAH	PAGE 1

(e) D Road Section (No On-Street Parking).



1. SEE THE GRAND VALLEY CIRCULATION PLAN FOR STREET DESIGNATIONS.
2. VERTICAL CURBS, GUTTERS AND SIDEWALKS ARE REQUIRED ON BOTH SIDES OF STREET.
3. ALL STREETS SHALL BE SURFACED WITH HOT BITUMINOUS PAVEMENT (HBP) OR PORTLAND CEMENT CONCRETE (PCC). ALL PAVEMENTS SHALL BE DESIGNED IN ACCORDANCE WITH THE AASHTO GUIDE FOR DESIGN OF PAVEMENT STRUCTURES.
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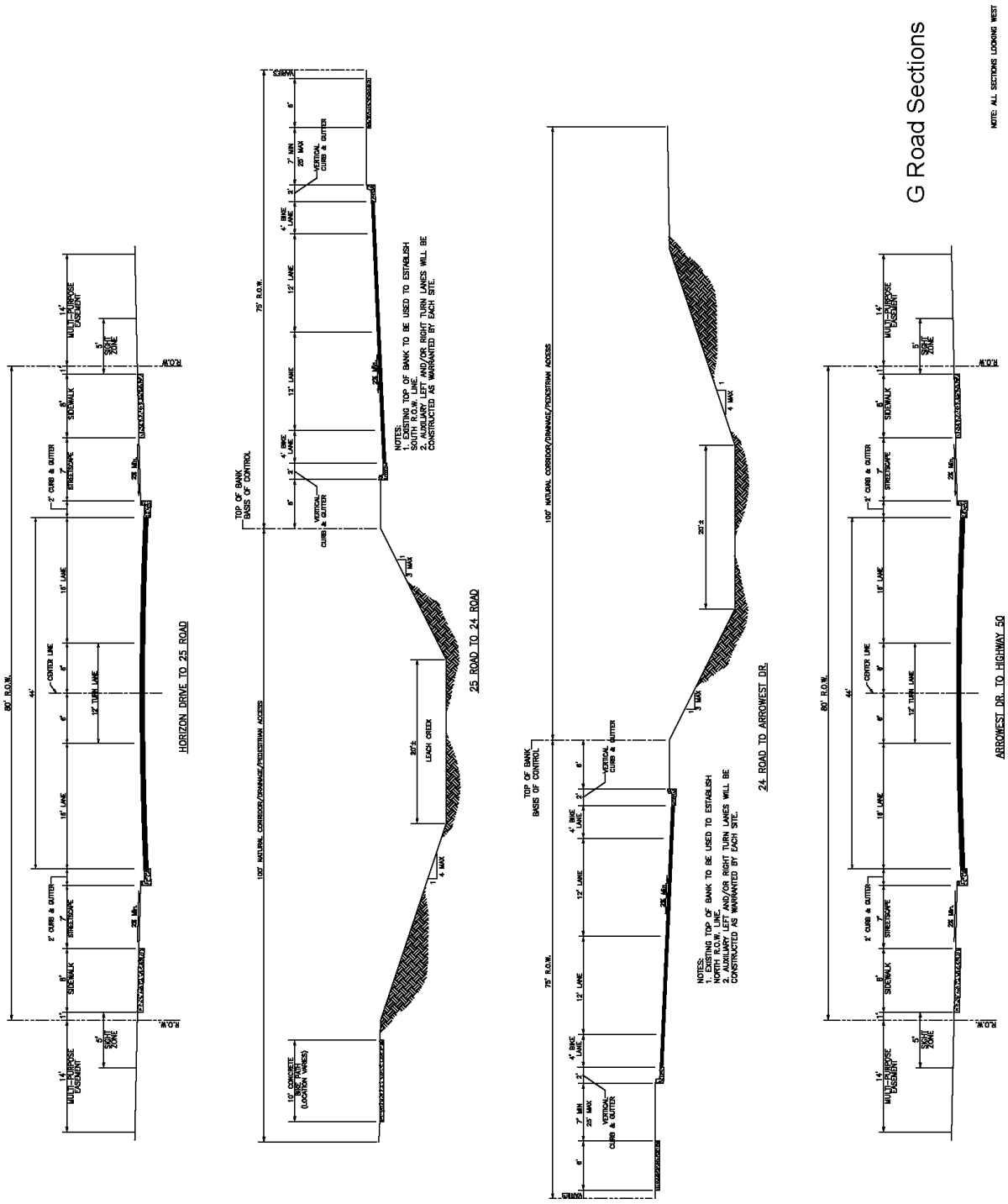
5. SEE PAGE ST-12 FOR DETAILS OF MULTI-PURPOSE EASEMENTS ADJACENT TO ROAD RIGHT-OF-WAY.
6. IN SIGHT ZONES, NO TREES, SHRUBS, FENCES, STRUCTURES OR OTHER OBSTRUCTIONS SHALL BE OVER 30" IN HEIGHT (MEASURED AT THE NEAR EDGE OF ROADWAY). SEE NOTE 5, PAGE ST-14 FOR EXCEPTIONS.

D ROAD SECTION (NO ON STREET PARKING)

DEPARTMENT OF PUBLIC WORKS AND UTILITIES ENGINEERING AND TECHNICAL SERVICES DIVISIONS CITY OF GRAND JUNCTION, COLORADO	STANDARD STREET DETAIL	APPROVED: MM REV: MARCH 2001 DRAWN: EWH	PAGE XXX

(f) G Road Sections.



(Res. 39-04 (§ 6.1.1), 4-21-04)

29.28.040 Alignments – Horizontal alignment.

Streets shall extend to the boundary lines of the land to be subdivided. Proposed streets with widths different from existing streets to which they are being connected must be transitioned using pavement transition taper standards.

All designs shall be based on the horizontal curve design criteria.

Horizontal Curve Design Criteria

Design Criteria	Major[1]	
	Collector	Arterial
Min. Design Speed (mph)	35	40
Min. Center[2] Line Radius (ft)	470	SEE[4]
Min. Horizontal Sight Distance (ft)	250	325
Min. Reverse Curve Tangent (ft)	200	200
Min. Approach[3] Tangent at Intersections	200	300

[1] These criteria are to be used without superelevation.

[2] Radii shown are based on the street having a crown section with a pavement cross-slope of two percent on each side of the crown. For minimum radii required for other cross-slopes or where superelevation is provided and approved, see Exhibit 3-40 in "A Policy on Geometric Design of Highways and Streets," AASHTO, 2001 Edition.

[3] Where a curved road approaches an intersection, these tangent sections must be provided on the approach to the intersection to provide for adequate sight distance for traffic control devices at the intersection.

[4] The maximum superelevation rate allowed is e = six percent. Where superelevation is used, runoff lengths shall conform to Exhibit 3-41 in "A Policy on Geometric Design of Highways and Streets," AASHTO, 2001 Edition.

(Res. 39-04 (§ 6.1.2), 4-21-04)

29.28.050 Alignments – Vertical alignment – Grades.

Grades, curve length and vertical sight distance shall be designed to ensure proper drainage, sight distance and safety for vehicles and pedestrians. Grades of streets shall not be less than 0.5 percent. The grade of a street may be reduced only when matching existing streets or property. Maximum street grades shall be eight percent. For algebraic differences of 0.5 percent or less, grade breaks shall be required for adequate drainage.

Design Controls for Vertical Curves

Design Speed MPH	Stopping Sight Distance (feet)	Crest "K" Values	Sag "K" Values
20	115	7	17
25	155	12	26
30	200	19	37
35	250	29	49
40	305	44	64
45	360	61	79
50	425	84	96
55	495	114	115
60	570	151	136

From Exhibits 3-76 and 3-79, AASHTO, "A Policy on Geometric Design of Highways and Streets," 2001.

[1] All minimum stopping sight distances for vertical curves with crests must be shown on the construction plans. Sight distances are based on design speeds.

(Res. 39-04 (§ 6.1.3.1), 4-21-04)

29.28.060 Clearance of structures.

A minimum of 17.5 feet shall be provided for all overhead sign structures. The clearance shall be measured from the crown of the street to the lowest portion of the structure. A minimum vertical clearance of 16 feet for all other structures shall be provided on all arterial streets and designated truck routes. A minimum clearance of 14 feet may be allowed on collector streets.

(Res. 39-04 (§ 6.1.3.2), 4-21-04)

29.28.070 Stopping sight distance.

"Stopping sight distance" is defined as the length of roadway ahead visible to the driver. The minimum stopping sight distance available on a roadway must be sufficiently long to enable a vehicle traveling at or near the roadway design speed to stop before reaching a stationary object in its path or react to a traffic control device such as a stop sign.

The appropriate stopping sight distance shall be provided. The distances shown assume vehicles traveling on wet pavement on flat grades. Factors that take into account the effect of grade on stopping sight distance shall be used in determining appropriate stopping sight distance where the grades are three percent or higher.

Minimum Stopping Sight Distance

Design Speed (MPH)	Stopping Sight Distance (Ft.)
20	115
25	155
30	200
35	250
40	305
45	360
50	425
55	495
60	570

Based on Exhibit 3-1, AASHTO, "A Policy on Geometric Design of Streets and Highways," 2001.

Effect of Grade on Stopping Sight Distance

Design Speed (MPH)	Downgrades			Upgrades		
	3%	6%	9%	3%	6%	9%
20	116	120	126	109	107	104
25	158	165	173	147	143	140
30	205	215	227	200	184	179
35	257	271	287	237	229	222
40	315	333	354	289	278	269
45	378	400	427	344	331	320
50	446	474	507	405	388	375
55	520	553	593	469	450	433
60	598	638	686	538	515	495

From Exhibit 3-2, AASHTO, "A Policy on Geometric Design for Highways and Streets," 2001.

(Res. 39-04 (§ 6.1.3.3), 4-21-04)

29.28.080 Cross section.

(a) Cross Slopes. The typical cross slope is two percent crown to provide for adequate drainage to the pavement edge. The maximum cross slope on the tangent sections shall not exceed four percent. The minimum cross slope shall be one percent.

(b) Superelevation. Superelevation shall be designed in accordance with the horizontal curve design criteria (GJMC 29.28.040).

(c) Clear Zones. All roadways shall meet clear zone requirements as set forth in AASHTO Roadside Design Guide, 1989 Edition. Where under-improved streets are constructed (for example, a half-street construction), the minimum shoulder width shall be provided.

(d) Roadside Barrier and Bridge Rails. Roadside barriers shall be required in accordance with warrants, design criteria and standards for roadside barriers and bridge rails as defined in the AASHTO Roadside Design Guide, 1989 Edition or latest.

(Res. 39-04 (§ 6.1.4), 4-21-04)

29.28.090 Tapers and transitions – Road width transition tapers.

When constructing a roadway that will connect with an existing roadway of a different width, a transition taper is required. These ratios are not to be used in the design of exclusive turn lanes.

Minimum Road Width Transition Tapers

Design Speed (MPH)	Transition Run/Offset (Ft/Ft)
30 or less	15 / 1
35	20 / 1
40	25 / 1
45	45 / 1
50	50 / 1
55	55 / 1
60	60 / 1

Table based on Section 3B-8, MUTCD.

(Res. 39-04 (§ 6.1.5), 4-21-04)

29.28.100 Bicycle treatments.

Bicycle facilities are required as shown on the Grand Junction Circulation Plan. Provisions for bicycle facilities shall be in accordance with the AASHTO Guide for Development of New Bicycle Facilities 1999.

(Res. 39-04 (§ 6.1.6), 4-21-04)

29.28.110 Intersections.

Generally, there are two types of intersections: unsignalized and signalized. Each of these may have several different configurations and levels of traffic control. A roundabout is a form of an unsignalized intersection and is specifically discussed in GJMC 29.28.220. All intersections shall conform to the guidelines set forth in AASHTO and the MUTCD.

(Res. 39-04 (§ 6.2), 4-21-04)

29.28.120 Unsignalized intersections.

There are three acceptable levels of traffic control at unsignalized intersections: yield controlled, two-way stop controlled and all-way stop controlled. The appropriate use of each of these is discussed in the following subsections.

(a) Yield Controlled Intersections. Yield controlled intersections will not generally be allowed, except at roundabouts.

(b) Two-Way Stop Controlled Intersections. Stop signs shall be used in accordance with the MUTCD.

(c) All-Way Stop Controlled Intersections. An all-way or “multi-way” stop installation shall be used only where the criteria of the MUTCD are met.

(Res. 39-04 (§ 6.2.1), 4-21-04)

29.28.130 Signalized intersections.

A signalized intersection shall only be installed after a careful analysis and engineering study of the roadway and traffic conditions at the intersection and on the corridor. When a signal is proposed on a corridor where signals are coordinated, the TIS shall analyze the impacts to the progression of traffic on the corridor and on surrounding land uses. This analysis shall include the progression bandwidth, efficiency and level of service determinations, signal timing and phasing including pedestrian movements, and an analysis of the storage queue lengths for exclusive turn lanes. Signal installations shall meet the spacing cri-

teria in GJMC 29.28.200. Traffic signal warrants and design criteria are thoroughly discussed in the MUTCD, Part IV.

(Res. 39-04 (§ 6.2.2), 4-21-04)

29.28.140 Sight distance.

Street intersections and private access to public streets shall be planned and located to provide as much sight distance as possible. At a minimum, there must be sufficient sight distance for the driver on the minor street or driveway to cross or turn onto the intersecting street. Minimum sight distance values are provided for passenger cars turning left or right from a minor street. When grades are steeper than three percent, adjustment factors must be applied.

The operating speed on each approach is assumed to be, in order of desirability, (a) the eighty-fifth percentile speed, (b) the speed limit if based on an engineering study, or (c) in the case of a new facility, 80 percent of the design speed.

Minimum Sight Distance for Left and Right Turns onto Major Street by Passenger Cars at Stop-Controlled Intersections

Major Street Speed	Minimum Sight Distance
20 MPH	200′
25 MPH	275′
30 MPH	350′
35 MPH	400′
40 MPH	500′
45 MPH	550′
50 MPH	600′
55 MPH	700′

Table based on Table 11-15 of the ITE Traffic Engineering Handbook, 5th Edition.

Factors for the Effect of Grade on Sight Distance

Approach Grade (%)	Design Speed (MPH)									
	15	20	25	30	35	40	45	50	55	60
-6	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.2	1.2	1.2
-5	1.0	1.0	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
-4	1.0	1.0	1.0	1.1	1.1	1.1	1.1	1.1	1.1	1.1
-3 to +3	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
+4	1.0	1.0	1.0	1.0	1.0	0.9	0.9	0.9	0.9	0.9
+5	1.0	1.0	1.0	0.9	0.9	0.9	0.9	0.9	0.9	0.9
+6	1.0	1.0	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9

Based on Exhibit 9-53, AASHTO, "A Policy on Geometric Design for Highways and Streets," 2001.

(Res. 39-04 (§ 6.2.3), 4-21-04)

29.28.150 Sight zones.

Within the sight zone there shall be no sight-obscuring sign, wall, fence, berming, or other object higher than 30 inches, or in the case of trees, no foliage lower than eight feet. Vertical measurement shall be made from the flowline of the adjacent gutter or, if no gutter exists, from the edge of the nearest traveled way. Objects that may be located in the sight zones are items such as hydrants, utility poles, and traffic control devices. These shall be located to minimize visual obstruction.

(Res. 39-04 (§ 6.2.3.1), 4-21-04)

29.28.160 Intersection radii.

Minimum intersection radii must be maintained at public street intersections.

Minimum Intersection Flowline Radii

Through Street[2]	Intersecting Street				
	Arterial	Collector	Local Residential	Local Commercial	Local Industrial[1]
Arterial	35′	30′	30′	30′	30′
Collector	30′	30′	25′	30′	30′

[1] Radii at intersections with industrial streets shall be individually designed based on the turning requirements for the type of truck that will most commonly use the street.

[2] At signalized intersections where right-turn channelization islands are provided or high truck and bus volumes may use the access, a larger flowline radius may be required.

(Res. 39-04 (§ 6.2.4), 4-21-04)

29.28.170 Lane requirements.

Lane design through an intersection shall be consistent with the lane design of the streets forming the intersection.

(a) Lane Widths. Lane widths shall be consistent with the cross-sections as shown in the City Standard Street Details.

(b) Exclusive Turn Lanes.

(1) The purpose of an exclusive turn lane is to expedite the movement of through traffic, increase intersection capacity, permit the controlled movement of turning traffic, and promote the safety of all traffic. The provision of left-turn lanes is essential from both capacity and safety standpoints where left turns would otherwise share the use of a through lane. Right-turn lanes remove the speed differences in the main travel lanes, reducing the frequency and severity of rear-end collisions.

(2) Separate right-turn lanes shall be required in accordance with the right-turn warrant chart. Separate left-turn lanes shall be required at all new signal locations and at unsignalized locations in accordance with the left-turn warrant chart.

Warrants for Right-Turn Lanes

Two Lane Roadways

Number of Peak Hour Turning Vehicles

DDHV (vph)	35 MPH or less	40 MPH	45 MPH	50 MPH	55 MPH
200				73	35
300			120	41	24
400	200	200	50	30	19
500	150	125	35	25	16
600	75	50	25	20	14
800	50	30	15	15	11
1,000	25	25	15	11	9
1,200	20	20	15	9	8

DDHV – Directional Design Hourly Volume; volume of vehicles in the design hour using the through lane adjacent to which the right lane is to be constructed.

Warrants for Right-Turn Lanes
Four Lane Roadways

Number of Peak Hour Turning Vehicles

DDHV (vph)	35 MPH or less	40 MPH	45 MPH	50 MPH	55 MPH
300					75
400			145	75	40
500			95	57	32
600	170	160	65	42	26
800	80	70	37	28	19
1,200	50	25	20	18	14
1,600	20	15	14	13	10
2,000	15	10	9	9	8

DDHV – Directional Design Hourly Volume; volume of vehicles in the design hour using the through lane adjacent to which the right lane is to be constructed.

Charts developed based on studies conducted by Kansas Department of Transportation and University of Nebraska.

Warrants for Left-Turn Lanes

Number of Peak Hour Turning Vehicles

DDHV	30 – 35 MPH	40 + MPH
100	30	14
200	15	12
300 +	12	12

(3) Construction of turn lanes on State highways shall be determined in accordance with the State Access Code.

(4) Dual left-turn lanes at signalized intersections shall be considered when the peak hour left-turn volume exceeds 300 vehicles/hour. An analysis of the signal timing is required to measure the effects of the protected movement on the rest of the intersection movements. Intersection geometry shall allow for the operation of dual lefts. Permissive dual left turns are prohibited.

(c) Left- and Right-Turn Lane Design.

(1) The components of a left-turn lane consist of a taper and the full width lane for storage as shown in the turn lane elements and design criteria. Turn lanes shall be 12 feet in width.

Minimum Left-Turn Tapers for Redirecting Through Lanes

Design Speed (MPH)	Tapers
25	10:1
30	15:1
35	20:1
40	30:1
45	45:1
50	50:1
55	55:1
60	60:1

Based on Table 4-9 CDOT Access Code.

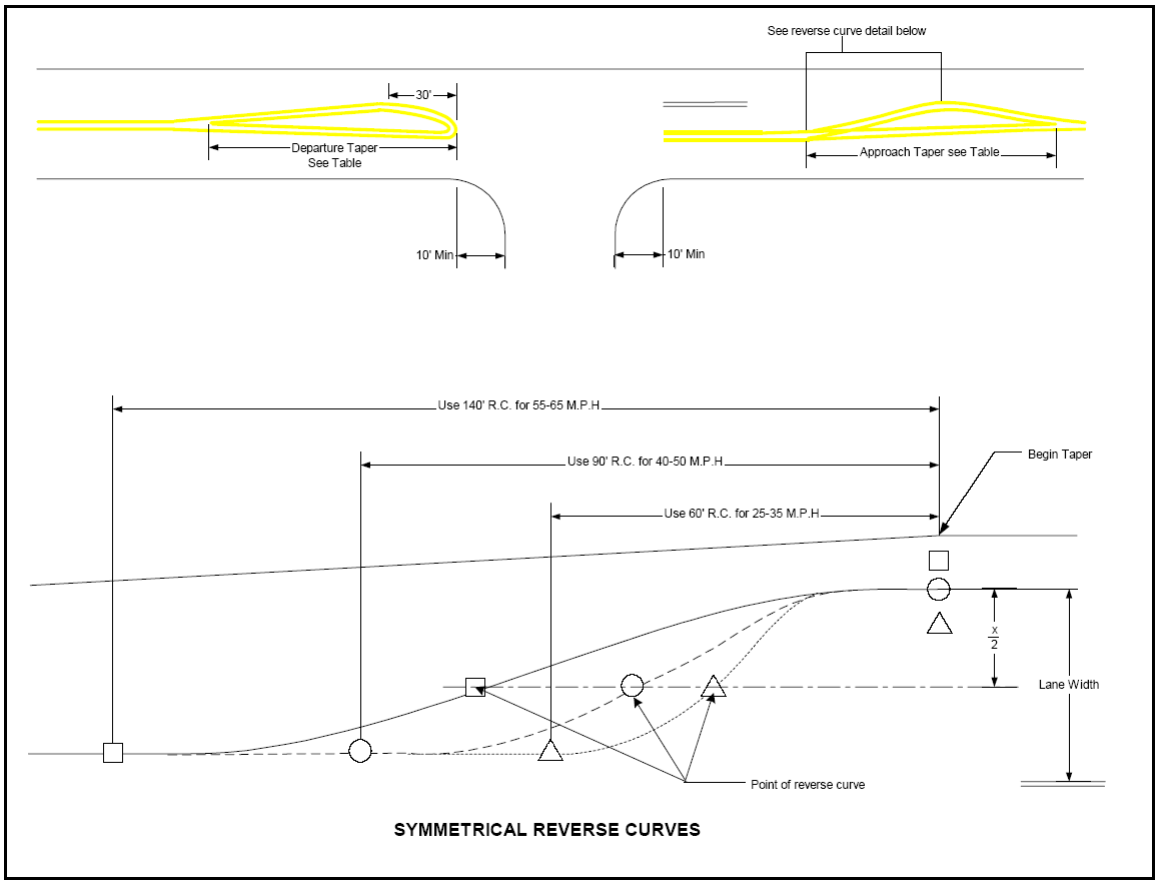
(2) Use the same ratio for both approach and departure tapers.

(3) Bay tapers shall be symmetrical reverse curves in accordance with the following:

(i) Use 60-foot reverse curve for 25 to 35 miles per hour.

(ii) Use 90-foot reverse curve for 40 to 50 miles per hour.

(iii) Use 140-foot reverse curve for 55 to 65 miles per hour.



(4) Storage lengths for turn lanes at signalized intersections shall be determined based on a signal timing analysis that predicts the 90 percent queue length required for the turn lane. At unsignalized intersections, the turn lane storage will be determined in accordance with the storage length table. Tapers for right-turn lanes shall be designed in accordance with the right-turn lane taper table. Use of the reverse curve is encouraged as part of the taper length to allow vehicles to decelerate in the full lane width. If used, the difference in length between the required taper and the reverse curve shall be added to the required storage length of the turn lane.

Minimum Storage Lengths for Unsignalized Turn Lanes

Turning VPH	≤60	100	200	300
Required Storage Length	50	100	175	250

Based on Table 9-7 CDOT Design Guide.

Minimum Right-Turn Tapers

Design Speed (MPH)	Tapers
25	7.5:1
30	8:1
35	10:1
40	12:1
45	13.5:1
50	15:1
55	18.5:1
60	25:1

Excerpted from Table 4-6, CDOT Access Code.

(5) Standards for State highway right-turn and left-turn speed change lanes are found in the State Access Code.

(Res. 39-04 (§ 6.2.5), 4-21-04)

29.28.180 Angles.

Proposed public streets must intersect at 90-degree angles or as close to 90 degrees as topography permits (no less than 80 degrees). Intersections on sharp horizontal curves shall be prohibited.

(Res. 39-04 (§ 6.2.6), 4-21-04)

29.28.190 Grades.

Intersections shall be on grades as flat as practical. At unsignalized intersections, the maximum allowable grade in the intersections is four percent and extends a minimum of 50 feet in each direction from the outside edge of the traveled way of the intersecting street. At signalized intersections, the maximum grade is two percent within the intersection and extends 200 feet in each direction. Grades above four percent will only be allowed on local and collector streets in areas with steep topography or other unusual circumstances that prevent a flatter grade, and must be documented as a design exception.

(Res. 39-04 (§ 6.2.7), 4-21-04)

29.28.200 Spacing and offsets.

(a) Principal Arterials. Signalized intersections shall be spaced at one-half mile intervals. Unsignalized intersections must be T-intersections spaced at least 600 feet apart, measured centerline to centerline. Unsignalized four-legged intersections may be allowed on arterial streets; provided, that the design of the intersection precludes left turns onto and through movements across the arterial. If the overlap of left-turn storage requirements for two T-intersections exceeds 600 feet, the minimum spacing must be increased to provide adequate left-turn storage in both directions.

(b) Minor Arterials and Collectors. Signalized intersections shall be spaced at one-quarter mile intervals. Unsignalized four-legged intersections must be spaced at least 300 feet apart. When T-intersections are used, the centerlines of streets not in alignment shall be offset a minimum of 150 feet and be 150 feet from the nearest four-legged intersection. If the left-turn storage requirements for adjacent intersections overlap, the minimum spacing must be increased to provide adequate left-turn storage in both directions.

(Res. 39-04 (§ 6.2.8), 4-21-04)

29.28.210 Pedestrian treatments.

Accommodations for pedestrians shall be designed into all intersections. Pedestrian accommodations include, but are not limited to, sidewalks, crosswalks, pedestrian refuge islands, and accommodations for disabled pedestrians. Sidewalks are an integral part of urban streets and shall be included in the intersection design. The City Standard Details shall be followed in designing and constructing pedestrian facilities. The intersection design shall conform to the standards set forth in the Americans with Disabilities Act. More information on the requirements can be found at http://www.access-board.gov/. Where sidewalks are provided, accessible ramps must also be provided. Utility boxes, drainage inlets, signs, and other fixed objects shall not be located within the path defined by ramp. The ramp shall align with the sidewalk and must be located entirely within the marked crosswalk area.

(a) Crosswalks. Crosswalks shall be marked at signalized intersections and designed as part of the markings for the traffic signal. All crosswalk markings must conform to MUTCD standards. Crosswalks at unsignalized intersections or mid-block locations will only be considered when an engineering study is conducted in accordance with Institute of Traffic Engineers guidelines and indicates crosswalks would increase pedestrian safety.

(b) Pedestrian Refuge Islands. Pedestrian refuge islands may be constructed where mid-block crosswalks are proposed. Islands must conform to the minimum standards established in the MUTCD, and must meet the design criteria for curbing and medians.

(Res. 39-04 (§ 6.2.9), 4-21-04)

29.28.220 Roundabouts.

(a) Design Criteria.

(1) A roundabout brings together conflicting traffic streams, allows the streams to safely merge and traverse the roundabout, and exit in the desired directions. The geometric elements of the roundabout provide guidance to drivers approaching, entering, and traveling through a roundabout.

(2) Good roundabout design places a high priority on speed reduction and speed consistency. Low vehicle speed provides safety benefits including reduced numbers and severity of crashes; more time for entering drivers to judge, adjust speed for and enter a gap in circulating traffic; and safer merging. Roundabout intersections typically operate with lower vehicle delays than other intersection control types.

(3) A capacity analysis of any proposed roundabout shall be conducted in accordance with Highway Capacity methods. The analysis shall include consideration for the largest motorized vehicle likely to use the intersection.

(4) Roundabouts shall be designed in conformance with the guidelines set forth in the FHWA publication “Roundabouts: An Informational Guide.” The guide can also be found at http://www.tfhrc.gov.

(b) Signing, Striping, and Pavement Markings. All signing, striping, and pavement markings shall follow the MUTCD standards.

(c) Lighting. Adequate lighting is essential for drivers to perceive the general layout and operation of the intersection in time to make the appropriate maneuvers. A lighting plan will be required as part of the construction drawings for roundabouts.

(d) Landscaping. Landscaping in the central island, the splitter islands and along the approaches is a benefit to both public safety and community enhancement. Landscaping shall follow these general principles:

(1) Make the central island more conspicuous;

(2) Improve the aesthetics of the area while complementing surrounding streetscaping as much as possible;

(3) Avoid obscuring the form of the roundabout or the signing to the driver;

(4) Maintain adequate sight distances;

(5) Clearly indicate to the driver that they cannot pass straight through the intersection;

(6) Discourage pedestrian movements through the center of the roundabout.

(Res. 39-04 (§ 6.3), 4-21-04)

29.28.230 Landscaping – General requirements.

All new developments must provide landscaping meeting the requirements of the City's zoning and development code, GJMC 21.06.040, and the County's Land Development Code, Chapter 7. Any landscaping in the sight distance triangles at intersections shall meet the sight distance requirements in the sight zones detail.

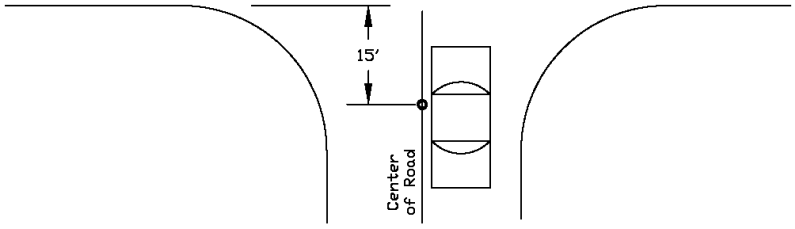
Sight Distance Design Standards

(ref. "Institute of Transportation Engineers Handbook," 5th Ed., 1999)

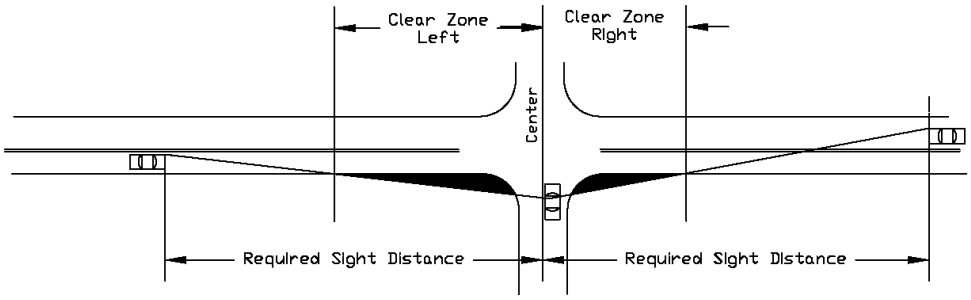
Dark areas represent mandatory Sight Distance clear zones, which vary by posted regulatory speed limit.

Clear zones apply to all driveways and intersections. They are defined by a line between a driver's view point 15' away from the edge of travel lane of the crossing roadway.

Measure from Driver's View Point (15' from the edge of travel lane)



Clear Zone Overview (shaded area is to be clear of sight obstructions from 2.5' to 8' H. above the road). Length varies by posted speed limit.



Cross Street Posted Speed Limit	Required Sight Distance	Clear Zone Length Left	Clear Zone Length Right
20 MPH	200 FT	108 FT	74 FT
25 MPH	275 FT	148 FT	101 FT
30 MPH	350 FT	188 FT	129 FT
35 MPH	425 FT	229 FT	157 FT
40 MPH	500 FT	269 FT	184 FT
45 MPH	575 FT	310 FT	212 FT
50 MPH	650 FT	350 FT	239 FT
55 MPH	725 FT	390 FT	267 FT

(Res. 39-04 (§ 6.4), 4-21-04)

Chapter 29.32

PAVEMENTS AND TRUCK ROUTES

Sections:
29.32.010 Design methods and procedures.
29.32.020 Pavement types.
29.32.030 Design input variables.
29.32.040 Pavement design procedures.
29.32.050 Truck routes.

29.32.010 Design methods and procedures.

The following pavement design methods and procedures shall be followed to create a consistent pavement thickness design throughout the urban area.

This chapter references the truck route map developed for the urban area of the City and County. The truck route map must be consulted prior to beginning pavement design to assure that the design will accommodate anticipated truck loading.

(Res. 39-04 (§ 7.0), 4-21-04)

29.32.020 Pavement types.

Pavement types which may be used for construction of City and County streets include Hot Mix Asphalt (HMA) and Portland Cement Concrete (PCC) pavements. The City and/or County shall approve in advance the type of pavement.

(Res. 39-04 (§ 7.1), 4-21-04)

29.32.030 Design input variables.

Parameters that must be evaluated in order to design an adequate pavement structure include subgrade soil properties, surface and sub-surface drainage, materials properties, environmental factors and traffic loading over the analysis period.

The minimum traffic analysis period to be used for the design of pavements for City streets is 30 years. Traffic growth rates vary depending upon the street classification, zoning location and other variables. Growth rates for most major streets are available from the Mesa County Regional Transportation Planning Organization, phone (970) 244-1830. The minimum growth rate to be used for traffic projections on major streets is 2.2 percent per year.

Traffic distribution by vehicle type shall be determined from actual traffic counts and projections based on land uses and future build-out of area serviced by the road. Classification of vehicles derived from traffic counts are available for most major streets from the City of Grand Junction, Transportation Engineering Division, phone (970) 256-4110.

All other pavement design parameters including 18 kip equivalency factors, lane distribution factors, Resilient Modulus (M_R) conversion equations, drainage coefficients, reliability factors and serviceability indices shall be determined in accordance with the Guideline for the Design and Use of Asphalt Pavements for Colorado Roadways, published by the Colorado Asphalt Pavement Association.

(Res. 39-04 (§ 7.2), 4-21-04)

29.32.040 Pavement design procedures.

(a) Flexible Pavement Design Procedure. Flexible pavement design includes asphalt concrete (AC) surfaces and surface treatments (ST). Flexible pavements shall be designed in accordance with the principles and procedures illustrated in the AASHTO Guide for Design of Pavement Structures (lat-

est edition). The computer software for the AASHTO guide is AASHTOWare DARWin 3.1 Pavement Design and Analysis System.

(b) Rigid Pavement Design Procedure. Rigid pavement design includes plain jointed (JCP), jointed reinforced (JRCP) and continuously reinforced (CRCO) concrete pavements. Rigid pavements shall be designed in accordance with the principles and procedures illustrated in the AASHTO Guide for Design of Pavement Structures (latest edition). Approved software for design of rigid pavement includes AASHTOWare DARWin 3.1 and WinPAS developed by the American Concrete Pavement Association.

(Res. 39-04 (§ 7.3), 4-21-04)

29.32.050 Truck routes.

Primary and secondary trucks routes are shown on the truck route map.

(Res. 39-04 (§ 7.4), 4-21-04)

Recommended Truck Routes For Grand Junction/Mesa County Urban Area

State of Colorado

City of Grand Junction Colorado

Mesa County

Fruita

Grand Junction

To Utah

To Denver

To Palisade

To Delta

Interstate 70 to Highway 50 Bypass

7th Street Historic District (see notes)

Colorado River

Gunnison River

Mesa Mall

Patterson Road (F Road)

North Ave.

Grand Ave.

Orchard Ave.

Horizon Dr.

Broadway

Redlands Parkway

River Rd.

South Camp Rd.

The Ridges

Uncompahgre Ave.

G Road

H Road

I Road

D Road

E Road

F½ Road

B½ Road

B Road

12th St.

7th St.

24 Road

25 Road

26 Road

29 Road

30 Road

31 Road

32 Road

34 Road

20 Road

21 Road

22 Road

23 Road

23½ Road

Notes

Truck Route Definitions

Primary Truck Routes

These routes are to be used by trucks that have no origin or destination within the Grand Junction/Mesa County urban area.

Secondary Truck Routes

These routes are to be used by trucks that have an origin or destination within the Grand Junction/Mesa County urban area. Trucks with an origin or destination within the urban area are requested to remain on these routes until reaching a point closest to their destination.

Historic District

Truckers - Please Note

The 7th Street Historic District is located on 7th Street between Teller Avenue and White Avenue, and is of great value to the community. Please refrain from using this section of 7th Street except for pick-ups and deliveries in the area.

Hazardous Materials Routes

The Colorado State Patrol has designated the following State Highways as Hazardous Materials Routes:

1. Interstate 70
2. I-70 Business Loop from Highway 141 to Interstate 70
3. Highway 141 from Highway 50 North to Interstate 70 Business Loop
4. Highway 50 South of the north junction of Highway 141

No other streets, roads or highways within the Grand Junction/Mesa County urban area are designated as Hazardous Material Routes.

Information

For additional information and maps contact the Colorado State Patrol at (970) 248-7283 or visit the CSP Hazardous Materials website at www.hazmat.state.co.us

You can get permits, weather information, road conditions and much more information on the CDOT website at www.dot.state.co.us
Statewide Road Condition Hotline (303) 639-1111

For information on Colorado trucking rules and regulations contact the Colorado Motor Carriers Association at (303) 433-3375 or visit their website at www.cmca.com

For information on this map or other traffic related issues contact the City of Grand Junction, Division of Transportation Engineering at (970) 256-4110 or visit our website at www.gjcity.org

Mesa County Regional Transportation Planning Office

N

Legend

Truck Routes
- Primary
- Secondary

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29-83

Chapter 29.36

STREET LIGHTING, UTILITIES AND MAILBOXES

Sections:
29.36.010 Requirements.
29.36.020 Street lighting.
29.36.030 Luminance requirements.
29.36.040 Acceptable poles and luminaires.
29.36.050 Pedestrian and bikeway lighting.
29.36.060 Breakaway structures and lateral clearances.
29.36.070 Utilities.
29.36.080 Mailboxes – Location.
29.36.090 Mailboxes – Construction standards.
29.36.100 Mailbox support standards.

29.36.010 Requirements.

This chapter outlines the requirements for street lighting, including whether lighting is required, installation, maintenance responsibilities, and acceptable poles and luminaries. Utilities are discussed for their placement in the rights-of-way.

(Res. 39-04 (§ 8.0), 4-21-04)

29.36.020 Street lighting.

Street lighting shall be installed on all new and existing public streets at the expense of the developer. Streetlights shall be designed, furnished and installed by the utility company responsible for supplying electrical power to the development or area. The location of all streetlights shall be shown on the traffic plan or street plan, or other design drawings as required by the City or County.

(Res. 39-04 (§ 8.1), 4-21-04)

29.36.030 Luminance requirements.

Street lighting shall provide average illuminance in accordance with Table 29.36-1.

Table 29.36-1
Average Maintained Illuminance (Foot-Candles) on Public Streets

Street Classification	Area Classification		
	Commercial	Intermediate	Residential
Arterial	1.7	1.3	0.9
Collector	1.2	0.9	0.6
Local	0.9	0.7	*

*On local residential streets, a standard light shall be located at each street intersection, at or near the throat of each cul-de-sac, and at a maximum spacing of 250 feet measured along the centerline of the roadway. Additional lights may be required on horizontal curves at other locations.

(Res. 39-04 (§ 8.1.1), 4-21-04)

29.36.040 Acceptable poles and luminaires.

The standard streetlights are shown in Table 29.36-2.

Table 29.36-2
Standard Street Lights

Street Light Style	Used on Street Classification	Wattage	Pole Color
GE Salem Luminaire Semi-Cutoff	Local Residential, Residential Collector	100	Black
Curvilinear Style Full-Cutoff "Hockey Puck"	Collectors, Arterials, Commercial	250 – 400	Black
Cobra Head Full-Cutoff – Flat Lens	Arterials (for existing overhead power), State highways	100 – 400	Silver, galvanized or existing wood pole

Height, wattage and spacing shall be determined by utility company in accordance with current IES standards. Where these standards conflict with existing lighting, design consideration will be given to consistency in the area.

(Res. 39-04 (§ 8.1.2), 4-21-04)

29.36.050 Pedestrian and bikeway lighting.

(a) When required, lighting for detached public pedestrian and bikeway trails shall be designed, furnished and installed by the utility company responsible for supplying electrical power to the development or area. The lighting standard shall be the cutoff luminaire style with 70-watt lamp.

(b) Pedestrian lighting is not considered in street light luminaire calculations.

(c) Pedestrian lighting is not normally required in residential subdivisions. Pedestrian lighting that is installed for decorative purposes shall be the responsibility of the homeowners' association for the cost of utilities and maintenance.

(Res. 39-04 (§ 8.1.3), 4-21-04)

29.36.060 Breakaway structures and lateral clearances.

All fixed objects such as utility, street light poles, fire hydrants, and telephone junction boxes installed in the right-of-way shall be of the breakaway type meeting AASHTO construction specifications. If breakaway type construction cannot be provided, a minimum of 10 feet horizontal clearance shall be provided between the flowline of the street (or the edge of the paved traveled way) and any new or relocated non-breakaway structure in excess of four inches in height. For local streets, a five-foot lateral clearance is recommended. If sufficient right-of-way or easement is not available for the 10-foot clear zone, all installations must be placed "as near as practical" to the edge of the public right-of-way. This policy is applicable to all arterial and major collector roadways whose posted speed limit is in excess of 30 miles per hour and is intended to provide minimum standards for the purpose of protecting the public health, safety, and welfare. Dynamic performance for breakaway objects shall be evaluated in accordance with current AASHTO specifications.

(Res. 39-04 (§ 8.1.4), 4-21-04)

29.36.070 Utilities.

All utilities shall be placed in the roadway section as set forth in the City Standard Details.

(Res. 39-04 (§ 8.2), 4-21-04)

29.36.080 Mailboxes – Location.

(a) Mailboxes may be located within public rights-of-way so as not to obstruct pedestrian or vehicular traffic.

(b) In no case shall a mailbox obstruct a sidewalk, the traveled way of a roadway, the road shoulder, or impede maintenance activities associated with the facility. Mailboxes shall not be permitted within sidewalks, paths, or roadside ditches.

(c) On roads without a curb, the mailbox face shall be located a minimum of eight feet from the traveled way and adequate shoulder areas shall be provided for mail pickup and delivery.

(d) Streets with a curb and detached sidewalk: the mailbox face shall be located a minimum of one foot behind the curb face. The mailbox should have a rear-facing door to facilitate mail removal without stepping into the street. Streets with attached sidewalk: the mailbox face shall be located a minimum of one foot behind back of walk.

(e) Group, gang mailboxes, or neighborhood box units shall not be placed in the area designated for sight distance or sight zone. Neighborhood mailboxes shall be considered a commercial location and must maintain the required driveway setback from intersections. Neighborhood mailboxes shall be shown on the utility composite and road plans.

(Res. 39-04 (§ 8.3.1), 4-21-04)

29.36.090 Mailboxes – Construction standards.

Mailboxes erected on public right-of-way shall be of light sheet metal or plastic construction conforming to the requirements of the U.S. Postal Service. Construction of supports and details shall be in accordance with AASHTO "A Guide For Erecting Mailboxes on Highways," 1984.

(Res. 39-04 (§ 8.3.2), 4-21-04)

29.36.100 Mailbox support standards.

(a) A single four-inch by four-inch square wooden post embedded no more than 36 inches into the ground; a single four-and-one-half-inch diameter wooden post embedded no more than 36 inches into the ground; a single metal post with a strength no greater than a two-inch standard strength steel pipe (two-and-three-eighths-inch O.D.) and embedded no more than 24 inches into the ground will be acceptable as a mailbox support.

(b) A metal post shall not be fitted with an anchor plate, but it should have an anti-twist device that extends no more than 10 inches below the ground surface.

(c) Supports shall not be set in concrete unless the support design has been shown to be safe by crash tests when so installed.

(d) The post-to-box attachment details should be of sufficient strength to prevent the box from separating from the post top if a vehicle strikes the installation.

(e) No more than two mailboxes may be mounted on a support structure unless the support structure and mailbox arrangement have been shown to be safe by crash testing, or meet the requirements set forth in the above AASHTO guidelines.

(f) Mailbox support designs that differ from the AASHTO guidelines are subject to the exception process outlined in Chapter 29.64 GJMC.

(g) Lightweight newspaper boxes may be mounted below the mailbox on the side of the mailbox support. Newspaper delivery boxes shall be of light sheet metal or plastic construction of minimum dimensions suitable for holding a newspaper.

(Res. 39-04 (§ 8.3.2.1), 4-21-04)

Chapter 29.40

STRIPING AND SIGNING

Sections:
29.40.010 Signs and markings.
29.40.020 Signing and striping plan.
29.40.030 Signing specifications.
29.40.040 Materials specifications.
29.40.050 Installation specifications.
29.40.060 Striping specifications.

29.40.010 Signs and markings.

Signs and markings must communicate to the users a clear and definitive message. Signs and markings must conform to industry standards given in the MUTCD. Modifications to signing and striping on the Colorado State Highway System shall be submitted to the Colorado Department of Transportation for approval.

(Res. 39-04 (§ 9.0), 4-21-04)

29.40.020 Signing and striping plan.

Preparation of a detailed traffic control plan, showing the locations of all traffic control devices, is required as part of the development plans. A signing and striping plan is required for all public street improvements. The signing and striping plan must be clear and it must contain all relevant information. Example striping plans may be found in the CDOT M & S Standards.

(Res. 39-04 (§ 9.1), 4-21-04)

29.40.030 Signing specifications.

All roadway signs shall conform to the latest edition of the MUTCD and any Colorado supplement. See GJMC 29.40.040(d)(2) for street name specifications.

(Res. 39-04 (§ 9.2), 4-21-04)

29.40.040 Materials specifications.

(a) All signs shall be reflectorized sheeting on 0.080-inch-thick tempered and anodized aluminum with radius corners. Letters and background shall faithfully reproduce their respective colors when illuminated at night.

(b) All other signs:

  (1) Shall conform to MUTCD standard sign sizes;

  (2) Shall be high intensity grade materials.

(c) Posts.

  (1) Twelve-foot length 3#/foot (minimum) U channel posts shall be used for:

    (i) Single signs less than seven square feet wind loading area;

    (ii) Double post mounting for signs eight square feet wind loading area.

  (2) Fourteen-foot length 3#/foot (minimum) U channel posts shall be used for:

    (i) Warning sign assembly (two signs) up to nine square feet wind loading area;

    (ii) Single square or diamond shaped signs nine square feet wind loading area;

(iii) Double post mounting for all signs 10 to 16 square feet wind loading area.

(3) Eight-foot length 3#/foot (minimum) U channel posts shall be used for:

(i) End of road markers;

(ii) Object markers.

(d) Fasteners.

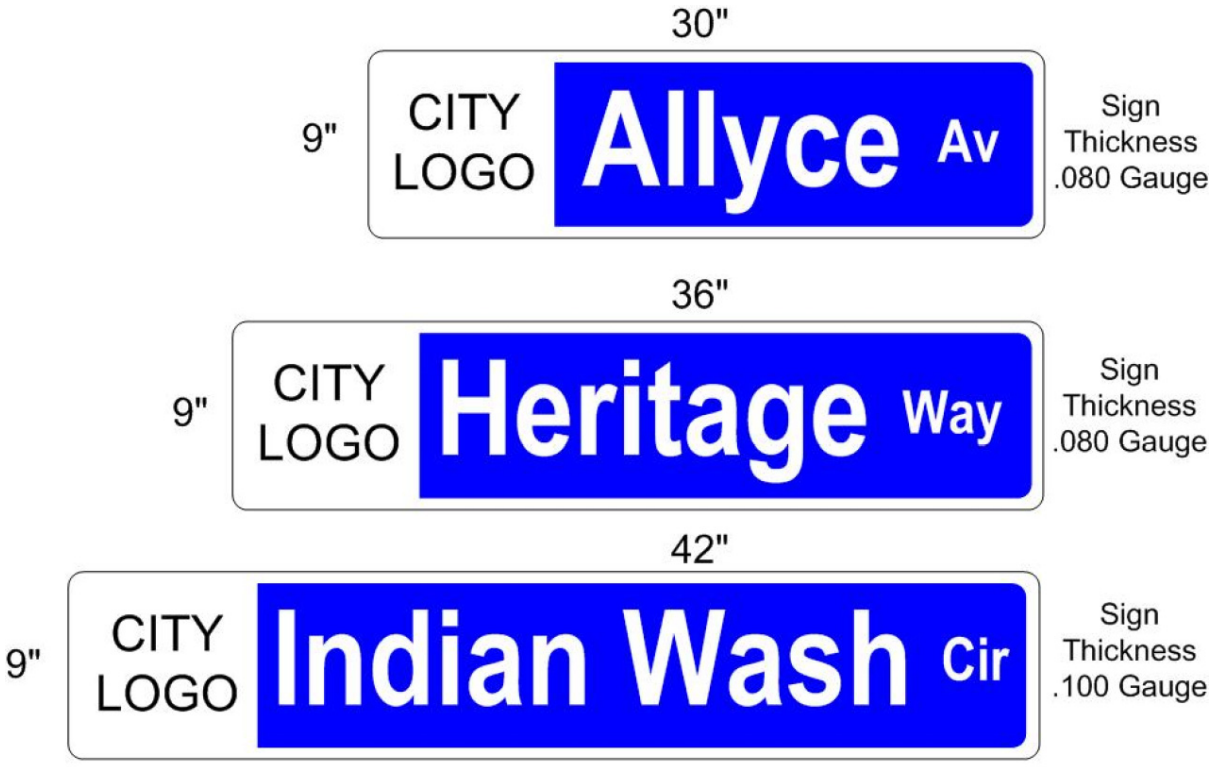
(1) Street Name Signs.

(i) Post caps: cast aluminum with 12-inch slots and five-sixteenths-inch set screws, attached to channel post with one-inch by five-sixteenths-inch bolts;

(ii) 90 cross piece: cast aluminum with 12-inch slots and five-sixteenths-inch set screws.

(2) All Other Signs.

(i) Three-eighths-inch grade 5 bolts with nylon lock nuts and flat washers. The bolt shall protrude beyond the lock nut by a full thread after assembly.



Background is 3M Blue (230-167). Font is White Highway Series C, 6" tall upper & lower case letters.
Border is white 5/8" thickness. City of Grand Junction requires the use of 30"X9", 36"X9", and 42"X9" Sign blanks only on High Intensity Sheeting.
Abbreviations used are Dr, Rd, St, Av, Ct, Cir, Way, Blvd. (3" upper & lower case).

(Res. 39-04 (§ 9.2.1), 4-21-04)

29.40.050 Installation specifications.

(a) Minimum driven depth of post shall be 30 inches for all sign installation.

(b) Mounting Height Restrictions. The mounting height is measured from the bottom of the sign to the near edge of pavement elevation:

(1) Street name signs: nine-foot minimum, 9.5-foot maximum.

(2) End of road markers: four-foot minimum, five-foot maximum.

(3) All other signs: seven-foot minimum, 7.5-foot maximum.

(c) Lateral Clearance Restriction. The near edge of sign shall not be less than two feet behind the face of curb. On roads without curb, the near edge of sign shall not be less than six feet from the shoulder or 12 feet from the travel way.

(d) To maintain sign uniformity, no substitute or decorative materials will be allowed. The use of concrete for mount stabilization will not be allowed. If a stable mount cannot be achieved at the minimum driven depths, greater depths must be used in conjunction with longer posts. Minimum sign heights shall be maintained.

(e) All signs (other than street name signs) shall be mounted on the wide, or open, side of the channel post. Care should be taken when tightening the bolts so as not to create a “dimple” in the aluminum sign.

(f) At least two “end of road” markers consisting of nine red reflectors, each with a minimum dimension of three inches, mounted symmetrically on an 18-inch diamond black panel shall be used where there is no alternate vehicular path. More than two markers may be required. Where a hazard exists such as an open ditch, the engineer may require permanent Type III barricades which may be used to mark the roadway terminus. The design criteria for the permanent Type III barricade shall be the Colorado Department of Transportation Standard Plan No. S-630-2, dated November 1, 1992.

(g) The developer shall bear all expenses for the fabrication and installation of permanent barricades and/or signs for implementing the approved project design (i.e., one way, no parking, dead end and private drive).

(Res. 39-04 (§ 9.2.2), 4-21-04)

29.40.060 Striping specifications.

All striping shall conform to the latest edition of the MUTCD and any Colorado supplement.

(a) Striping and Marking Materials. All painted lines shall be applied at a minimum thickness of 15 mils, with six to eight pounds of reflective glass beads applied per gallon of paint.

All permanent markings such as elongated arrows, stop lines, crosswalks, preferential and bike lane markings must be an approved type thermoplastic material, applied a minimum of 120 mils thickness. All letters, arrows and symbols shall be in conformance with the “Standard Alphabets for Highway Signs and Pavement Markings” adopted by the Federal Highway Administration.

(b) Re-Striping. When the removal of pavement markings is necessary for re-striping, the old markings must be ground off, sand-blasted or covered with a chip-seal. Covering the markings with black paint is prohibited.

(Res. 39-04 (§ 9.3), 4-21-04)

Chapter 29.44

TRAFFIC SIGNALS AND CONSTRUCTION ZONES

Sections:

Article I. Generally

29.44.010 Installation/relocation of traffic signals.
29.44.020 Signal design plans.
29.44.030 Easements.
29.44.040 Traffic control plans for construction zones.
29.44.050 Signal design plans.

Article II. Traffic Signal Specifications

29.44.060 General requirements.
29.44.070 Traffic control and street closure.
29.44.080 Testing.
29.44.090 Intersection power.
29.44.100 Equipment salvage.
29.44.110 Existing traffic signals.
29.44.120 Signal heads.
29.44.130 Field location.
29.44.140 Utilities.
29.44.150 Notification of work.
29.44.160 Regulations and code.
29.44.170 Equipment list and drawings.
29.44.180 Excavating and backfilling.
29.44.190 Removing and replacing improvements.
29.44.200 Instructions and wiring diagrams.
29.44.210 Guarantee.
29.44.220 Underground facilities – Foundations.
29.44.230 Underground facilities – Conduit.
29.44.240 Underground facilities – Pull boxes.
29.44.250 Underground facilities – Detector loop wire installation.
29.44.260 Underground facilities – Conductor and cable.
29.44.270 Underground facilities – Bonding and grounding.
29.44.280 Underground facilities – Maintenance.
29.44.290 Underground facilities – Field testing.
29.44.300 Material specifications – Traffic signal indication unit specifications.
29.44.310 Material specifications – Pedestrian signal units.
29.44.320 Material specifications – Back plates.
29.44.330 Material specifications – Traffic signal lamps.
29.44.340 Electrical cable – Signal cable.
29.44.350 Electrical cable – Traffic wire specifications.
29.44.360 Electrical cable – Interconnect cable.
29.44.370 Electrical cable – Loop wire.
29.44.380 Electrical cable – Pedestrian push button cable.
29.44.390 Electrical cable – Loop lead in cable.
29.44.400 Electrical cable – Illuminated street name signs wire.
29.44.410 Electrical cable – Ground.
29.44.420 Electrical cable – Optical detector lead in cable.
29.44.430 Vehicle detectors – General.

29.44.440 Vehicle detectors – Vehicle video detection.
29.44.450 Vehicle detectors – Emergency vehicle detectors.
29.44.460 Pedestrian push button detectors – General.
29.44.470 Illuminated street name signs – General.
29.44.480 Traffic signal poles, pedestals and mastarms.
29.44.490 Controller cabinet – General.
29.44.500 Actuated controllers – General.
29.44.510 Actuated controllers – Coordination unit.
29.44.520 System telemetry.
29.44.530 On-street master – General.
29.44.540 Traffic signing and pavement markings.
29.44.550 Traffic control in construction areas – General.
29.44.560 Traffic control in construction areas – Time of submittal.
29.44.570 Traffic control in construction areas – Scope of construction traffic control plan.
29.44.580 Traffic control in construction areas – Elements of construction traffic control plan.
29.44.590 Traffic control in construction areas – Basis for construction traffic control plan.
29.44.600 Traffic control in construction areas – Restriction, regulations and opportunities.
29.44.610 Traffic control in construction areas – Approval.
29.44.620 Traffic control in construction areas – Modifications.

Article I. Generally

29.44.010 Installation/relocation of traffic signals.

New traffic signal installations and relocations of existing signal equipment may be required in the developer's public improvement agreement. New signals will be installed only when warranted as specified in the MUTCD and when the new signal will not have a detrimental effect on the traffic flow. The need for a traffic signal will be addressed in the TIS and be designed in accordance with the criteria in GJMC 29.28.130.

The installation, modification or relocation of a traffic signal must follow the specifications defined in the Traffic Signal Specifications (Article II of this chapter).

(Res. 39-04 (§ 10.1), 4-21-04)

29.44.020 Signal design plans.

Signal design plans shall be submitted as part of the development plans. The design of the traffic signal shall follow the ITE *Manual of Traffic Signal Design* and the MUTCD standards. The signal design shall follow the signal specifications of the City.

Signal design plans shall contain all necessary information. Typical traffic signal installation and design details are included at the end of this chapter.

New signals or improvements to existing signals shall be required to install conduit for fiber optic cable and all necessary fiber optic equipment to connect to adjacent signals on streets as shown on the signal communications plan.

(Res. 39-04 (§ 10.2), 4-21-04)

29.44.030 Easements.

At proposed signalized private accesses, the first 50 feet of a private driveway approach as measured from the flowline of the cross street shall be dedicated as a permanent easement to provide for traffic signal loop detector placement and maintenance.

(Res. 39-04 (§ 10.3), 4-21-04)

29.44.040 Traffic control plans for construction zones.

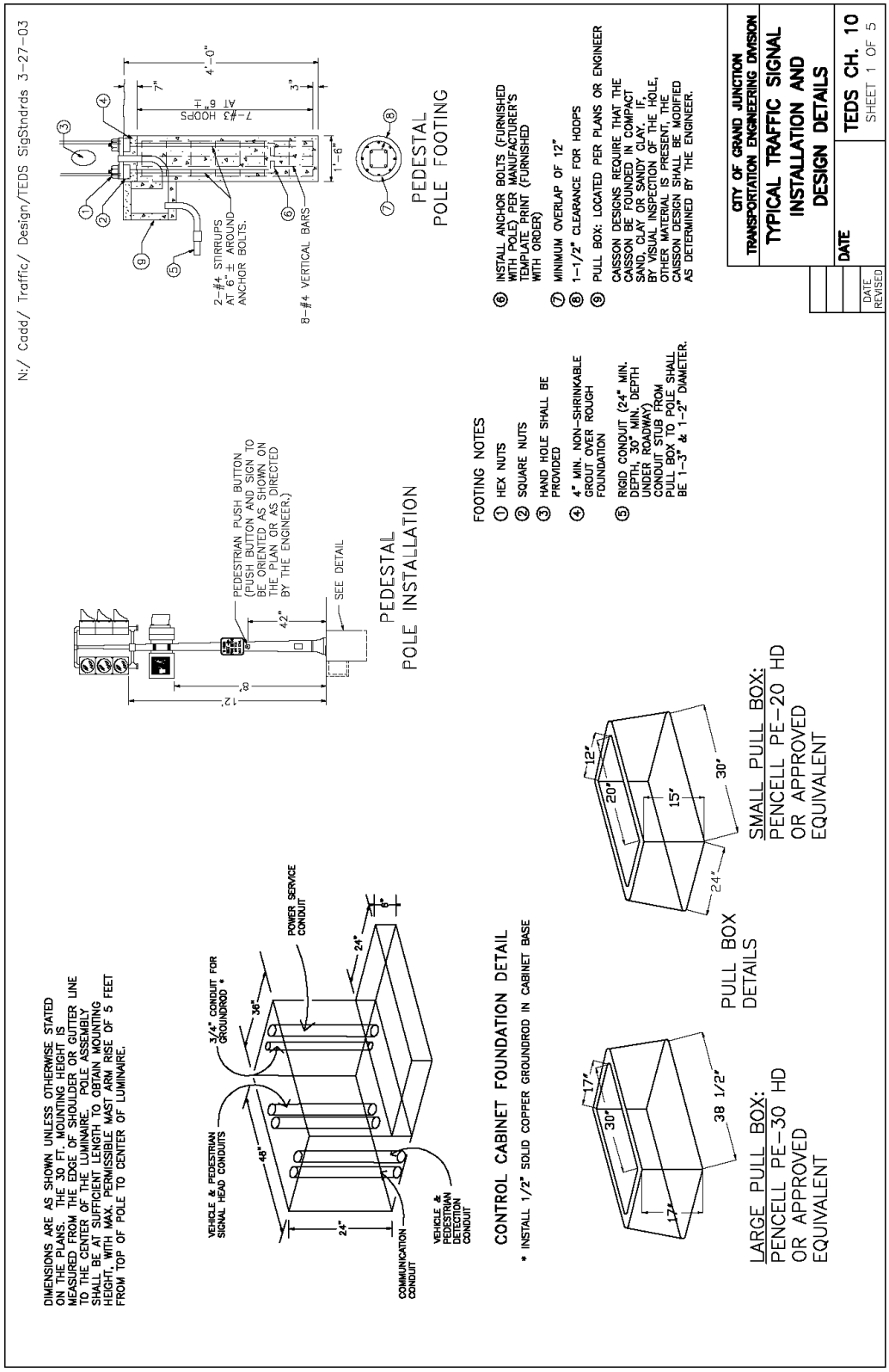
All maintenance of traffic plans for construction areas shall be submitted to and approved as part of the permitting process for work in the public right-of-way. All plans shall conform to the MUTCD and be prepared by a certified traffic worksite supervisor. On State highways, the Colorado Department of Transportation shall approve work area traffic control signing and detour plans.

(Res. 39-04 (§ 10.4), 4-21-04)

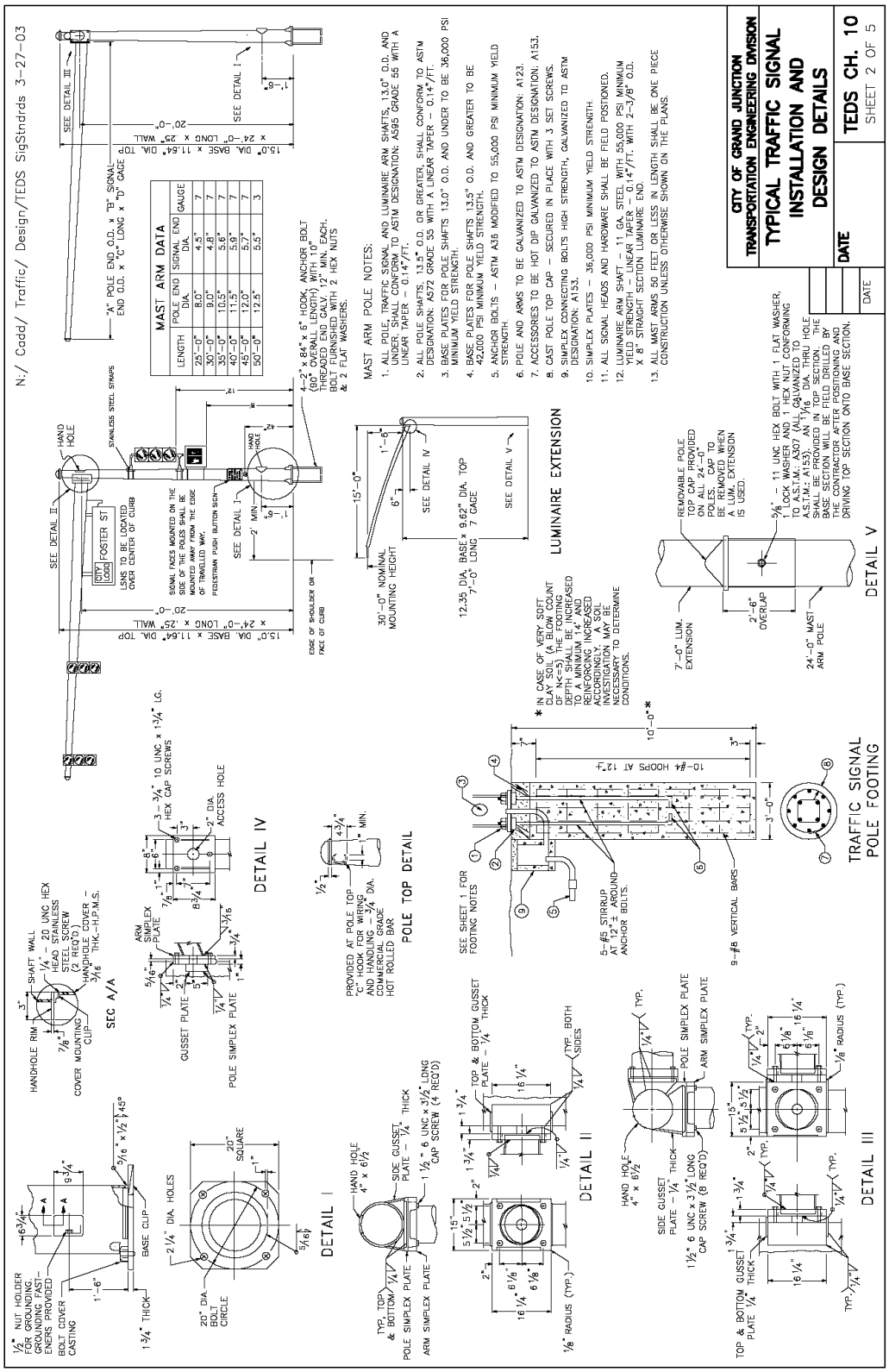
29.44.050 Signal design plans.

Signal design plans shall contain all necessary information. Sample signal design drawings illustrating the proper information required are listed below:

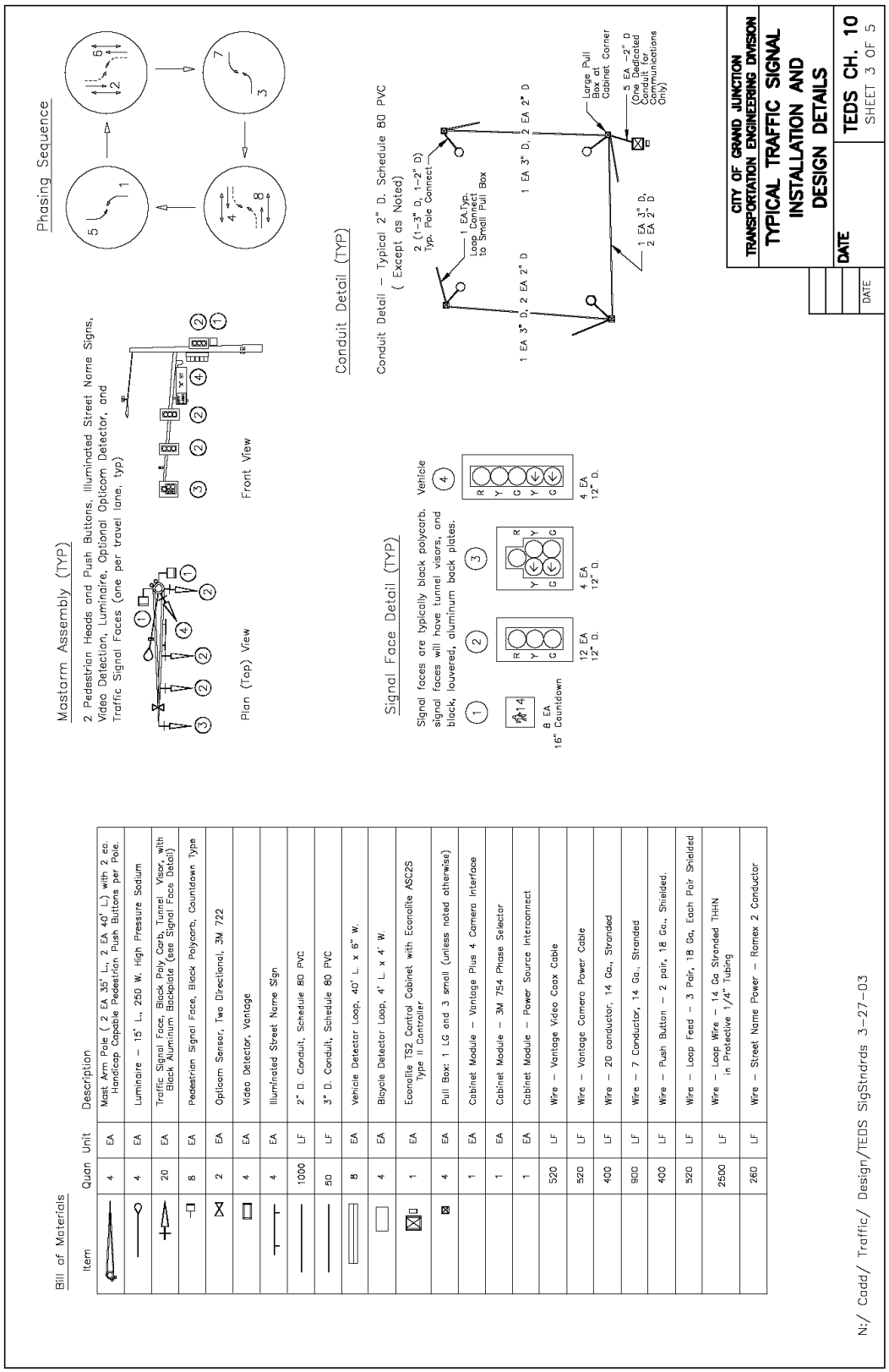
(a) Control Cabinet Foundation Detail, Pull Boxes, Pedestal Pole Installation, Pedestal Pole Footing.



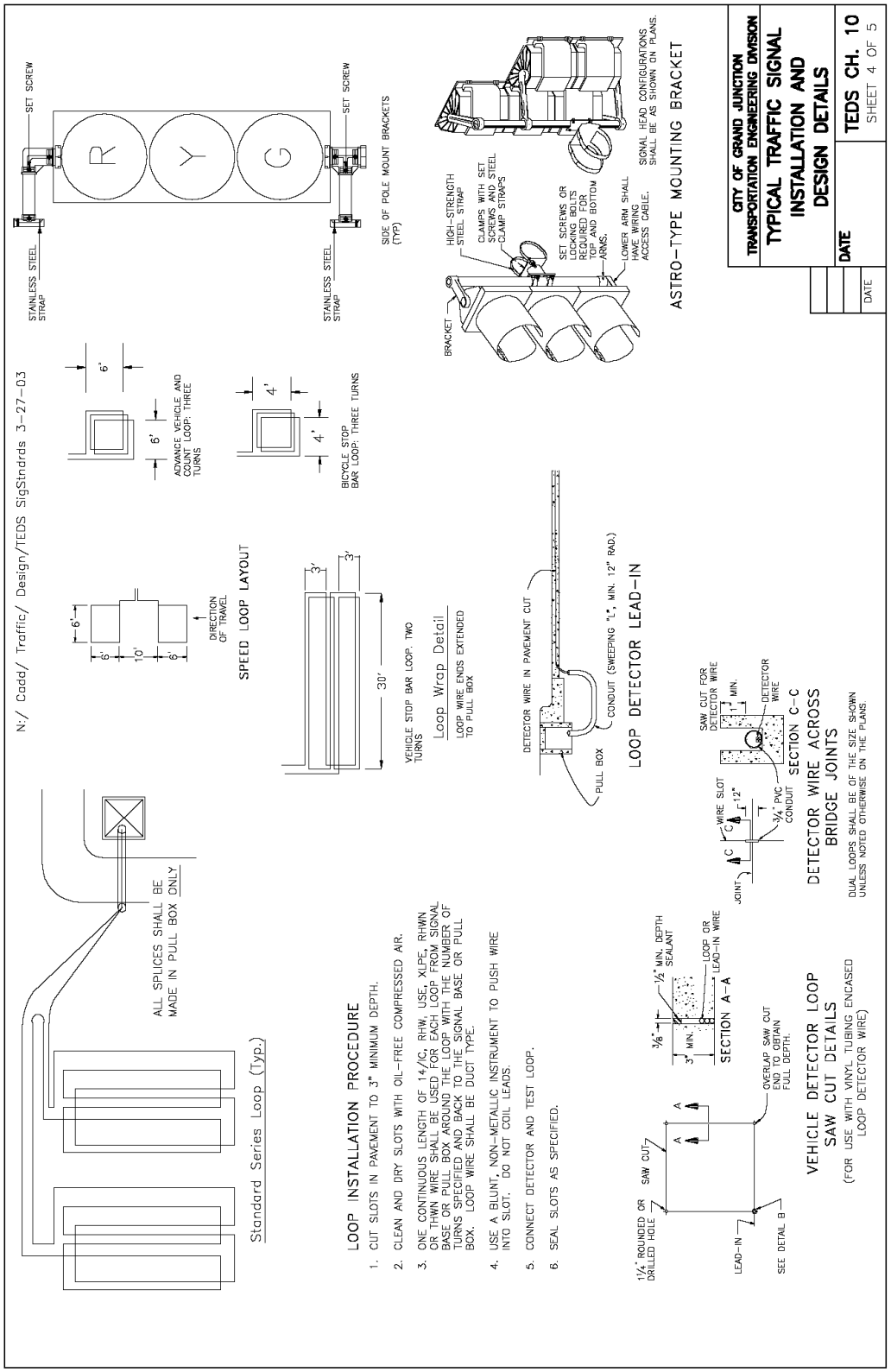
(b) Traffic Signal Pole Details.



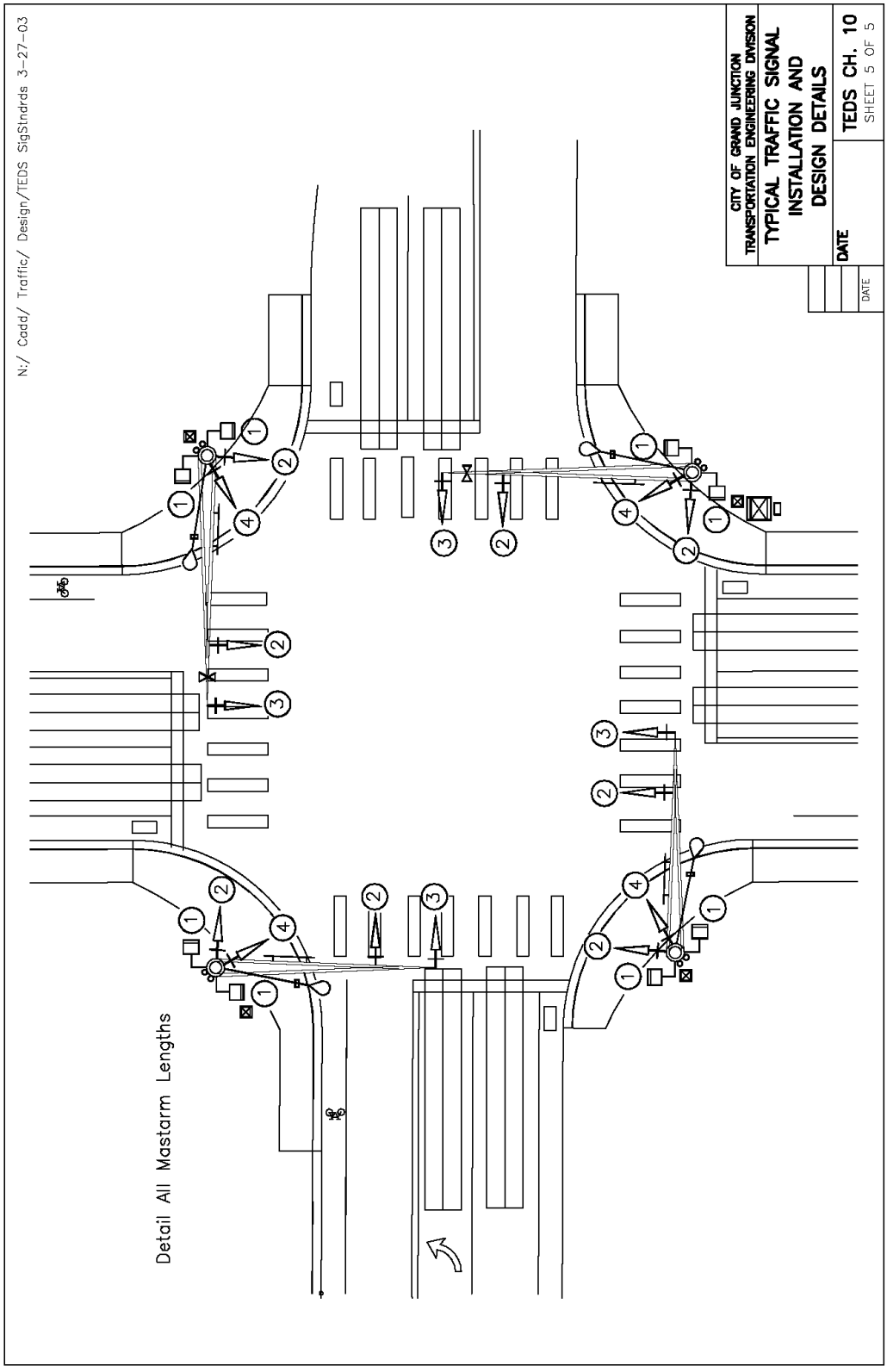
(c) Mastarm Assembly, Signal Face Detail, Conduit Detail, Phasing Sequence.



(d) Loop Installation Detail.



(e) Example of Typical Installation.



(Res. 39-04, 4-21-04)

City of Grand Junction, Co
Fiber Optic Project Detail

Edited 11-07-02 G. M. Miller
N:/CADD/Traffic/gmiller/ValleyFiber_Signals.dwg

NORTH

Scale - One Mile

Traffic Control / Monitoring Devices
Color Denotes Juisdictional Control

- Mesa County
- City of Grand Junction
- Colo. Dept. of Transportation
- Traffic Signal
- Flashing Beacon
- School Xing Signal
- School Speed Limit Flasher
- Permanent Count Station
- Future Traffic Signal

Grand Junction Area Fiber
(Solid denotes existing conduit, dashed denotes future conduit)

- Grand Junction Fiber Trunk
- Grand Junction Fiber Local
- Mesa County Fiber Trunk
- Mesa County Fiber Local
- Fiber Aerials

Destination Structures

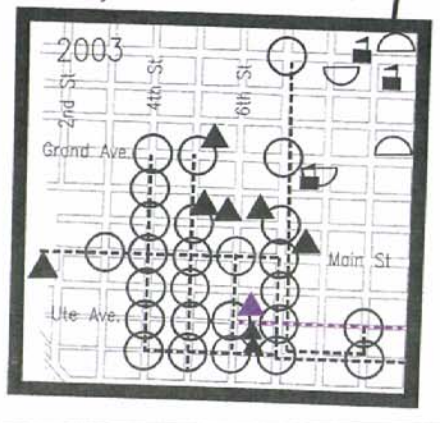
- Hospital
- School
- City Building
- County Building
- State Building

Project Period Boundaries

- 2004 — Project Area with Target Installation Year
- Future Project Area

I-70
I-70 B
I-70B
G Rd.
24 Rd.
25 Rd.
1st St.
2nd St.
3rd St.
Horizon
2005
2004
Pottenson
2002
2007
Redlands Pkwy
Orchard
North
2003
Gunnison
29 Rd.
31 Rd.
Kuterian
E Rd.
F Rd.
D 1/2 Rd.
D Rd.
30 Rd.
Hwy 141
Hwy 340
S. Camp
Main
Unaweep
Hwy 50
27 Rd.
B 1/2 Rd.
B Rd.

Project Area Detail



29-99

Article II. Traffic Signal Specifications

29.44.060 General requirements.

The work specified in this article describes the installation of necessary material and equipment to complete traffic signals and/or other electrical systems as specified on the drawings, in the special contract provisions, or herein.

(Res. 39-04, 4-21-04)

29.44.070 Traffic control and street closure.

The contractor shall be required to maintain access to all private drives throughout the period of construction. The contractor shall be required to erect and maintain all barricades, traffic control signs, cones, and other traffic control items necessary to provide proper traffic control during construction. The contractor shall submit three copies of the traffic control plan to the City Transportation Engineer for approval 72 hours prior to beginning construction. At the completion of the project the contractor shall remove all barricades, traffic control signs, cones and other necessary construction traffic control items and return all areas or permanent traffic control devices damaged during construction to their original condition at no cost to the City. Traffic control signs and devices shall be in accordance with Part VI of the "Manual on Uniform Traffic Control Devices for Streets and Highways," (MUTCD) Millennium Edition, dated June 14, 2001, published by the Federal Highway Administration, and as directed by the Engineer.

(Res. 39-04, 4-21-04)

29.44.080 Testing.

The City may at its option and cost retain the services of an independent testing lab to perform all testing consultation and to assist in the review of the work and equipment.

(Res. 39-04, 4-21-04)

29.44.090 Intersection power.

The contractor shall notify the engineer two weeks prior to the signal turn on so that orders may be issued for power connection to the intersection on the specified turn on date. Electrical power supply shall be separate from any other electrical service.

(Res. 39-04, 4-21-04)

29.44.100 Equipment salvage.

All traffic signal equipment that is removed shall remain the property of the City. Such property is to be removed from the work site and returned by the contractor to the City of Grand Junction located at 2551 River Road.

(Res. 39-04, 4-21-04)

29.44.110 Existing traffic signals.

When existing traffic signal installations are modified or completely rebuilt, the contractor shall avoid disturbing existing traffic signal equipment until the new or modified traffic signal system has been installed and put into operation. If the existing traffic signal equipment must be removed to accommodate the new construction, the contractor shall, with the engineer's approval and at the contractor's sole expense, install temporary overhead traffic signal equipment. The contractor shall at all times maintain a minimum of two three-section (red, yellow, and green) traffic signal heads for each roadway approach in conformance with the MUTCD.

(Res. 39-04, 4-21-04)

29.44.120 Signal heads.

Signal heads installed on standards or poles at new signal locations, which are not ready for actual electrical operation, shall be bagged. This shall include pedestrian heads and pedestrian push buttons.

(Res. 39-04, 4-21-04)

29.44.130 Field location.

All loops, poles, control cabinets, pull box locations, and pole foundations shall be field located by the engineer. Traffic signal poles and mastarms shall not be ordered until field verification of pole foundations is complete.

(Res. 39-04, 4-21-04)

29.44.140 Utilities.

All utilities shall be shown on the plans to the extent that they can, based upon utility records, surface field indications and proposed installations. During the progress of the work, all utility locations and elevations will necessarily require field verification in cooperation with the affected companies and public agencies. The contractor shall be responsible for locating all valve boxes, manholes, etc., and ensuring that they are properly protected and/or adjusted.

(Res. 39-04, 4-21-04)

29.44.150 Notification of work.

The contractor shall work only on weekdays between the hours of 8:00 a.m. and 5:00 p.m. The contractor must receive written approval from the engineer to work at any other time.

(Res. 39-04, 4-21-04)

29.44.160 Regulations and code.

All electrical equipment and material shall conform to the standards of the National Electrical Manufacturers Association (NEMA), Qwest Communications Company or the Colorado Department of Transportation, whichever is applicable. In addition to requirements of these specifications, the plans, the special contract provisions, all material, and work shall conform to the requirements of the National Electrical Code (hereinafter referred to as the "Code"), the Rules for Overhead Electrical Line Construction of the Public Utilities Commission, the Standards of the American Society for Testing Materials (ASTM), the American Standards Association (ASA), and any local ordinance which may apply. Wherever reference is made in these specifications or in the special contract provisions to the code, rules, or the standards mentioned above, the reference shall be construed to mean the code, rule, or standard that is in effect at the date of bidding.

(Res. 39-04, 4-21-04)

29.44.170 Equipment list and drawings.

The contractor shall submit a list of equipment and material that he proposes to furnish within five days of the execution of the owner-contractor agreement. The submittal shall include all equipment and material as identified on the plans or in the specifications by the manufacturer's name which is necessary or customary in the trade to identify such equipment and material. The list shall be complete as to name of manufacturer, unit size, and material composition and shall be supplemented by such other data as may be required by the City Transportation Engineer.

The engineer or his designee prior to installation must make inspection or sampling of any materials, other than those already approved, according to the material specifications. If the contractor proposes a substitution of equipment called for in the plans or specifications, he shall provide additional information to prove the substitution item is of equal or superior quality. Any material and/or equipment installed by

the contractor that is not in conformance with the City of Grand Junction specifications will be removed or changed at the contractor's expense. Upon completion of the work, the contractor shall submit an "as built" or corrected plan showing, in detail, all construction changes including, but not limited to, wiring, cable, and location and depth of conduit.

(Res. 39-04, 4-21-04)

29.44.180 Excavating and backfilling.

Excavations for the installation of conduit, foundations, and other traffic signal items shall be performed in such a manner as to cause the least possible injury to the streets, sidewalks, and other improvements. Whenever possible, directional boring shall be used in place of trenching. The trenches shall not be excavated wider than necessary for the proper installation of the electrical appliances and foundations. Excavating shall not be performed until immediately before installation of conduit and other appliances. The material from the excavation shall be removed as the trenching progresses.

Trenches in existing or proposed roadways shall be backfilled with concrete or approved flow-fill material. After backfilling, all trenches shall be kept well filled and maintained in a smooth and well drained condition until permanent repairs are made.

Excavations in streets or highways shall be performed in such a manner that one lane of traffic in each direction shall be open to public traffic. All lane closures shall be approved by the engineer prior to closure. At the end of each day's work and any other time construction operations are suspended, all construction equipment and other obstructions shall be removed from that portion of the roadway open for use by public traffic. When excavations must remain open overnight, they shall be properly marked to warn motorists and/or pedestrians according to guidelines established in the "Manual on Uniform Traffic Control Devices for Streets and Highways," latest edition. The engineer may require the trench to be covered with steel plate so that the street remains open to traffic.

(Res. 39-04, 4-21-04)

29.44.190 Removing and replacing improvements.

The contractor shall at his sole expense replace or reconstruct sidewalks, curbs, gutters, rigid or flexible pavement, and any other City or privately owned property which is removed, broken, or damaged by him with material which conforms to current City standards and specifications. Whenever a part of a square or slab or existing concrete, sidewalk, or driveway is broken or damaged, the entire square or slab shall be removed and the concrete reconstructed as above specified.

The outline of all areas to be removed in Portland cement concrete sidewalks and in pavements shall be cut to a minimum depth of one and one-half inches with an abrasive type saw prior to removing the sidewalk and pavement material. Cut for remainder of the required depth may be made by a method satisfactory to the engineer. Cuts shall be neat and true with no shatter outside the removal area.

(Res. 39-04, 4-21-04)

29.44.200 Instructions and wiring diagrams.

All equipment shall be provided with three sets of complete installation instructions, including a complete chart of field connections as well as a manual for the controller, containing service instructions, wiring diagrams, trouble shooting procedures, etc. Each and every component used shall be clearly referenced in the service manual and its value, ratings and manufacturer part number shall be given.

(Res. 39-04, 4-21-04)

29.44.210 Guarantee.

The contractor shall include in his proposal all warrants and/or guarantees with respect to materials, parts, workmanship and performance of the product to be supplied. The minimum guarantee period for the

product shall be one year from the date of final acceptance of the contract. The contractor shall attach to the bid a statement that all material to be supplied is either in exact accordance with the specifications or shall list in detail any and all deviations therefrom. The supplying of equipment that is not in accord with the specification and on which the contractor has indicated no exception shall be cause for rejection of the equipment and correction of the non-specification items entirely at the contractor's expense.

(Res. 39-04, 4-21-04)

29.44.220 Underground facilities – Foundations.

(a) All foundations shall be Portland cement concrete conforming to the applicable requirements of construction specifications of the City of Grand Junction, except as herein provided.

(b) The bottom of concrete foundations shall rest on firm ground. Cast-in-place foundations shall be poured monolithically where practicable. The exposed portions shall be formed to present a neat appearance.

(c) Forms shall be true to line and grade. Tops of foundations, except as noted on plans, shall be finished to curb or sidewalk grade or as ordered by the engineer. Forms shall be rigid and securely braced in place and inspected prior to the pouring of concrete. Conduit ends and anchor bolts shall be placed in proper position and in a template until the concrete sets.

(d) Anchor bolts shall conform to the specifications and each individual bolt shall have two flat washers, and two nuts. Shims or other similar devices for plumbing or raking will not be permitted.

(e) Both forms and ground that will be in contact with the concrete shall be moistened before placing concrete. Forms shall not be removed until the concrete has thoroughly set.

(f) All abandoned foundations shall be removed and disposed of by the contractor. All conduit runs associated with an abandoned foundation shall be extended or abandoned as called for on the plans. When a foundation is removed, the hole shall be backfilled in accordance with State of Colorado and City of Grand Junction standard practices.

(Res. 39-04, 4-21-04)

29.44.230 Underground facilities – Conduit.

(a) All cables and conductors not shown on the plans as aerial cable shall be installed in conduit unless installed in poles, pedestals, or mastarms. All metal conduits referred to in the specifications and shown on the plans shall be rigid and adequately galvanized. All PVC conduits will be of Schedule 80 or greater.

(b) All trenches excavated in roadways, including new construction areas, shall be backfilled with concrete or State of Colorado approved flow fill, and capped with six inches of Grade E Asphaltic Pavement.

(c) Following conduit schedule is in effect unless otherwise specified in the plans:

Run Type	Quantity	Size	Use
Street Crossings	1	3″	120 voltage
Street Crossings	1	2″	Low voltage
Street Crossings	1	2″	EXCEL use
Signal Pole	1	3″	Signal cables
Signal Pole	1	2″	EXCEL use
Controller Cabinet	2	2″	120 voltage
Controller Cabinet	1	2″	Excel use
Controller Cabinet	1	2″	Low voltage
Service Point	1	2″	EXCEL use
Fiber Optic Interconnect	1	2″	Communications

(d) The contractor, at his sole expense, may use larger conduit if desired. Where larger conduit is used, it shall be for the entire length of the run from outlet. No reducing couplings will be permitted underground.

(e) The end of all metal conduit, existing or new, shall be well reamed to remove burrs and rough edges. Field cuts of existing or new conduit shall be made square and true, and the ends shall butt together for the full circumference thereof. Slip joints of running thread will not be permitted for coupling metal conduit. When a standard coupling cannot be used, an approved threaded union coupling shall be used. All couplings shall be screwed up until the ends of the metal conduits are brought together.

(f) Where a "stub out" is called for on the plans, a sweeping ell shall be installed in the direction indicated and properly capped. The locations of ends of all conduits in structures or terminating at curbs shall be marked by a "Y" at least three inches high cut into the face of the curb, gutter, or wall directly above the conduit.

(g) Conduit bends, except factory bends, shall have a radius of not less than six times the inside diameter of the conduit. Where factory bends are not used, conduit shall be bent without crimping or flattening, using the longest radius practicable.

(h) Conduit shall be laid at a depth of not less than 24 inches below the top of curb grade in sidewalk or grass areas and to a depth of not less than 30 inches below the finished grade in all other areas. Conduit under railroad tracks shall be not less than 48 inches below the bottom of the tie.

(i) Trench excavations for conduit shall be two inches wider than the outside diameter of the conduit. Placing concrete or approved flow-fill up to the bottom surface of the existing or new roadway surface material shall accomplish backfilling of conduit trenches. The remaining portion of the excavation shall be backfilled with the same type of material used to construct the existing roadway surface.

(j) Conduit shall always enter a foundation, pull box, or any other type structure from the direction of the run only.

(k) Conduits terminating in a pole shall extend approximately six inches vertically above the foundation.

(l) All conduit runs that exceed 10 feet in length shall have a continuous nylon line pulled into the conduit along with the specified electrical cables. The line shall be firmly secured at each end of the conduit run with a minimum slack of three feet. The purpose of this line is to be able to pull future

electrical cable through the existing conduit runs. All nylon line shall be free of knots and "birds nest."

(m) Existing underground conduit to be incorporated into a new system shall be cleaned with a mandrel or blown out with compressed air.

(n) New conduit runs shown on the plans are for bidding purposes only and may be changed with approval of the engineer.

(Res. 39-04, 4-21-04)

29.44.240 Underground facilities – Pull boxes.

(a) A pull box shall always be installed in combination with a steel strain pole and at all other locations shown on the plans and at such additional points as ordered by the engineer. The contractor may install, at his own expense, any additional pull box that he may desire to facilitate the work.

(b) Pull boxes that are required shall be fabricated and installed in general conformance with the size and details shown on standard drawings.

(c) Pull boxes shall be installed so that the covers are level with curb or sidewalk grade or level with the surrounding ground when no grade is established. The bottoms of all pull boxes shall be bedded in crushed rock. Conduit stub outs into pull boxes shall be no shorter than four inches from bedding grade. When installed in the concrete, two bolts on each side of the pull box two inches below the top shall be installed to adhere the box to the concrete.

(d) When a new conduit run enters an existing pull box, the contractor shall remove the pull box or tunnel under the side at no less than 18 inches and enter from the direction of the run. No new conduit will be allowed to enter a new or existing pull box in any other manner than that shown on standard drawings.

(Res. 39-04, 4-21-04)

29.44.250 Underground facilities – Detector loop wire installation.

(a) Each individual detector loop is to be terminated as specified on the construction drawing, without splicing, to this termination point. Any required series or parallel connections are to be at the termination point.

(b) All loops shall have a tag attached to the leading clockwise lead of the loop. This tag shall be marked to indicate the relative location of the loop. This marking shall correspond directly to the loop designations on the intersection drawing provided in the contract.

(c) Detector loop roadway slots shall be cut in asphalt that has a six-inch minimum depth and sealed one-fourth inch below the surface level of the roadway with 3M sealer or approved equal.

(d) Loop lead ins shall run to pull box on side of walk designated on plans. Leads shall not be placed in valve box in roadway unless approved by engineer.

(Res. 39-04, 4-21-04)

29.44.260 Underground facilities – Conductor and cable.

(a) Wiring shall conform to appropriate articles of the National Electrical Code. Wiring within cabinets, junction boxes, etc., shall be neatly arranged and tagged/color coded per cable schedule.

(b) Powdered soap stone, talc, or other approved lubricant shall be used in placing conductors in conduit.

(c) A common neutral conductor, separate from the signal light circuit neutral, shall be used for all low voltage circuits, including the detectors and pedestrian push button circuits.

(d) Splicing of cable will not be permitted in conduit, outside of signal heads, standards, foundations or pull boxes. All splicing shall be done in the pole base, except for loop wires and where the main tie in at the signal cabinet pull box/cabinet corner.

(e) In no case shall any shellac compounds be used. Wire nut type connectors shall be used on all splices made above ground level. Detector loop lead in splices in underground systems shall be waterproofed with 3M splice kits or City approved equivalent. A minimum of 18 inches of slack shall be left at each splice except within hand holes where 24 inches shall be left.

(f) When conductors and cables are pulled into the conduit, all ends of conductors and cables shall be taped to exclude moisture and shall be so kept until the splices are made or terminal appliances attached. Ends of spare conductors shall be taped and marked.

(g) Cable shall be stranded.

(h) A small permanent tag on which the direction and phase is printed, in the order named, using the codes given in "Cable Schedule," shall be securely attached near the end of each conductor at each controller, standard, or pull box where conductors are separated. Where direction and phase are not clearly indicated by conductor insulation, additional tags shall be used.

Cable Schedule

Direction/Tag	Tape Color
NBLT	Red/Yellow
NB	Red
SBLT	Green/Yellow
SB	Green
EBLT	Orange/Yellow
EB	Orange
WBLT	Blue/Yellow
WB	Blue
Illuminated Street Signs	White
Pedestrian	Brown

Note: This is a typical cable schedule and shall be used for the wiring of all signal installations. A new cable schedule will be noted on the plans at each intersection where different phasing and/or special equipment is required. It should be noted that a band of yellow is used to indicate a left turn and brown for a pedestrian movement. This is in addition to directional tape for the phase. For cable size and number of conductors see traffic signal material specifications and/or standard drawings.

(i) Inboard and outboard heads, mounted on mastarms, are to be wired separately from head to base of pole or pull box.

(Res. 39-04, 4-21-04)

29.44.270 Underground facilities – Bonding and grounding.

(a) Metallic cable sheaths, conduit, metal poles, and foundations shall be made mechanically and electrically secure to form a continuous system and shall be effectively grounded. Bonding and grounding jumpers shall be copper wire, No. 8 AWG, for all systems.

(b) Bonding of standards shall be by means of a bonding wire attached to a bolt or a three-sixteenths inch or larger bolt installed in the lower portion of the shaft.

(c) At each pull box the ground electrode shall be a one piece copper ground rod of five-eighths inch diameter and eight feet in length, driven into the ground so that the top is two inches above the bottom of the pull box. The ground rod connector will be placed so that the bare copper wire, No. 8, can be pulled into a pole, foundation, or attached to the control cabinet ground buss.

(Res. 39-04, 4-21-04)

29.44.280 Underground facilities – Maintenance.

The contractor shall have full maintenance responsibility of the traffic signal from the date of the written notification by the City Transportation Engineer to the final inspection and date of written approval of the work performed. The contractor shall provide continuous maintenance and emergency service 24 hours each day during the time frame outlined above. The contractor shall provide and maintain a 24-hour-a-day continuous one number telephone answering service. All malfunctions of a controller and its accessory equipment shall be considered an emergency unless otherwise identified by the City. Equipment malfunctions and/or damage which, in the opinion of Grand Junction's Transportation Engineer or other authorized person, constitutes a serious hazard or inconvenience to the public shall be considered an emergency. Such malfunctions or damage may include, but not necessarily be limited to, situations where:

(a) All indications are out including bulbs and lenses, for any one traffic movement;

(b) Signal heads give conflicting indications to any intersection approach;

(c) A signal has been knocked down;

(d) An overhead red indication is out.

Contractor shall undertake each such emergency repair no later than one hour after Grand Junction notifies contractor of the emergency.

(Res. 39-04, 4-21-04)

29.44.290 Underground facilities – Field testing.

Prior to completion of the work, the contractor shall cause the following tests to be made on all traffic signals in the presence of the engineer or his designee.

(a) Each circuit shall be tested for continuity.

(b) Each circuit shall be tested for grounds.

(c) A functional test shall be made in which it is demonstrated that each and every part of the system functions as specified or intended herein. The functional test for each traffic signal system shall consist of not less than 14 days of continuous, satisfactory operation commencing with full operation of all electrical facilities. During the 14-day period, the contractor will maintain the system or systems. The cost of any maintenance necessary, except electrical energy and maintenance due to damage by public traffic, shall be borne by the contractor and will be considered as included in the price paid for the contract item involved, and no additional compensation will be allowed.

(Res. 39-04, 4-21-04)

29.44.300 Material specifications – Traffic signal indication unit specifications.

All signal indication units shall be of the individual section, adjustable type, gloss black polycarbonate or approved equivalent.

(a) Visors shall be detachable, 12-inch tunnel type, open at the bottom; be gloss black in color on the outside and flat black on the inside.

(b) Reflectors shall be a single piece of silvered glass or specular aluminum with an anodic coating. Reflectors shall conform to ITE standards.

(c) Lenses shall be in accordance with Institute of Traffic Engineers Specifications.

(d) Sockets shall be fixed focus.

(e) Doors on the signal heads for the installation of lamps and lens replacement or other maintenance shall not require use of any tool whatsoever to be opened. Doors and lenses shall be equipped with neoprene weatherproof gaskets to ensure against infiltration of moisture, road film, and dust. Each three color signal unit shall have the socket leads from all signal sections connected to a terminal board stamped with identifiable terminals. There shall be a terminal for color indication plus a common terminal where one lead from each socket shall terminate. The terminal board shall be mounted in the middle section and be properly insulated. All openings, top and bottom, shall be for one-half inch pipe or pipe mounting brackets. Gaskets shall be supplied for top and bottom openings.

(Res. 39-04, 4-21-04)

29.44.310 Material specifications – Pedestrian signal units.

Sixteen-inch, one way, ICC or equal pedestrian signal heads as specified on the plans. "Walk/Don't Walk" indications shall be symbolized and side by side. Visors shall be egg crate type and heads shall be gloss black. When countdown timers are required they shall be manufactured by Tassimco Technologies.

(Res. 39-04, 4-21-04)

29.44.320 Material specifications – Back plates.

(a) Where shown on the plans, black back plates shall be furnished and installed on signal faces. No background light shall show between the back plates and the signal face or between sections. All back plates are to be of aluminum or plastic construction and shall be the louvered type. Back plates shall provide a five-inch border for all 12-inch signal heads.

(b) Traffic signal heads requiring backboards shall be drilled for three-sixteenths-inch diameter by one-half-inch pan head bolt with nut and lock washer. If the manufacturer fails to supply as described, it will then be the contractor's responsibility to do so. When installing backboards on the traffic signal head, the contractor will furnish three-sixteenths-inch fender washers between bolt head and backboard.

(c) The manufacturer will fabricate all backboards with a three-sixteenths-inch washer on both sides of each rivet, which is used to hold each section of backboard together.

(Res. 39-04, 4-21-04)

29.44.330 Material specifications – Traffic signal lamps.

All signal indications, for both vehicle and pedestrian signals, shall be LED and meet the requirements of the applicable CDOT specifications.

(Res. 39-04, 4-21-04)

29.44.340 Electrical cable – Signal cable.

14 AWG multi-conductor, stranded, copper wire manufactured to meet IMSA 19-1 specifications or approved equivalent. Each conductor in the cable will be individually insulated and rated at 600 volts. The number of conductors per cable will be specified in quantities and blueprints for the project in question.

(Res. 39-04, 4-21-04)

29.44.350 Electrical cable – Traffic wire specifications.

20 Conductor (Under Ground to Each Corner)

Green	Main St. Green
Orange	Main St. Amber
Red	Main St. Red
White	Through Traffic Common
Orange with Red tracer	Main St. Amber Arrow
Green with White tracer	Main St. Green Arrow
White with Black tracer	Turn Arrow Common
Blue	Main St. Walk
Black	Main St. Don’t Walk
White with Red tracer	Pedestrian Common
Green with Black tracer	Side St. Green
Orange with Black tracer	Side St. Amber
Red with Black tracer	Side St. Red
Red with White tracer	Side St. Amber Arrow
Blue with Black tracer	Side St. Green Arrow
Blue with White tracer	Side St. Walk
Black with White tracer	Side St. Don’t Walk
Black with Red tracer	Side St. Red Arrow (exclusive)
Blue with Red tracer	Spare
Red with Green tracer	Main St. Red Arrow (exclusive)

7 Conductor (Through Traffic Vehicular Heads)

Green	Green
Orange	Amber
Red	Red
White	Common
White with Black tracer	Spare
Blue	Spare
Black	Spare

7 Conductor (5 Section Turn Arrow Vehicular Heads)

Green	Green
Orange	Amber
Red	Red
White	Through Traffic Common
Blue	Green Turn Arrow
Black	Amber Turn Arrow
White with Black tracer	Turn Arrow Common

All spare wiring in vehicular heads shall be kept at length, marked with black tape and coiled neatly in the amber lens housing.

7 Conductor (Pedestrian Heads)

Green	Main St. Walk
Red	Main St. Don’t Walk
White	Main St. Pedestrian Common
Orange	Side St. Walk
Black	Side St. Don’t Walk
White with Black tracer	Side St. Pedestrian Common

Loop Lead-In Wire: 18 Gauge 3 Pair Shielded

Black/White	Through Traffic
Black/Red	Turning Traffic
Black/Green	Spare

Directional Color Codes

Red	N/B
Orange	E/B
Green	S/B
Blue	W/B
Yellow	Left Turn
Brown	Pedestrian

Pedestrian Push Button Wiring (2 Pair 18 AWG)

Black and Red (Labeled Pair One (1))	Main Street
Black and Red (Labeled Pair Two (2))	Secondary Street

Illuminated Street Sign Wiring (12 AWG (UL) Type UF with Ground)

Black	AC Positive
White	AC Negative
Bare	Green (Ground)

(Res. 39-04, 4-21-04)

29.44.360 Electrical cable – Interconnect cable.

General single mode fiber optic cable shall conform to the following general cable specifications and in accordance with the city's signal communications plan:

(a) Fiber complies with EIA/TIA 455 and IEC 793 test methods for required attributes.

(b) The cable is loose tube with a dry block to prevent water from seeping into the cable (no gel fillings shall be permitted).

(c) All fiber optic cables intended to be installed in conduit are dielectric.

(d) A minimum length of 1.8m on each end of the cable is accessible for on-reel testing.

(e) Fiber has a D-LUX coating or approved equivalent to ensure color retention, minimize microbending losses and improve handling. The coating is mechanically strippable.

(Res. 39-04, 4-21-04)

29.44.370 Electrical cable – Loop wire.

Detect-A-Duct Cable consisting of single conductor No. 14 stranded THHN with an outer protective sleeve.

(Res. 39-04, 4-21-04)

29.44.380 Electrical cable – Pedestrian push button cable.

Push-button wire shall be two conductor quarter-inch diameter, shielded and jacketed cable. Conductors shall be AWG No. 18 stranded copper with polypropylene insulation.

(Res. 39-04, 4-21-04)

29.44.390 Electrical cable – Loop lead in cable.

Detector loop lead in cable shall be a six-conductor quarter-inch diameter, shielded and jacketed cable. Conductors shall be AWG No. 18 stranded copper with polypropylene insulation. The conductors shall be twisted at least six turns per foot. Color rotation shall be black and red, black and white, black and green. The interior of the cable shall be filled with an amorphous material that prevents water penetration. Aluminized polyester shielding shall be applied around the conductors to prevent electromagnetic interference. The cable jacket shall consist of black or gray high-density polyethylene. The jacket shall not be degraded by prolonged exposure to typical pavement runoff components. The cable shall be suitable for operation at temperatures of minus 60 degrees Celsius to plus 80 degrees Celsius.

(Res. 39-04, 4-21-04)

29.44.400 Electrical cable – Illuminated street name signs wire.

Shall be UL Type UF 12-2 with ground 600 volt sunlight resistant grade romex.

(Res. 39-04, 4-21-04)

29.44.410 Electrical cable – Ground.

Single conductor, AWG No. 8, soft drawn bare copper wire.

(Res. 39-04, 4-21-04)

29.44.420 Electrical cable – Optical detector lead in cable.

The lead in cable for the emergency vehicle optical detectors shall be 3M Type 138 or approved equal.

(Res. 39-04, 4-21-04)

29.44.430 Vehicle detectors – General.

(a) Detectors shall be 3-M Canoga or approved equivalent.

(b) This specification defines the minimum design operational and performance requirements for multiple channel, digital self-tuning inductive loop detectors. Detector units shall be card rack mounted plug-in type and operate from an external 24 VDC power supply. Detector units shall be in full compliance with the environmental and size requirements of NEMA standard TS1 Section 15 and meet the design, operation, electrical and functional performance requirements of both TS1 and TS2 specifications.

(c) The front panel shall include an erasable, write-on channel identification area and clearly indicated switch operating position. I.D. area one centimeter square per channel minimum.

(d) All component part and test points shall be clearly identified by permanent marking of circuit referenced on the P.C. board. Integrated circuit devices having 16 or more leads shall be socket mounted to facilitate repair and maintenance of units. Detectors supplied to this specification shall be warranted by the supplier to be free of defects in materials and workmanship for a period of five years from date of shipment from manufacturer.

(e) Each detector unit shall include two or four complete detector channels. Each channel shall sequentially energize its loop inputs to eliminate crosstalk (mutual coupling) between large, very closely spaced adjacent loops connected to the same unit. The sequential time sharing and digital processing of loop inductance data shall be accomplished on a single LSI microcircuit per unit for maximum reliability. The method of measuring shall be crystal reference digital period counting, multichannel scanning. Only one channel input per unit shall be active at any point in time.

    (1) Sequential scanning shall fully prevent crosstalk between channels of a detector connected to closely spaced or overlapped loops for directional detection.

    (2) Sequential scanning shall allow two detection channels to operate with full performance using a common home run cable.

    (3) Sequential scanning shall allow two or more detection channels to be connected to a single detection amplifier with full operating performance, including separate mode and sensitivity selection capability on each channel.

(f) Each channel of the sensor unit shall automatically self-tune to any loop and lead in inductance from 20 to 2,500 micro henries within two seconds with full sensitivity after application or interruption of supply voltage. Units shall also track changes in loop/lead in electrical characteristics, as might reasonably be expected to occur in undamaged loops, properly installed in sound pavements, without producing false indications or changes in sensitivity.

(g) Each detector unit shall be provided with a loop test switch position to verify loop system integrity and reduce maintenance costs. The “open loop test” position shall indicate a previous fault via the front panel indicator. The memory shall remain intact and can be queried repeatedly. Existing detections shall not be reset and the memory shall only be reset by power interruption as by removing and re-inserting the plug-in detector units.

(h) Each channel shall include a 16-position push-type wheel switch to allow selection of eight pulse sensitivities, seven presence levels and a "Reset" and an "Off" position. Each detector unit shall include eight sensitivity selections in 2:1 steps that can be correlated to the relationship of the number of turns of wire in a loop versus the sensitivity required to detect a specified vehicle. The selections shall be designed to allow detection of licensable vehicles in loops of two or more turns electrically in series, parallel or series/parallel configuration in nonreinforced or reinforced pavements with lead in/homerun combinations from 50 feet to 1,000 feet. The number of turns in a loop, electrical configuration of multiple loops and pavement type will dictate the sensitivity required for proper, predictable detection.

(i) If specified, channel presence time shall be modified if delay or extension time is selected. The timing switch shall select delay or extension or "Off," if no timing is desired. Internal DIP switches shall provide for selection of "Delay" time of zero to 31 seconds in one-second increments and "Extension" time of zero to seven and three-quarters seconds in quarter-second increments.

(j) Presence indicators shall be wide angle, high brightness type LEDs suitable for sunlight visibility. When timing is selected and a channel is active that channel's indicator shall flash at four Hz during delay and at 16 Hz during extension to indicate timing is in progress. Further, the timing shall be aborted when the vehicle is no longer present and/or the channel control input shall become inactive. The delay timer shall be reset when a vehicle leaves the loop prior to time out and shall abort when the control input becomes inactive. The extension timer shall operate and reset when a vehicle leaves the loop and be aborted when the control input becomes inactive. Each timer (delay and extension) shall be provided with buffer circuitry to enable or disable the timer based on an external input (green gate) signal. Circuit shall be designed for AC or DC input control on AC powered units and for DC control on DC powered units.

(k) Each detector unit shall utilize a ΔL = (Delta L) thresholding technique to provide a more constant, predictable vehicle detection sensitivity with series added inductance, i.e., many loops connected in series and/or long lead in/homeruns will generally require the same sensitivity setting as would be required for a single loop with short lead in, to simplify setup.

(l) Each channel shall automatically recover from intermittent opens or multiple shorts to ground. Each channel shall tolerate and continue to operate with no change with a single point short to ground on the loop or lead in system. Each channel shall provide a continuous, non resettable (fail safe) output and indication in response to an open loop/open lead in system. The open loop indication and output shall not be resettable as long as the open exists, except that they shall be defeated when the channel "Off" position is selected.

(m) Extended features shall include: two serial ports (front panel RS232 and Edge connector Xmit/Recve), TS1 and TS2 compatible from manual or software switch, micro loop occupancy detection, traffic counting capable to include long-loop presence count from 15 minute to infinite intervals all accessible from either serial interface, dual detect and fault LED indicators per channel, external inputs to control timing functions and enable remote reset, extended diagnostics, programming and live status available via serial interface utilizing Windows compatible software.

(Res. 39-04, 4-21-04)

29.44.440 Vehicle detectors – Vehicle video detection.

Shall be Iteris video detection equipment or approved equal.

(Res. 39-04, 4-21-04)

29.44.450 Vehicle detectors – Emergency vehicle detectors.

Optical communication detectors for emergency vehicle preemption shall be components of the 3M Opticom Priority Control System (Model 754 or as approved by the Engineer). All detectors shall be two-

direction, two-channel. Detectors, phase selectors, harnesses, rack mount, and cabling shall be the manufacturer's latest make and model. No splicing of the lead-in cable shall be allowed.

(Res. 39-04, 4-21-04)

29.44.460 Pedestrian push button detectors – General.

Push buttons shall be manufactured by Alinco Electric Sales or approved equal.

(a) Pedestrian push buttons shall be of the direct push button contact type. They shall operate on a voltage not to exceed 18 volts AC. They shall be of tamper proof design and equipped with a push button instruction sign as shown in the Standard Details.

(b) The assembly shall be weatherproof.

(c) The housing shall be shaped to fit the curvature of the pole to which it is attached to provide a rigid installation. Saddles shall be provided to make a neat fit when required. Pedestrian signs shall be installed as shown on the Standard Details.

(Res. 39-04, 4-21-04)

29.44.470 Illuminated street name signs – General.

Lighted street name signs shall be manufactured by NuArt or approved equal.

(a) Signs shall have a city logo on the left side.

(b) The background shall be blue.

(c) Lettering to be white uppercase and lowercase font.

(d) Photo cell mounts shall be on the bottom of illuminated street name sign frame.

(e) One-half-inch black wire loom shall be used to cover romex drip loop coming from sign into mastarm.

(Res. 39-04, 4-21-04)

29.44.480 Traffic signal poles, pedestals and mastarms.

Traffic signal poles, pedestals, and mastarms shall be of the general configuration shown on standard drawings. All traffic signal poles and mastarms shall be designed to meet the requirements outlined in the 1985 edition of "Standard Specifications for Structural Supports for Highway Signs, Luminaries, and Traffic Signals," published by AASHTO, for a wind velocity of 90 miles per hour. Poles shall be galvanized. Poles shall be manufactured by Valmont or approved equal.

(Res. 39-04, 4-21-04)

29.44.490 Controller cabinet – General.

(a) All controllers and auxiliary equipment shall be housed in a factory wired, weatherproof, metal cabinet following NEMA specification TS2 Type 1. The cabinet shall have minimum interior dimensions, exclusive of stiffeners, shelf brackets, etc., of height 46 inches, width 29 inches, and depth 15 inches.

(b) The cabinet shall be constructed of 0.125 minimum thickness bare aluminum. Cabinets shall be braced internally or by folded seams in order to provide sufficient rigidity to withstand normal handling and transport to the field location without deforming.

(c) The main door shall have a self-locking, keyed, tumbler lock with two keys. Hinges shall be mounted on the cabinet in such a way that interchange ability of doors is possible between cabinets of like size and manufacture. Hinge pins shall be stainless steel. Doors shall have neoprene gaskets

of sufficient thickness to provide a rain tight and dust tight seal. Secondary door (back door) shall have same design as the main door.

(d) The engineer will provide, during the construction period, an additional external lock for the controller cabinet to maintain security of the controller cabinet.

(e) A police or auxiliary door shall be provided. It shall be constructed so that no sharp edges protrude from the main door and shall provide access to a panel with labeled switches for automatic to flashing operation and signal power on/off.

(f) The cabinet shall be equipped with two thermostatically controlled, ball bearing fans with a capability of at least 100 cubic feet per minute. The fans shall be mounted in a weatherproof housing attached to the top of the cabinet. The thermostat shall be adjustable to turn on between 90 degrees Fahrenheit and 150 degrees Fahrenheit and be so mounted as to be easily accessible for adjustment from the front of the cabinet. An internally mounted incandescent lamp socket shall be provided with 150-watt capability and switched “on” only when the main door is open.

(g) The cabinet shall have two shelves each capable of supporting 75 pounds. Shelves shall be supported on brackets which provide for height adjustments. Each cabinet shall contain a 10-mil thick plastic envelope with side opening. It shall be a minimum size of 10 inches by 12 inches and be attached to the door by screws.

(h) Assembly Wiring. All cabinet wiring shall be neatly arranged and laced or enclosed in plastic tubing. No harness or wire shall be attached to any shelf rack or other point where movement of shelves or doors may damage it.

(i) Terminal Facilities. Terminal facilities (load bays) shall be firmly attached in a position not less than six inches from the bottom of the cabinet so as to provide easy access and maximum convenience to the user.

(j) Side mounted auxiliary panels should be firmly installed with the forward edge not more than four inches from the door sill and not less than six inches from the bottom of the cabinet in all cabinets.

(k) The load bay and its associated equipment, harness, switches, etc., shall be grouped on removable panels. Each panel or group of receptacles and connecting cables shall be arranged to permit so that work can be performed on panel backs or cables.

(l) A load switch bay and flash transfer capability is required for each phase. Load switches shall be provided for all the phases in the cabinet.

(m) The load bay shall be protected by a main circuit breaker. A gas tube surge arrestor with MOV and a suitable radio interference filter shall be supplied. The arrestor shall be a three-electrode type with the following ratings:

(1) Impulse breakdown: less than 1,000 volts in less than 0.1 microseconds at 10 kV per microsecond.

(2) Standby current: less than one milliamp ere.

(3) Striking voltage: greater than 212 VDC.

(4) Energy capability: capable of withstanding pulses of peak current each of which will rise in eight microseconds and fall in 20 microseconds to one-half the peak voltage at three-minute intervals.

(5) Peak current ratings shall be 20,000 amps. The MOV shall have ratings equal to or better than a General Electric type VI50LA20A. The RFI filter shall have a current rating equal to or greater than the main circuit breaker capacity.

(n) Field terminals shall be screw types, capable of accommodating at least three number 12AWG wires. Engraving, silk screening or contrasting plastic labels shall permanently identify all terminals

in the load bay. Terminal blocks shall be the barrier type and no live parts shall extend above the barrier.

(o) A convenience construction grade duplex, fused at 15 amps shall be provided. It should be located in a position which is convenient and safe for service personnel.

(p) All AC power busses, switch or relay lugs and/or similar activity connection points which extend more than one and one-half inches from the panel are to be protected by insulation for safety. The locations of these items shall provide reasonable protection for service personnel.

(q) Signal power relays shall be mercury wetted, equal to or greater than circuit breaker capacity. Flash transfer relays shall be as manufactured by Midtex Model 136-62 T 3A1, 120 VAC, DPDT, 30 amp with Jones Plug base and dust cover or approved equal.

(r) Flasher. The cabinet shall be equipped for flashing operation of signal lights with a two-circuit solid state flasher in accordance with the latest NEMA specifications (15 amps per circuit). Flashing operation shall be set for flashing yellow on all main street approaches and red on all other approaches. Pedestrian and turn signals shall be extinguished during flashing operation. The flashing mechanism shall remain in operation during shutdown or removal of controller.

(s) Load Switches. The cabinet shall be equipped with solid state load switching assemblies in accordance with the latest NEMA specification. Each load switch to be equipped with a three input LED indicator. Load switches shall contain three separate cube type solid state relays, which use a solid state switch which is capable of operations at 240 VAC and 25 amps when properly heat-shrinked but derated to 10 amps when used in load pack assembly.

(t) Conflict Monitor. The cabinet shall have provision for conflict prevention in accordance with the latest NEMA TS2 specification. A conflicting display monitor unit that monitors all green, yellow and walk displays and detects absence of reds to cause flashing operation and stop timing if conflicting indications are detected shall provide conflict prevention. Removal of the monitor from the cabinet shall cause flashing operation. Conflict monitors shall be as manufactured by Eberly Designs, 12 LEP or approved equal.

(u) Emergency Vehicle Preemption. The cabinet shall be equipped and wired with an Opticom Card rack mount for 3M Model 754 or approved equal. Detectors, phase selectors, harnesses, rack mount, and cabling shall be the manufacturer's latest make and model.

(Res. 39-04, 4-21-04)

29.44.500 Actuated controllers – General.

(a) Compatibility. The local controller and cabinet shall be 100 percent compatible with the City of Grand Junction's existing computerized signal system which utilizes Econolite equipment, or necessary modifications of the software and hardware shall be included to make both systems fully compatible.

(b) An actuated controller shall be completely solid state, electronic device capable of selecting and timing traffic movements. It shall provide timing and load switch control of each major vehicular phase, including concurrent associated pedestrian movements. The controller shall conform to the latest NEMA specifications and shall provide for complete and full operation of eight phases from within either a TS1 or TS2 type 1 cabinet.

(c) The controller shall have all electronic components easily accessible and arranged in functional groupings on the printed circuit boards. Printed circuit boards shall be designed to facilitate identification of components for maintenance purposes. Printed circuit design shall be of NEMA specification quality and designed so that the components may be removed and replaced without permanent damage to the board or track.

(d) Timing shall be adjustable on the controller face by keyboard programming. A security code or other means shall be provided to prevent unauthorized or accidental entry.

(e) Timing shall be readable from a display that is sufficient to make certain that all register positions can be easily and definitely recalled. Every keyboard controller shall have an easily followed legend silk screened on the face of the controller or on a metal or plastic card or placard which is securely attached by screws or rivets.

(f) All circuitry components shall be available on the open market and the original manufacturer's part number shall be shown on the parts list.

(g) Overlap programming shall be provided by NEMA standard overlap board and/or keyboard.

(h) An entry mode to any single phase parameter of a keyboard controller shall not affect any other parameter or the same parameter on another phase, unless programmed by specific keyboard instructions, such as "copy" sequences or other prescribed methods of rapid program entry.

(i) Every controller supplied shall be the manufacturer's latest, first line production model tested and delivered by a domestic manufacturer who is regularly engaged in the construction of such equipment.

(j) Each controller shall be supplied with a complete set of operational and service manuals, wiring schematics and parts layout up to a maximum of 10 sets per order. Any controller for which these documents are not available is not a production model within the meaning of these specifications.

(k) Each controller shall have a removable data module.

(l) Preemption. All actuated controllers shall be equipped to accommodate four E.V.P. inputs and one railroad preemption input.

(Res. 39-04, 4-21-04)

29.44.510 Actuated controllers – Coordination unit.

(a) The coordination unit shall be an internal function within each local controller and shall meet, as a minimum, the following functional requirements.

(b) The coordinator shall provide for at least four cycle lengths adjustable from 30 to 255 seconds, three offsets adjustable from zero to 99 percent with offset correction by dwelling in coordinated phase or smooth transition, and four splits per cycle.

(c) Standard NEMA functions shall be used to control the intersection timing.

(d) The coordinator shall be capable of changing the controller's phase sequence upon command and telemetry failure.

(e) The coordinator shall be capable of setting the intersection free by loss of system sync, cycle/offset false commands, free command and telemetry failure.

(f) The coordinator shall be capable of setting the intersection into a flashing operation in accordance with the Manual on Uniform Traffic Control Devices, latest edition.

(g) The coordinator shall be capable to operate with telemetry module without additional hardware or software.

(h) Time base coordination mode shall be provided as a backup with all standard coordination features available. At least two seven-day programs shall be available with 50 additional holiday programs in the event of a master controller or communications failure. Time base standby mode shall be programmable for an entire year with automatic daylight savings and leap year changes.

(Res. 39-04, 4-21-04)

29.44.520 System telemetry.

(a) Telemetry equipment shall be an internal plug-in module to a local controller with easy access for removal. Master controller or stand alone chassis may contain standard plug-in module. Each

telemetry unit shall be capable of transmitting data to and from local controller, local detectors and system detectors (eight per intersection). A provision shall be made to reject invalid messages. The system command shall be transferred each second to maintain time sync.

(b) The telemetry equipment shall be designed so that all communications among intersections in one system can be accomplished over no more than two pairs of hard wire interconnect or leased phone lines. Dedicated pairs from the master to each local intersection are not permitted.

(Res. 39-04, 4-21-04)

29.44.530 On-street master – General.

(a) Cabinet Assembly. The master controller shall be wired into a cabinet assembly that also includes a local intersection equipment configuration. The cabinet shall be wired complete with master connecting cables in accordance with applicable portions of the local controller cabinet specifications. The incoming power service and interconnect terminals shall be adequately equipped with surge arrestors to protect against high-energy transients.

(b) Incoming Sensor Data. The master shall have the ability to receive output data from at least eight sensors from each local intersection. It shall be possible to assign at least 32 of the incoming sensors to internal computational channels for pattern selection analysis.

(c) Traffic Pattern Selection. The program in effect shall be selected on a priority basis with the following priority arrangements:

(1) Manual entry from keyboard;

(2) External command from a master;

(3) Time of day/day of week schedule;

(4) Traffic responsive based on sampling sensor analysis.

(d) The master shall select one of six different cycle lengths or “free” operation based on inbound or outbound volume levels. It shall be possible to program segments in the volume range levels to change to the next higher or lower cycle lengths.

(e) The master shall be able to select any of five different offset plans per cycle. Offset plans shall be chosen based on the differential between inbound and outbound volume levels. The five offset plans shall be designated as follows:

(1) Heavy inbound;

(2) Inbound;

(3) Average;

(4) Outbound;

(5) Heavy outbound.

(f) When balanced flow occurs, the master shall select the average offset plan. When the volume in one direction exceeds the volume in the other direction by the programmed amount, a standard preferential offset shall be implemented. If the volume differential exceeds a second (higher) programmed amount, a heavy preferential offset must be implemented. It shall also be possible to reserve the heavy preferential offset plans for special pattern implementation only. Programmable settings must be provided for both entering and leaving each offset.

(g) Split plan selection shall be identical to offset plan selection except that arterial traffic volume levels must be compared to side street volume levels. Three different split plans shall be provided:

(1) Heavy arterial;

(2) Average;

(3) Heavy side street.

(h) The master shall call for the average split plan during normal conditions. If the arterial volume exceeds the side street volume by the programmed amount, the heavy arterial split shall be selected. In the same manner, if side street volume exceeds arterial volume by a programmed amount, the heavy side street split shall be called.

(i) Crossing Artery Synchronization. The master controller shall have capability to coordinate with a separate master controller of the crossing artery through the common intersection for both systems.

(j) System Diagnostics. Diagnostic tests shall be performed on system detectors, telemetry communications and intersection operation.

(k) Sampling sensors shall be monitored for absence of calls or constant calls. If a sensor fails, it shall be automatically disconnected from the calculations for traffic responsive plan selection. If normal sensor operation resumes, the sensor shall be automatically reinstated.

(l) Telemetry communications diagnostics shall monitor readbacks for no response condition including local telemetry and telemetry channels.

(m) Intersection diagnostics shall be available to display intersection status condition. All fault conditions shall be reported and logged.

(n) Count Storage. The master shall have the ability to tabulate and store 15-minute count data from up to 32 different sensors. The data shall be available for automatic transfer to the central office facility upon request.

(o) The selection of the sensors to be counted in any 24-hour period shall be completely programmable from the central office computer.

(p) Miscellaneous Data Storage. The master shall store all of the following data:

(1) The time of day and location of all sampling sensor failures. If normal operation resumes, this time shall also be recorded.

(2) The time of day, location and mode of all local intersection failures. The time that normal operation resumes must also be recorded.

(3) The time and mode of all pattern changes. Changes due to external override must be distinguished from normal pattern changes.

(4) The average volume or occupancy level for each 15-minute period for all computational channels.

(q) It shall be possible to transmit any of the data listed above to the central office computer automatically or upon demand.

(r) Downloading Local Coordination Settings. It shall be possible to download any local intersection coordination setting (offset, force off or permissive period) from the master via the unit's keyboard.

(s) Display. During normal operation, the timing pattern in effect shall be displayed on the front panel, including the cycle, offset plan and split plans selected. Also, the unit shall indicate how the timing plan was selected through normal volume calculations, by an occupancy channel or by manual or central computer override. The master shall also indicate when the time of day mode is in effect and show whether this mode was selected manually or because of sensor failures.

(t) External Override. The master controller shall have appropriate inputs to externally select any timing pattern and override the pattern selected through traffic analysis.

(u) Telemetry. The master shall include a telemetry module for two-way communications between the master and local controllers. The equipment shall be compatible with the telemetry equipment specified for the local controllers.

(Res. 39-04, 4-21-04)

29.44.540 Traffic signing and pavement markings.

(a) General. The installation of all traffic control devices shall conform to the Manual on Uniform Traffic Control Devices and the Colorado Standard Specifications for Road and Bridge Construction, latest edition.

(b) Traffic Control Devices on Public Property. The developer, at his own expense, will generally install all permanently fixed traffic signs. The developer must submit a signage plan for approval by the City Transportation Engineer. Traffic signs shall be placed to conform to the drawing details.

(c) Traffic Control Devices on Private Property.

(1) Responsibility. All traffic control devices on private property, i.e., pavement markings, regulatory signs, fire lane signs, and handicapped parking signs shall be installed and maintained by the property owner.

(2) Placement. A signage and striping plan specifying the various types and combinations of traffic control devices shall be submitted to the City Transportation Engineer for approval.

(d) Pavement Markings. The contractor shall submit a plan for all pavement markings to the City Transportation Engineer for approval prior to the beginning of the work. The pavement marking plan shall meet the requirements for such work as outlined in the Manual on Uniform Traffic Control Devices. The City Transportation Engineer must approve all pavement marking materials.

(Res. 39-04, 4-21-04)

29.44.550 Traffic control in construction areas – General.

For any construction done on, in or to an existing City roadway and/or right-of-way or for the construction of a new City roadway, appropriate traffic control during construction shall be provided. For any such construction, a construction traffic control plan shall be prepared by the contractor and/or project engineer and shall be approved by the City Transportation Engineer prior to issuance of a street cut permit or public improvement construction permit.

Where a roadway does not currently exist, it is presumed that there is no motorist expectation of a travel route. Therefore, a construction traffic control plan for construction of a new roadway should strive to do two things: alert the motorist that this is a construction area, and alert the motorist that the road is not open to traffic. Construction traffic control plans shall also be prepared for construction occurring on existing City roadways where the motorist has an expectation of accessibility and shall be warned, advised, guided or regulated through any construction activity.

(Res. 39-04, 4-21-04)

29.44.560 Traffic control in construction areas – Time of submittal.

A construction traffic control plan shall be submitted to the City Transportation Engineer at the earliest with the submittal of final construction plans and at the latest with the application for a right-of-way or public improvement construction permit(s). All final construction plans submitted to the City of Grand Junction that entail construction on an existing City roadway or construction of a new City roadway must either:

(a) Be accompanied by a construction traffic control plan.

(b) Include a note stating a construction traffic control plan shall be submitted to the City of Grand Junction for approval before any permit for construction is issued. No right-of-way or public

improvement construction permit shall be issued without the approved construction traffic control plan.

(Res. 39-04, 4-21-04)

29.44.570 Traffic control in construction areas – Scope of construction traffic control plan.

For construction of new roadways, traffic control during construction should strive to keep the motorist from entering the facility. The primary means to accomplish this are by use of temporary barricades located in advance of the point where new construction joins old and appropriate signing. New roadways shall not be opened to general traffic, nor the construction traffic controls removed, without the approval of the Engineering Construction Inspector and the City Transportation Engineer. One precondition of such an opening is that permanent signage and striping be in place.

(Res. 39-04, 4-21-04)

29.44.580 Traffic control in construction areas – Elements of construction traffic control plan.

(a) All construction traffic control plans shall contain the following information:

(1) Name of contracting firm and, if different, the name of the firm responsible for traffic control devices.

(2) Name and phone number(s) of 24-hour contact person responsible for traffic control devices.

(3) Description of location of activity (roadway names, north arrow, etc.)

(b) Projects identified as minor construction traffic control plans as determined by the City Traffic Engineer shall include, in addition to items listed in subsection (a) of this section, either one of the following:

(1) A neat sketch of the roadways and the proposed traffic control devices; or

(2) A copy of a typical drawing of traffic device layout from an accepted source approved by the City's Transportation Engineer.

(c) Projects identified as major construction traffic control plans as determined by the City Transportation Engineer shall include, in addition to items in subsection (a) of this section, the following: The proposed traffic control devices specifically identified as to type and explicitly noted and dimensioned on as-builts, construction plan drawings or other detailed drawings.

(Res. 39-04, 4-21-04)

29.44.590 Traffic control in construction areas – Basis for construction traffic control plan.

The Manual on Uniform Traffic Control Devices shall be the basis upon which the traffic control plan is designed in concert with proper, prudent and safe engineering practice. All necessary signing, striping, coning, barricading, flagging, etc., shall be shown on the plan. Other acceptable documents may be consulted or referenced, such as Traffic Control in Construction and Maintenance Work Zone (FHWA) and Flagging and Traffic Control Supervisor's Training Manual (CDOT).

(Res. 39-04, 4-21-04)

29.44.600 Traffic control in construction areas – Restriction, regulations and opportunities.

In concept, City streets shall not be closed overnight and work shall not force road or lane closures before 8:30 a.m. or after 3:30 p.m. If exceptions to this are required, this shall be noted on the construction traffic control plan and shall be approved by the City Transportation Engineer. Travel-way width may be restricted. Minimum travel lane width in construction areas shall be 10 feet, but proper controls, including flagging, shall be indicated. Prohibition of on-street parking should be considered and noted where applicable.

All traffic control devices necessary to provide for public safety at the work site shall be furnished and maintained by the contractor at his own expense. If the contractor does not provide the approved traffic control devices, the City Transportation Engineer may install such devices, and the entire costs of such devices shall be borne by contractor. If the City is required to install the required traffic control devices due to negligence by the contractor, a minimum administrative charge of $300.00 will be assessed to the contractor.

(Res. 39-04, 4-21-04)

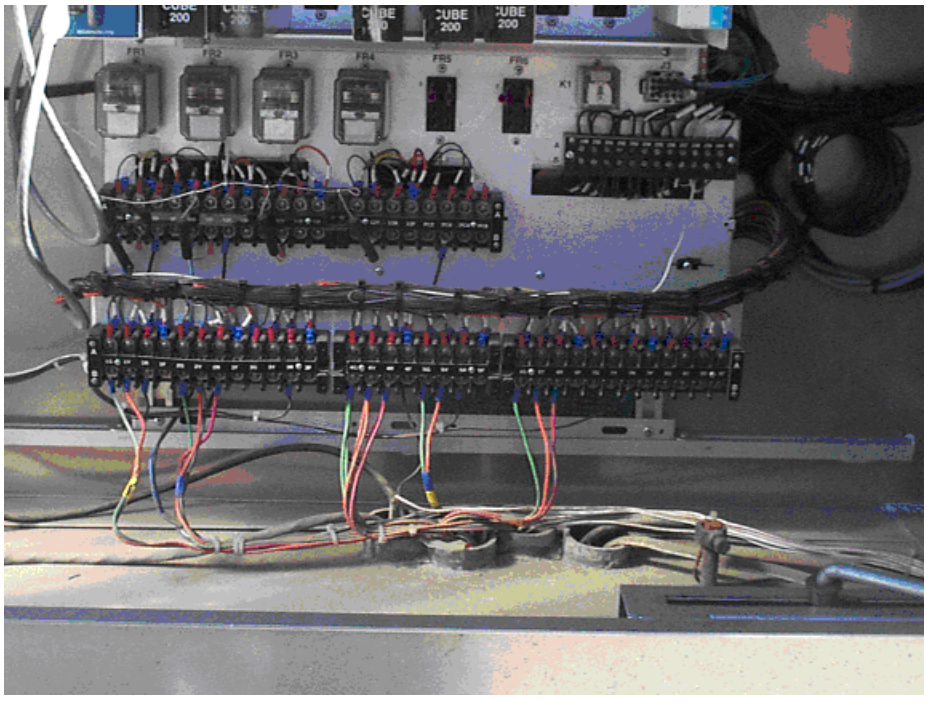
29.44.610 Traffic control in construction areas – Approval.

Staff of the City's Transportation Engineering Division should approve (sign and date) all construction traffic control plans. In general, this responsibility rests with the Engineering Division Inspection Section. However, it is likely that most major plans will be referred to the Traffic Section for consideration. All complete road closures and all partial road closures (removing one or more travel lanes) that are proposed for overnight shall be approved by the City Transportation Engineer. One copy of the approved plan shall remain with the Inspection Section for their verification that the traffic control plan has been adhered to in the field. One copy shall be placed in the engineering project file. The contractor shall have one approved copy of the traffic control plan on-site at all times.

(Res. 39-04, 4-21-04)

29.44.620 Traffic control in construction areas – Modifications.

Actual conditions in the field may necessitate modifications to the construction traffic control plan. Provided that the general intent of the original plan is satisfied, these modifications may occur without revision to the plan. The Engineering Construction Inspector shall be notified of any substantial changes and may refer these to the Transportation Engineering Division as needed for construction.



Cabinet wiring shall be neatly arranged and laced as shown above.

(Res. 39-04, 4-21-04)

Chapter 29.48

TRANSIT, BICYCLE AND PEDESTRIAN FACILITIES

Sections:
29.48.010 Planning and implementation.
29.48.020 Transit facilities.
29.48.030 Planning and design standards for bicycles.
29.48.040 Facility type.
29.48.050 Pedestrian facilities.

29.48.010 Planning and implementation.

Transit, bicycle, and pedestrian facilities are an integral part of the transportation system.

This chapter establishes how to plan and implement these facilities. Transit, bicycle and pedestrian accommodations shall be addressed in transportation impact studies as discussed in Chapter 29.08 GJMC.

(Res. 39-04 (§ 11.0), 4-21-04)

29.48.020 Transit facilities.

All transit facilities shall conform to the Transit Design Standards and Guidelines for all Development in Mesa County. As part of the development review process, all new development shall accommodate transit in the overall development process.

(Res. 39-04 (§ 11.1), 4-21-04)

29.48.030 Planning and design standards for bicycles.

The AASHTO publishes The Guide for the Development of Bicycle Facilities, 1999, to address planning and implementation of bike facilities. Additionally, the American Planning Association publishes a guide entitled “Bicycle Facility Planning” to guide the planning process.

The Grand Junction area has adopted a Grand Junction Circulation Plan. The plan shows existing and future paths, off-road routes and on-street routes. All development shall comply with the plan.

(Res. 39-04 (§ 11.2), 4-21-04)

29.48.040 Facility type.

(a) AASHTO has developed three major classes of facilities that are used by bicyclists. They are:

  (1) A *shared use path* which is a separate multi-use bike trail that has an alignment separate from automobile traffic that is typically 12 feet wide or more.

  (2) A *bike lane* facility which is a striped bike lane on a street. The lane is typically four feet wide.

  (3) A *signed shared roadway* facility which is an on-street bike route that is designated by signage alone.

(b) The design standards for these different facilities are contained in the AASHTO manual; however, the list below is a list of the minimum bicycle facility design standards to be provided:

  (1) Uniformity in facility design, signage and pavement markings for bicyclist and motorist safety.

  (2) Bicycle lanes as one-way in same direction of travel as vehicles, and marked as such. For shared use paths, refer to AASHTO for the proper buffering.

(3) Six feet or greater shoulder width on rural roads. Minimum widths are four feet on an open shoulder and five feet against a curb or guardrail.

(4) Cross railroad tracks perpendicular to direction of bike travel with appropriate treatment to ensure smooth and safe crossings.

(5) On-street bicycle facilities shall provide curb inlet grates.

(6) Avoid diagonal on-street parking.

(7) Implement bike sensitive traffic detector loops where possible.

(Res. 39-04 (§ 11.2.1), 4-21-04)

29.48.050 Pedestrian facilities.

(a) Pedestrian facilities are required as a part of the street cross-section, as detailed in the City Standard Details. Detached paths that are constructed must conform to these details as well.

(b) Environmental factors that contribute to the walking experience and therefore to the perceived level of service include:

(1) Comfort factors that include weather protection, climate control, transit shelters and other pedestrian amenities.

(2) Convenience factors such as walking distances, pathway directness, grades, sidewalk ramps, directional signing, directory maps and other features that make pedestrian travel easy and uncomplicated.

(3) Safety that is provided by separation of pedestrians from vehicular traffic, or traffic control devices that can provide for time separation of pedestrian and vehicular traffic.

(4) Security features include lighting, open lines of sight, and the degree and type of street activity.

(5) Economy aspects related to user costs associated with travel delays and inconvenience, and to the rental value and retail development as influenced by the pedestrian environment.

(c) The quality of the pedestrian environment should be evaluated in three broad areas:

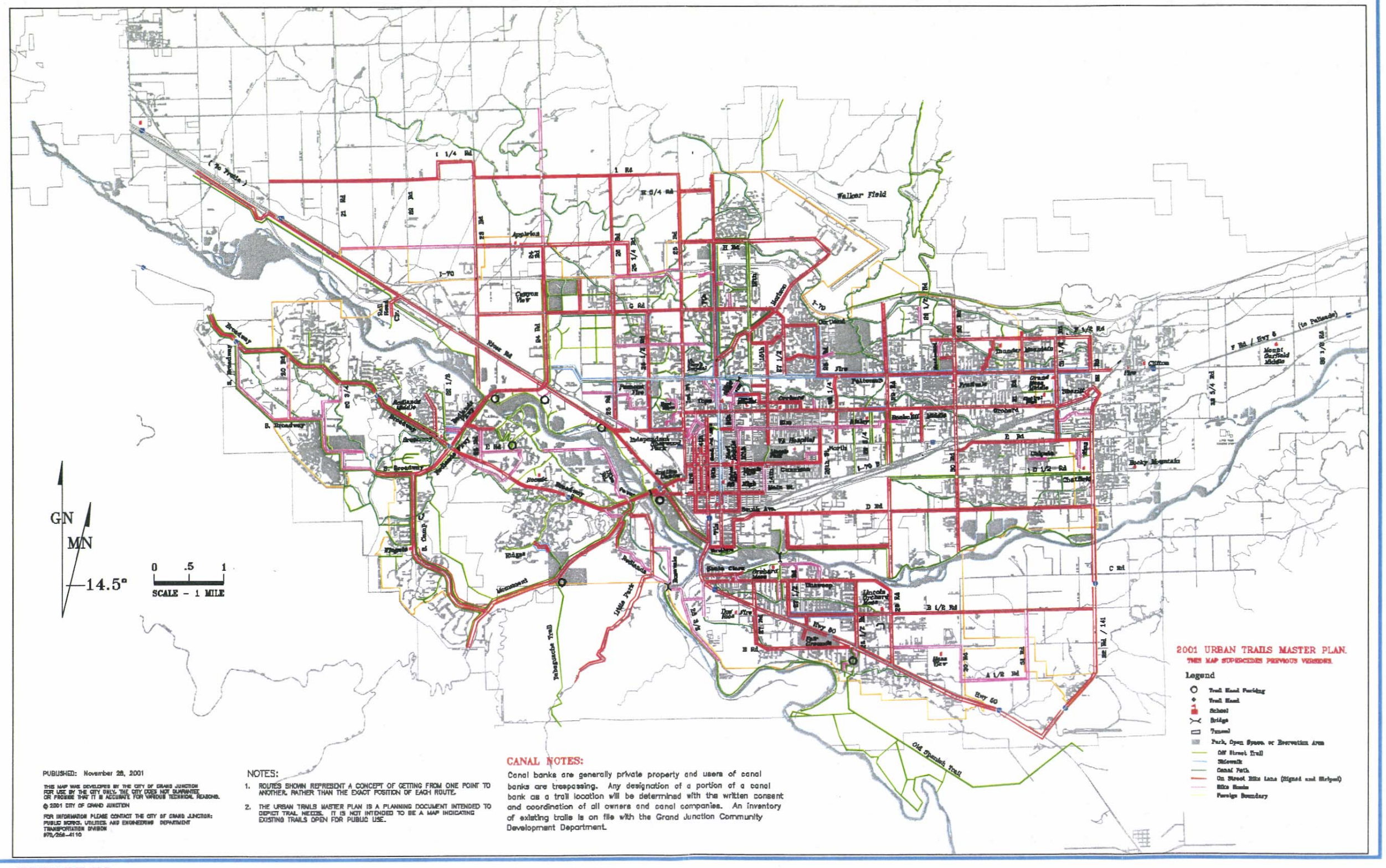
(1) Walking along the street – includes continuity, capacity and comfort.

(2) Crossing the street – includes safety, sufficient space, delay, and route deviation.

(3) Some place to walk to – in terms of travel time on foot, destinations, and how much of an area can be reached within a reasonable time or distance.

(Res. 39-04 (§ 11.3), 4-21-04)

THE 2001 URBAN TRAILS MASTER PLAN



PUBLISHED: November 28, 2001

THIS MAP WAS DEVELOPED BY THE CITY OF GRAND JUNCTION FOR USE BY THE CITY ONLY. THE CITY DOES NOT GUARANTEE OR PROMISE THAT IT IS ACCURATE FOR VARIOUS TECHNICAL REASONS.

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FOR INFORMATION PLEASE CONTACT THE CITY OF GRAND JUNCTION:
PUBLIC WORKS, UTILITIES AND ENGINEERING DEPARTMENT
TRANSPORTATION DIVISION
970/256-4110

NOTES:

1. ROUTES SHOWN REPRESENT A CONCEPT OF GETTING FROM ONE POINT TO ANOTHER, RATHER THAN THE EXACT POSITION OF EACH ROUTE.
2. THE URBAN TRAILS MASTER PLAN IS A PLANNING DOCUMENT INTENDED TO DEPICT TRAIL NEEDS. IT IS NOT INTENDED TO BE A MAP INDICATING EXISTING TRAILS OPEN FOR PUBLIC USE.

CANAL NOTES:

Canal banks are generally private property and users of canal banks are trespassing. Any designation of a portion of a canal bank as a trail location will be determined with the written consent and coordination of all owners and canal companies. An inventory of existing trails is on file with the Grand Junction Community Development Department.

Chapter 29.52

TRANSIT DESIGN STANDARDS AND GUIDELINES

Sections:

29.52.010 Objectives and transit service area.
29.52.020 Transit stop location and type.
29.52.030 Transit stop design.
29.52.040 Bus stop siting and review policy.

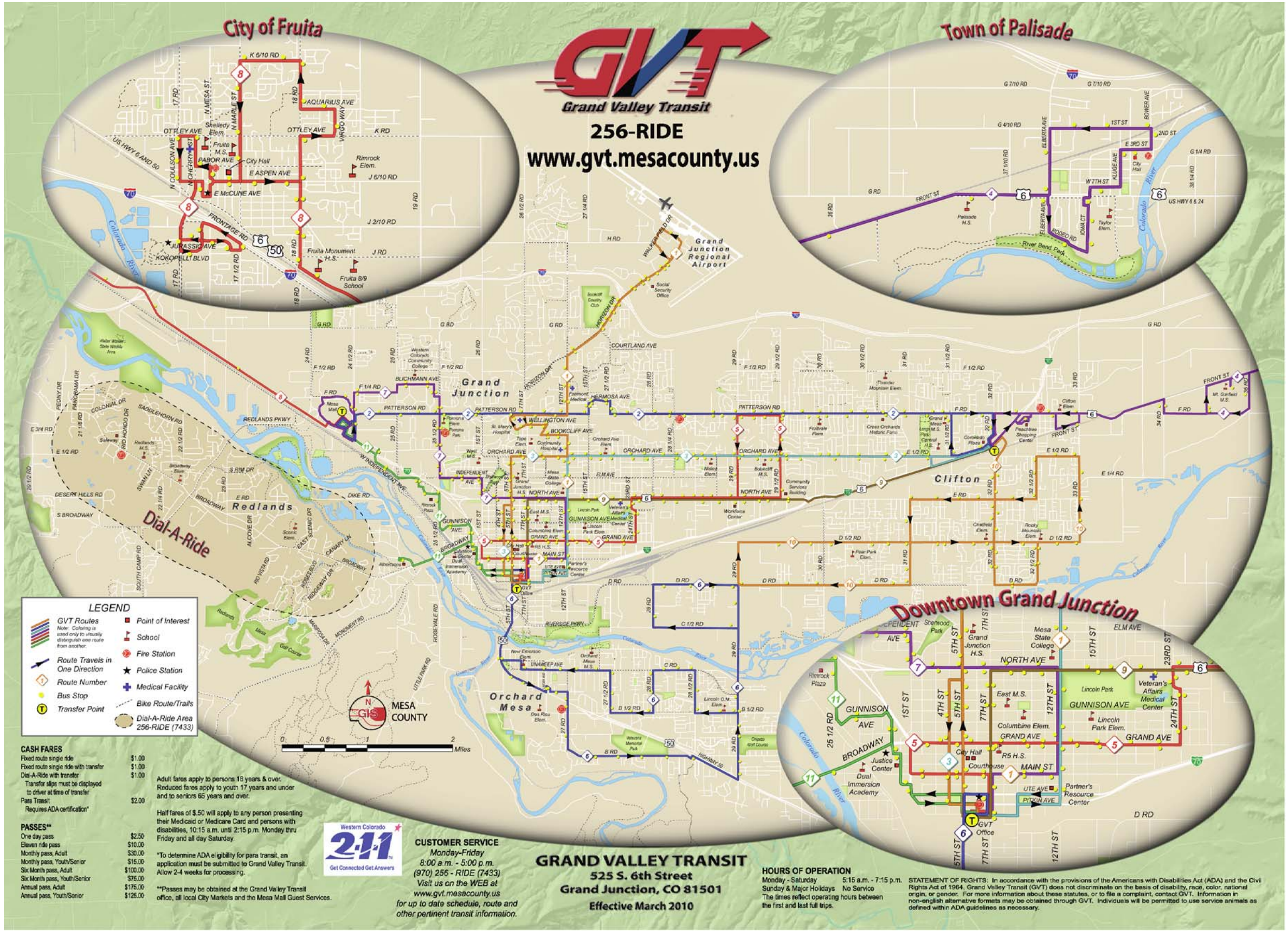
29.52.010 Objectives and transit service area.

These guidelines describe the recommended methodology for the location and design of transit stops and other transit facilities within the Grand Valley Transit service area. A number of specific elements are included – guides to the location and design of stops, proper placement of amenities at stops, and general guidelines for other transit facilities.

Although the process of location and designing bus stops would appear fairly simple to the casual observer, creating a design with optimal transit facilities requires the consideration of many factors. The ideal arrangement of bus stops from the transit user's point of view includes frequent stops in the travel lane of the roadway and sidewalk or trail connections to the user's destination. However, from the perspective of the other users of the roadway, the ideal arrangement for bus stops is infrequent stops placed in turnouts out of the travel lane. These guidelines seek a balance of the needs of all roadway users.

Improved pedestrian systems connected to transit stops will make using the transit system safer and more enjoyable. Appropriately located turnouts will enhance user safety while minimizing delay to traffic. As barriers to transit use are removed, the system will become easier for all residents to use.

(Res. 39-04, 4-21-04)


City of Fruita
Town of Palisade
Grand Valley Transit
256-RIDE
www.gvt.mesacounty.us
Grand Junction
Grand Junction Regional Airport
Redlands
Dial-A-Ride
Orchard Mesa
Clifton
Downtown Grand Junction
LEGEND
GVT Routes
Note: Coloring is used only to visually distinguish one route from another.
Route Travels in One Direction
Route Number
Bus Stop
Transfer Point
Point of Interest
School
Fire Station
Police Station
Medical Facility
Bike Route/Trails
Dial-A-Ride Area 256-RIDE (7433)
MESA COUNTY
0 0.5 1 2 Miles
CASH FARES
Fixed route single ride $1.00
Fixed route single ride with transfer $1.00
Dial-A-Ride with transfer $1.00
Transfer slips must be displayed to driver at time of transfer
Para Transit: $2.00
Requires ADA certification*
PASSES**
One day pass $2.50
Eleven ride pass $10.00
Monthly pass, Adult $30.00
Monthly pass, Youth/Senior $15.00
Six Month pass, Adult $100.00
Six Month pass, Youth/Senior $75.00
Annual pass, Adult $175.00
Annual pass, Youth/Senior $125.00
Adult fares apply to persons 18 years & over. Reduced fares apply to youth 17 years and under and to seniors 65 years and over.
Half fares of $.50 will apply to any person presenting their Medicaid or Medicare Card and persons with disabilities, 10:15 a.m. until 2:15 p.m. Monday thru Friday and all day Saturday.
*To determine ADA eligibility for para transit, an application must be submitted to Grand Valley Transit. Allow 2-4 weeks for processing.
**Passes may be obtained at the Grand Valley Transit office, all local City Markets and the Mesa Mall Guest Services.
Western Colorado 2-1-1 Get Connected Get Answers
CUSTOMER SERVICE
Monday-Friday
8:00 a.m. - 5:00 p.m.
(970) 256 - RIDE (7433)
Visit us on the WEB at www.gvt.mesacounty.us for up to date schedule, route and other pertinent transit information.
GRAND VALLEY TRANSIT
525 S. 6th Street
Grand Junction, CO 81501
Effective March 2010
HOURS OF OPERATION
Monday - Saturday 5:15 a.m. - 7:15 p.m.
Sunday & Major Holidays No Service
The times reflect operating hours between the first and last full trips.
STATEMENT OF RIGHTS: In accordance with the provisions of the Americans with Disabilities Act (ADA) and the Civil Rights Act of 1964, Grand Valley Transit (GVT) does not discriminate on the basis of disability, race, color, national origin, or gender. For more information about these statutes, or to file a complaint, contact GVT. Information in non-english alternative formats may be obtained through GVT. Individuals will be permitted to use service animals as defined within ADA guidelines as necessary.

29-131

29.52.020 Transit stop location and type.

Decisions regarding bus stop frequency, location and length call for careful analysis of passenger service requirements, the type of service provided and the interaction of stopped buses with general traffic flow. Achieving a balance of convenience to both the transit passenger and the auto user is a prime objective.

(a) Stop Spacing and Location. The proper location of a transit stop requires a site investigation of the stop(s) under consideration; no standard type of stop can be recommended for all locations. An inventory of land uses within a quarter-mile corridor of the road under consideration should be developed, noting uses that serve as major trip producers and attractions. The bus stop location flow chart outlines the sequence of decisions for locating a transit stop. The administrative regulation details the process for requesting changes to stops.

(b) Stops at Major Generators. Stops should be located within a short walk from schools, major retail malls, office buildings and multi-unit apartments. These stops provide access to the transit system for uses that generally produce numerous transit riders. Bus stops should be located to balance good rider access with pedestrian safety. Stop locations should minimize the potential for jaywalking while minimizing rider walking distance and avoiding unnecessary crosswalk movements.

(c) Stops at Signalized Intersections. Stops at the far-side of signalized intersections can operate conveniently for both auto and transit users. Buses can use the gaps in the traffic stream created by the signal to pick up and discharge passengers and to reenter traffic.

(d) Intermediate Stops. Transit industry standards suggest that most riders will not want to walk more than one-quarter mile to a bus stop. Stops for areas of low to moderate passenger demand should be preliminarily established by applying the one-quarter mile criteria. Bus stop spacing should be related to ridership density; stops should be closer together in the major commercial districts and farther apart in the outlying areas. Ideally, stops should be as far apart as possible without adversely affecting passenger convenience. Recommended ranges for bus stop spacing are as follows:

Major Commercial Areas	500 – 800 feet
Urban	700 – 1,000 feet
Suburban	1,000 – 1,500 feet

In suburban areas, consideration should be given to how far a person must walk to get to the street with bus service. Stops on both sides of a two-way street should be paired up whenever possible to provide passengers with boarding and alighting points near one another.

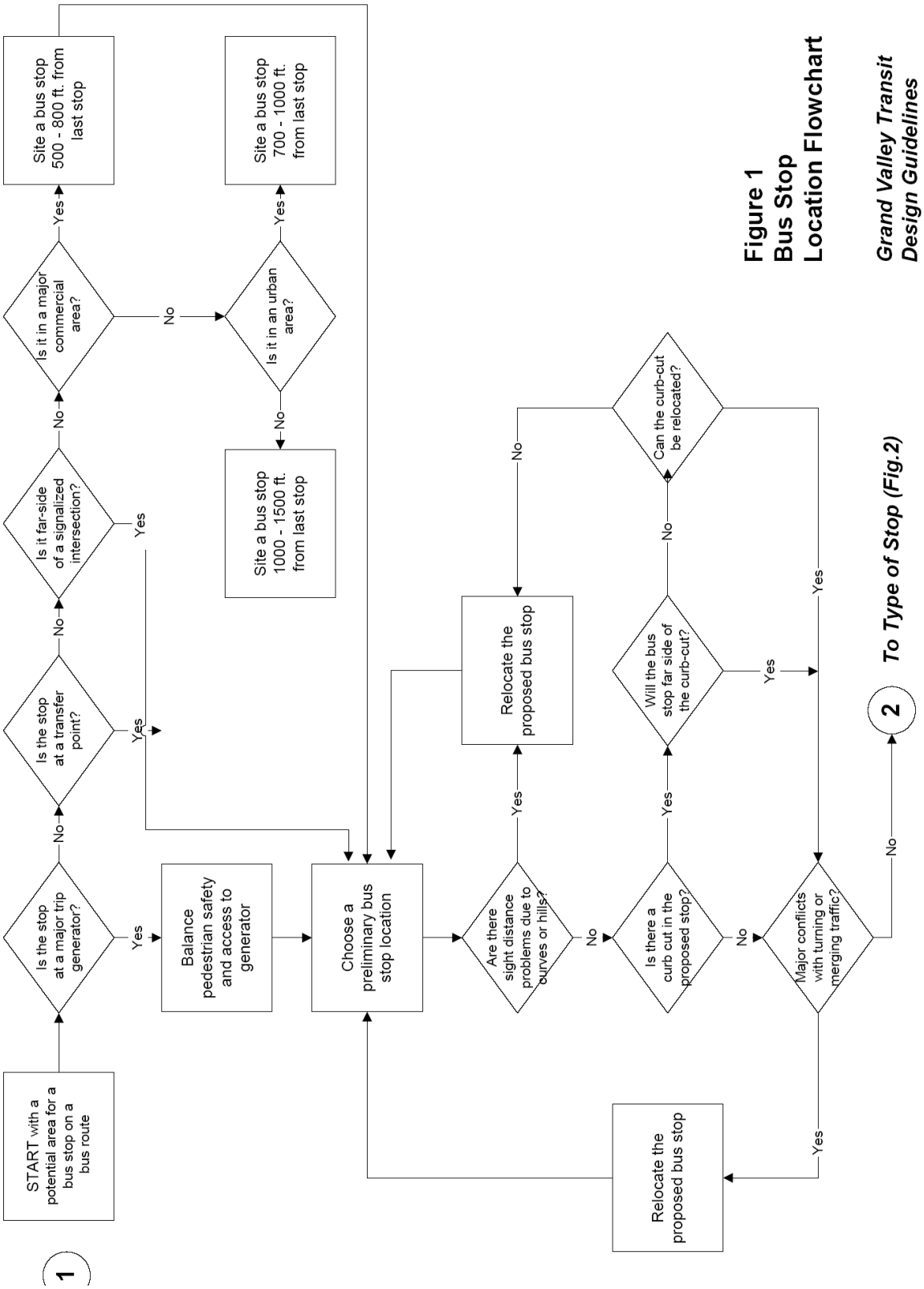
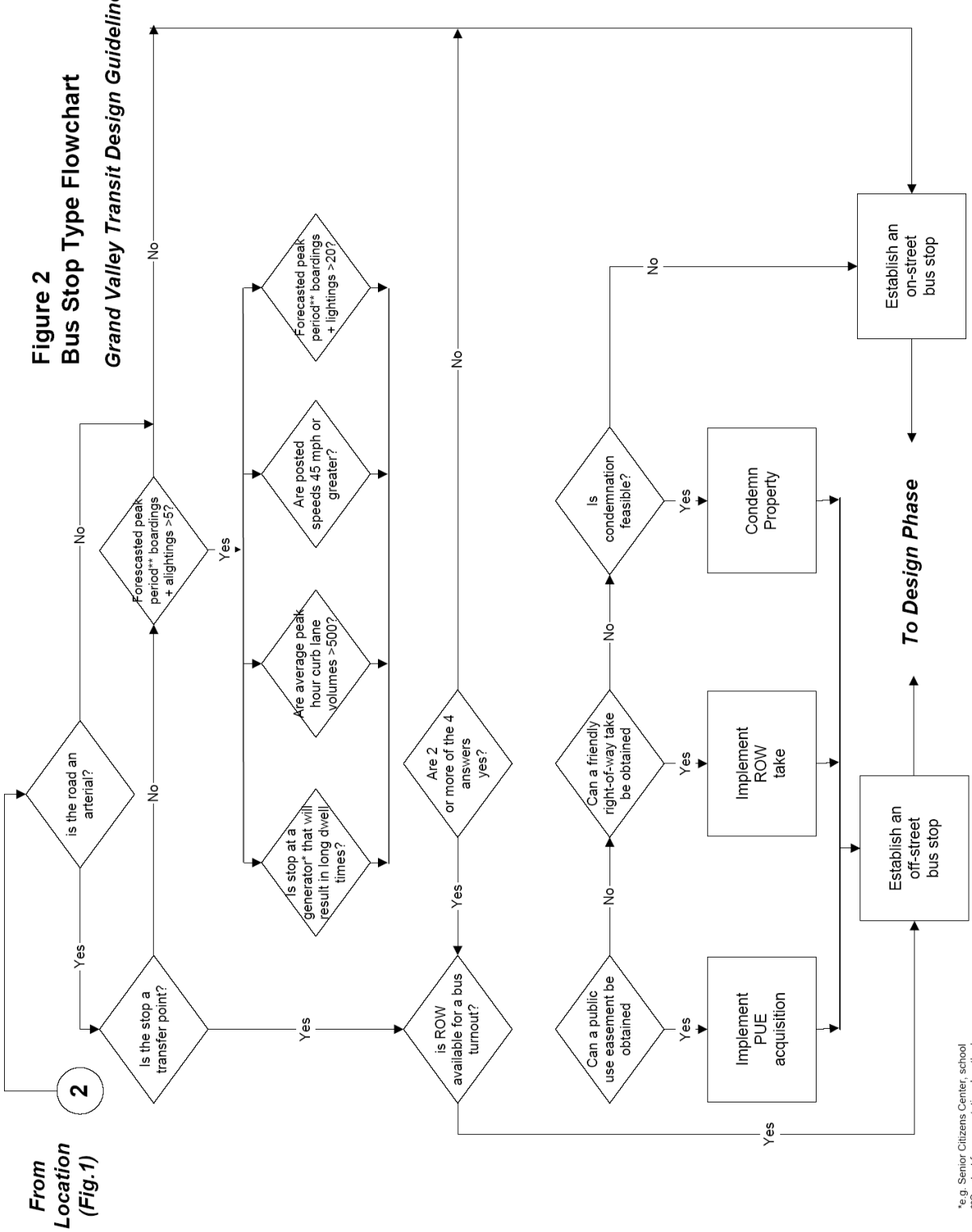


Figure 1
Bus Stop
Location Flowchart

Grand Valley Transit
Design Guidelines

Figure 2
Bus Stop Type Flowchart
Grand Valley Transit Design Guidelines



(e) Refining Transit Stop Locations. In general, stops should be located after (far-side of) an intersection to facilitate bus and traffic operations. However, far-side stops are occasionally impractical or conflict with existing development.

Specific attributes of potential transit stops must be reviewed. Sight distance is critical. Transit drivers need to be able to see to the rear sufficiently to safely re-enter traffic, following vehicles need to see the stopped bus in time to safely stop or merge left, and vehicles on side streets or driveways need to be able to see oncoming traffic.

(1) Far-side transit stops are recommended under the following conditions:

(i) At intersections controlled by signals, stop or yield signs.

(ii) The traffic is heavier on the approach side than on the departure side of an intersection.

(iii) The intersecting street is a one-way street with traffic moving from left to right when viewed as one approaches the intersection.

(iv) At intersections where heavy left or right turns occur.

(v) At intersections where the bus route and heavy traffic movements diverge.

(2) Advantages of far-side stops:

(i) Reduced conflicts between right-turning vehicles and stopped buses.

(ii) Additional intersection capacity is provided by making the approach curb lane available for traffic.

(iii) Sight-distance deficiencies created by buses stopped near-side of the intersection are eliminated.

(iv) Shorter maneuvering distances for the buses to enter and leave moving traffic are required.

(v) Increased ease and speed for bus re-entering the traffic stream during heavy traffic, as a result of platooning of traffic at signalized intersections.

(3) Disadvantages of far-side stops:

(i) Intersections may be blocked if other vehicles park illegally in the stop, obstructing buses and causing traffic to back up across the intersection.

(ii) A bus at a far-side stop obscures sight distance to the right of a driver entering the intersection from the right.

(iii) Where the bus stop is too short for multiple buses stopping at the same time, the overflow will obstruct the cross street.

(4) Near-side stops are recommended under the following conditions:

(i) Traffic is heavier on the departure side than on the approach side of the intersection.

(ii) The cross street is a one-way street where traffic flows from right to left.

(iii) Where the transit route turns right, a near-side stop should be established before the turn.

(iv) At intersections controlled by signals, stop or yield signs when transit operations are more critical than traffic or parking.

(5) Advantages of near-side stops:

(i) Create a minimum of interference at locations where traffic is heavier on the far-side of an intersection.

(ii) Passengers generally board buses closer to a crosswalk, minimizing walking distance.

(6) Disadvantages of near-side stops:

(i) Heavy vehicular right turns can cause conflicts, especially where a vehicle makes a right turn from the left of a stopped bus.

(ii) Buses often obscure stop signs, traffic signals, or other control devices, as well as pedestrians crossing in front of the bus.

(iii) The sight distance of a driver entering an intersection is diminished from the right.

(iv) The bus re-entering traffic flow after stopping often must wait through several cycles.

(v) Lengthy separate right-turn lanes cause the bus stops to be located too far from the intersection.

(7) Mid-block stops are recommended under the following conditions:

(i) Traffic or street characteristics prohibit a near or far-side stop at an intersection.

(ii) Large transit passenger generators exist and heavy ridership makes the location desirable.

(iii) Blocks are exceptionally long and allow adequate distance for the bus to merge into a left-turn lane if required.

(iv) A median island exists in the roadway.

(8) Advantages of mid-block stops:

(i) Buses create a minimum of interference with sight distance for both vehicles and pedestrians.

(ii) Waiting passengers assemble at less crowded sections of the sidewalk.

(9) Disadvantages of mid-block stops:

(i) The removal of curbside parking may be required.

(ii) Patrons from a cross-street may have to walk farther to board the bus.

(iii) Pedestrian jaywalking is more prevalent, resulting in increased friction, congestion and potential accidents.

(f) On-Street or Off-Street? The decision to place a bus stop off-street in a turnout should be made carefully. The decisions will affect the ability of the roadway and transit to move people safely and quickly. The bus stop type flow chart depicts the decision-making process.

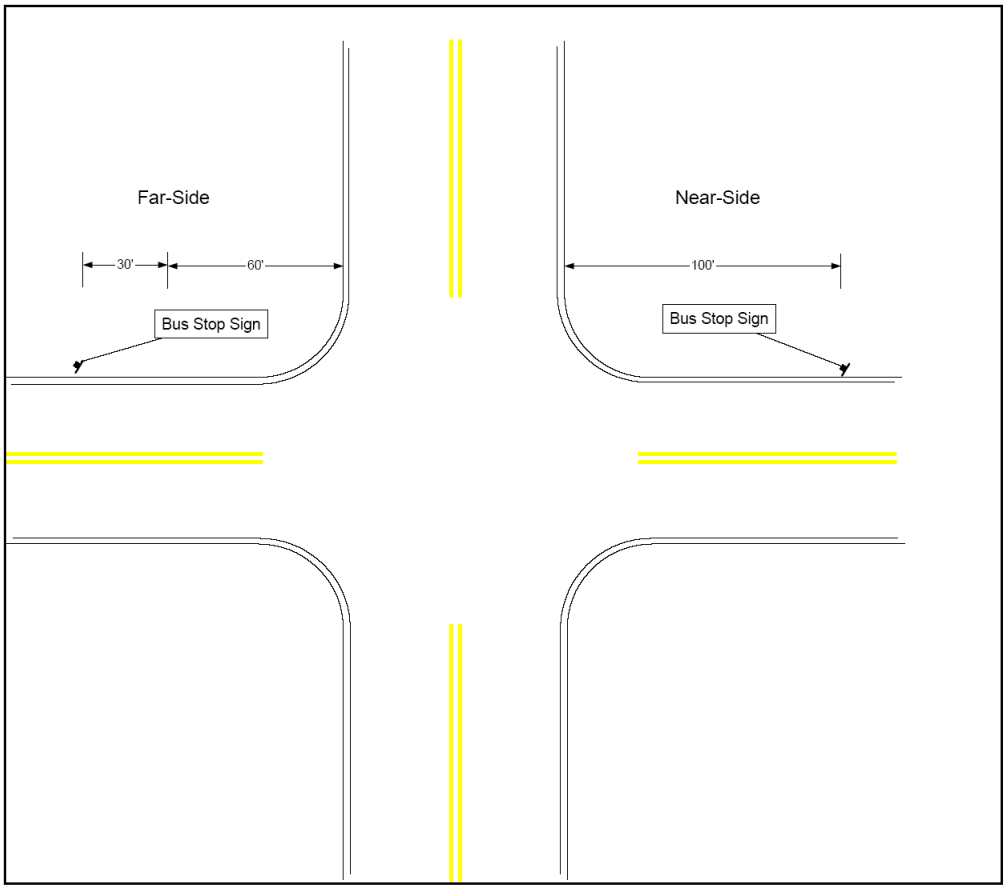
(Res. 39-04, 4-21-04)

29.52.030 Transit stop design.

Transit stops serve as interface points between sidewalk/trail systems, street networks and transit routes. Consequently, transit stop designs should provide access, temporary and permanent storage capacity and through traffic bypass capacity.

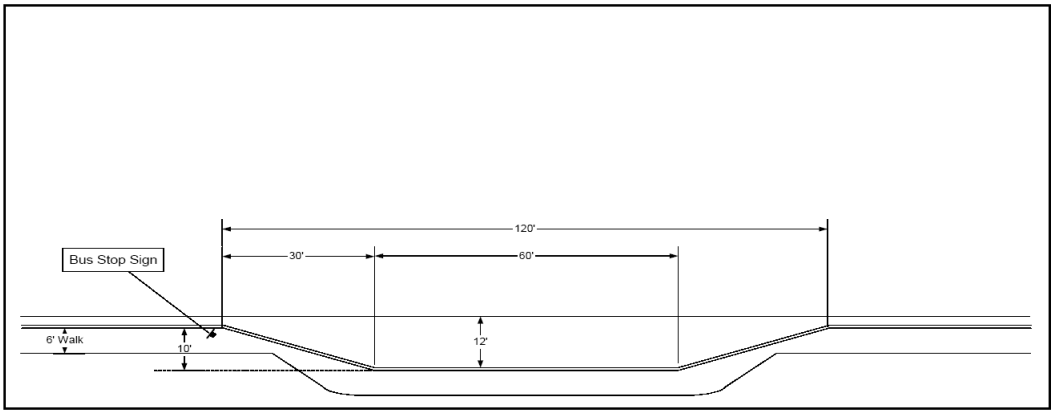
(a) On-Street Stops. On-street stops need to be located minimum distances from intersections and driveways to avoid conflicts. On streets with on-street parking, the parking must be removed to allow for the stop and is a consideration in siting stops. Figure 29.52.030.A shows the minimum distances from intersections for stops.

Figure 29.52.030.A
On-Street Transit Stops



(b) Off-Street Turnouts. Off-street turnouts allow buses to pull out of the traffic stream. The geometric layout is shown in Figure 29.52.030.B. Turnouts should not be located where there are potential rear sight distance problems. The desirable surface material for turnouts is concrete pavement. If asphalt pavement is used, the pavement design must be structurally sufficient for the shear forces created by buses turning into and out of the turnout.

Figure 29.52.030.B
Off-Street Transit Turnout – Grand Valley Transit



(c) Facility Access. Transit stops shall be connected with an accessible route to all streets, sidewalks and/or trails within the site boundary. The site boundary is defined by the beginning and end of the transit stop, the adjacent street and the right-of-way line for the street segment. Where a transit stop serves as a transfer point, the site boundary and an accessible route shall extend to the connecting route bus stops. Where a bus stop is the closest stop to an intersection, major generator or other private development, it is necessary to extend the site boundary and route to the generator or development. In the case of a mid-block stop with no adjacent sidewalk or trail, it is desirable to provide an accessible route to the nearest intersection or signalized crosswalk.

Accessible routes shall meet adopted standards for sidewalks and trails, including accessible standards for grades and ramps.

(d) Transit Stop Amenities. Amenities include the following:

(1) Waiting Areas. The stop should include adequate area and clearance for passenger access to buses, other amenities, and connecting sidewalks and trails.

(2) Benches. Bench placement shall be no closer than five feet from the curb where the posted speed limit is 35 miles per hour or less; no closer than 10 feet from the curb where the posted speed limit is greater than 35 miles per hour; and no closer than 10 feet where there is no curb. Bench design and construction must conform to the applicable zoning and development code.

(3) Shelters. Shelter placement shall meet the minimum standards established for benches. Shelters need to be aesthetically and functionally compatible with nearby uses. A shelter should not severely affect an adjacent residence or business use. Shelters should be considered at the following locations:

(i) Any stop serving more than 40 boarding/transferring passengers per day within major commercial areas.

(ii) Any stop serving more than 25 boarding/transferring passengers per day within urban and suburban areas.

(iii) Any stop that is a major transfer point between routes.

(iv) Any stops located near schools, senior citizen housing facilities or community recreation centers where large concentrations of the young or elderly are expected.

(4) Signs. All bus stops will be signed. Sign placement is shown in Figures 29.52.030.A and 29.52.030.B.

(5) Route and Schedule Information. Information including bus route, numbers, schedule information, transit riding tips and other appropriate information should be placed at all stops.

(6) Illumination. Passenger safety is enhanced by adequate lighting. Direct illumination of waiting passengers by a streetlight allows the transit driver to easily see waiting passengers. Supplemental lighting shall be provided at shelters in accordance with the applicable zoning and development code requirements.

(Res. 39-04, 4-21-04)

29.52.040 Bus stop siting and review policy.

Regional Transportation Planning Advisory Committee and the Mesa County Regional Transportation Planning Office

POLICY 1.0 – GRAND VALLEY TRANSIT POLICIES AND PROCEDURES
BUS STOP SITING AND REVIEW

ARTICLE I, PURPOSE

This policy and procedure establishes a systematic process for the purpose of siting new bus stops and reviewing current bus stops if any under scrutiny. This allows all staff, citizens and public officials to know exactly how new bus stops are sited and how bus stops can be reviewed in the case of criticism or complaints. This policy and procedure also ensures that the bus stops receive the proper technical review before they are moved or established.

ARTICLE II, BACKGROUND

Mesa County's contracted transit services, known as Grand Valley Transit (GVT), are overseen by the Regional Transportation Planning Office (RTPO). It has been the intent of the RTPO that all GVT bus stops are in compliance with the regulations that govern these types of uses in each applicable jurisdiction. It is also the RTPO's intent to provide an established and consistent method for the review of current bus stops when one is under scrutiny.

ARTICLE III, FARE INCREASE AND MAJOR SERVICE CHANGES

1. Initial Coordination by the Regional Transportation Planning Office (RTPO)

The suggestion of a potential bus stop location may originate from any of a number of sources. Each potential bus stop suggestion will be referred to the RTPO for coordination among the requisite agencies.

2. Functionality Assessment

Once a potential bus stop location has been proposed, the RTPO's Transit Coordinator will meet with the Operations Manager from Grand Valley Transit (GVT) to assess the functionality of the proposed bus stop. If the proposed stop meets GVT's functionality requirements, the Transit Coordinator will proceed with approval by the appropriate Traffic and/or Planning Departments and review of bench and/or shelter feasibility.

3. Bench and/or Shelter Feasibility

The Transit Coordinator will meet with a representative of the transit amenities provider to study the feasibility of adding a bench and/or shelter at the proposed stop either directly or in the future. If it is feasible for a bench and/or shelter to be installed at the proposed bus stop location, it is the responsibility of the transit amenities provider to obtain all necessary permits and/or other required documentation from the appropriate local agency and/or private property owner before the transit amenity is installed. If no bench and/or shelter is proposed, no further action in this area will be taken.

4. Approval by Traffic Departments

The proposed bus stop location must be approved to meet all of the appropriate Traffic Department's regulations for safety and access management.

5. Approval by Planning Departments

If there is a feasibility of adding a transit amenity to the proposed bus stop, the Transit Coordinator will forward the proposed stop location to the appropriate Planning Department for review of code compliance and zoning designation of the proposed stop.

6. Feedback Coordination by RTPO

Revisions by any of the participating agencies to the original bus stop location proposal will be referred to the Transit Coordinator for modification of the original proposal and resent to the appropriate agency for approval.

7. Notification to Agencies and Affected Property Owners

The Transit Coordinator will provide notification to the appropriate agency upon completion of the approval process. A letter of notification will be sent to any affected property owner/s informing him or her of the forthcoming bus stop.

8. Implementation

Implementation of a new or revised bus stop location will not commence until after the completion of the Bus Stop Siting Policy and Procedures process.

9. Complaint Procedure

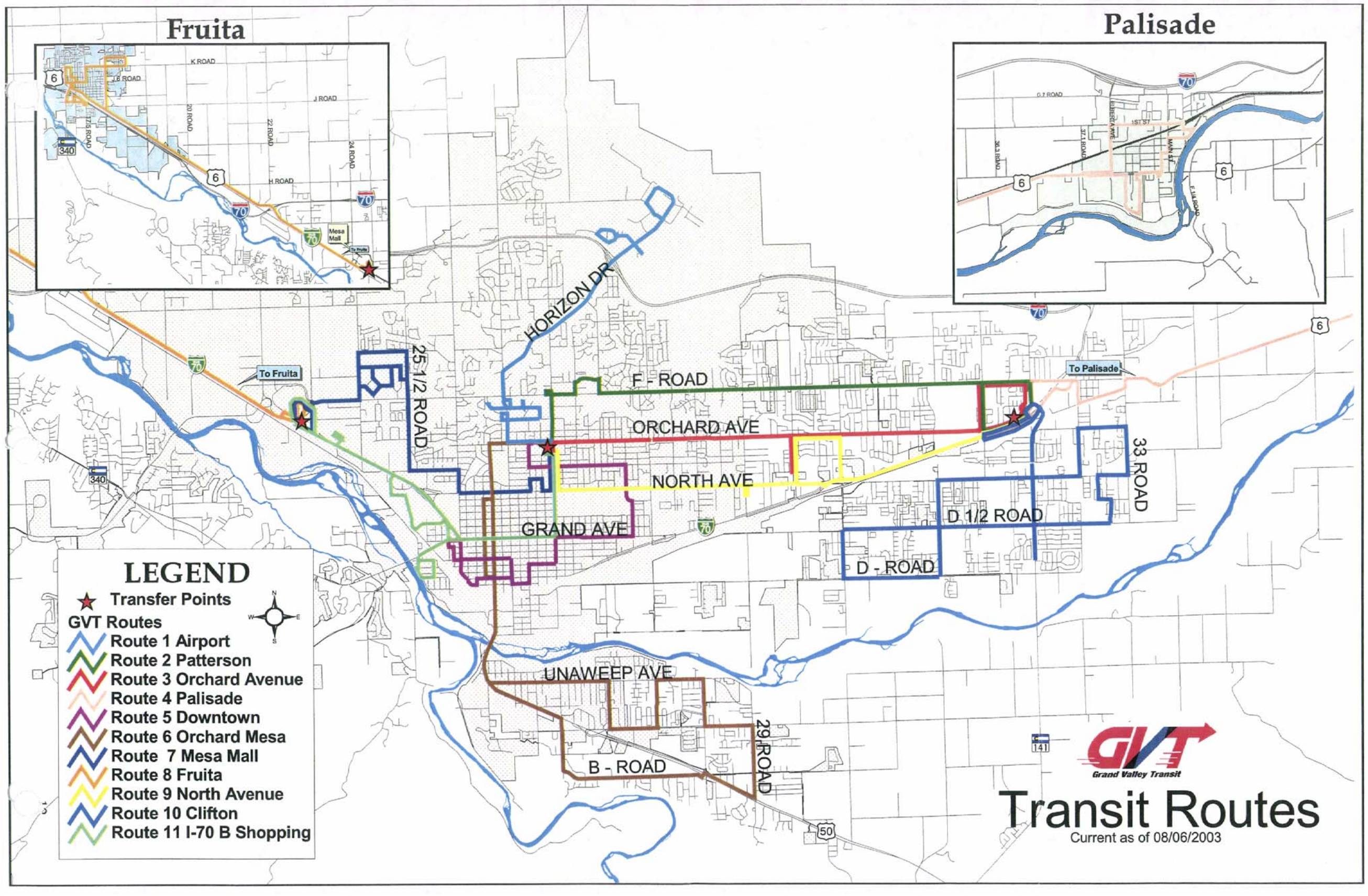
Any complaints regarding an existing bus stop location will follow the adopted Bus Stop Siting Policy and Procedures process.

THE REGIONAL TRANSPORTATION POLICY ADVISORY COMMITTEE HEREBY APPROVES AND ADOPTS THE BUS STOP SITING POLICY AND PROCEDURES ON JANUARY 17, 2002.

_____

Kathy Hall
Chair, Regional Transportation Policy Advisory Committee

(Res. 39-04, 4-21-04)


Fruita
Palisade
K ROAD
J ROAD
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20 ROAD
22 ROAD
24 ROAD
Mesa Mall
HORIZON DR
25 1/2 ROAD
To Fruita
To Palisade
F - ROAD
ORCHARD AVE
NORTH AVE
GRAND AVE
UNAWEEP AVE
B - ROAD
29 ROAD
33 ROAD
D 1/2 ROAD
D - ROAD
LEGEND
Transfer Points
GVT Routes
Route 1 Airport
Route 2 Patterson
Route 3 Orchard Avenue
Route 4 Palisade
Route 5 Downtown
Route 6 Orchard Mesa
Route 7 Mesa Mall
Route 8 Fruita
Route 9 North Avenue
Route 10 Clifton
Route 11 I-70 B Shopping
Grand Valley Transit
Transit Routes
Current as of 08/06/2003

29-143

Chapter 29.56

ALLEY STANDARDS

Sections:
29.56.010 Alley construction.
29.56.020 *Repealed.*
29.56.030 Alley Standard Street Detail.

29.56.010 Alley construction.

Alleys are a useful alternative for accessing properties, especially in the Central Business District (CBD). The construction of new alleys shall follow the design standards defined in the standard detail for alleys in the Standard Street Detail in GJMC 29.56.030. Any variation from the specifications defined in this drawing must go through the design exception process.

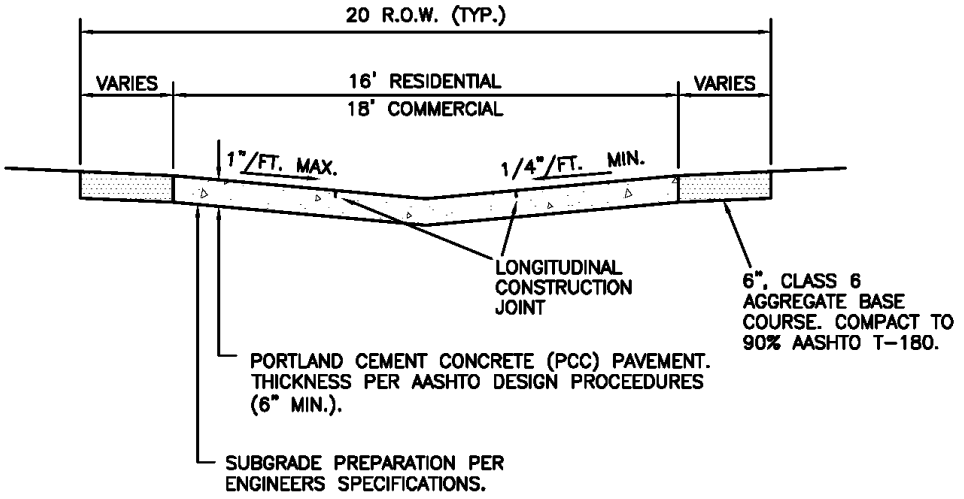
(Res. 39-04 (§ 12.0), 4-21-04)

29.56.020 Building setbacks.

Repealed by Ord. 4890.

(Res. 39-04 (§ 12.1), 4-21-04)

29.56.030 Alley Standard Street Detail.



① SAW CUT LONGITUDINAL CONTRACTION JOINTS SPACED AT 1/3 PAVEMENT WIDTH. (SEE DETAIL ON PAGE C-29)

② SAW CUT TRANSVERSE CONTRACTION JOINTS AT 10' SPACING (SEE DETAIL ON PAGE C-29)

③ SEE PAGE C-06 FOR EXPANSION JOINT SPACING.

④ ALL EXPANSION AND CONTRACTION JOINTS SHALL BE SEALED IN ACCORDANCE WITH DETAILS ON PAGE C-28.

⑤ PCC PAVEMENT SHALL BE DESIGNED IN ACCORDANCE WITH THE AASHTO GUIDE FOR DESIGN OF PAVEMENT STRUCTURES.

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ALLEY			
DEPARTMENT OF PUBLIC WORKS AND UTILITIES ENGINEERING AND TECHNICAL SERVICES DIVISIONS CITY OF GRAND JUNCTION, COLORADO	STANDARD STREET DETAIL	APPROVED: DN REV: JAN. 2001 DRAWN: DPW	PAGE ST-10

(Res. 39-04 (§ 12.0), 4-21-04)

Chapter 29.60

PRIVATE STREETS, SHARED DRIVEWAYS AND LOOP LANES

Sections:
29.60.010 Generally.

29.60.010 Generally.

Private streets may be considered as an alternative to residential public streets without a specific design exception if the standards in this chapter are met. Private streets have historically posed problems over time as they deteriorate and property owners do not realize the burden of maintenance is theirs. Application of the criteria established in this chapter should avoid problems encountered in the past with private streets and provide property owners some protection through a maintenance agreement and funding.

The shared driveway (also called an “autocourt”) is a private street. The loop lane is intended as an alternative public street.

(Res. 39-04 (§ 13.0), 4-21-04)

Chapter 29.64

DESIGN EXCEPTIONS

Sections:
29.64.010 Design exceptions.

29.64.010 Design exceptions.

(a) This manual establishes standards for the construction of transportation and infrastructure improvements in the City and urban areas of the County. There may be certain circumstances where those standards do not adequately meet the public's needs. The public needs, as defined by these standards, may conflict with constraints on the property or a new or innovative development proposal.

(b) This chapter describes an exception process. It may be that an exception is a one-time event or it may be that the manual will be revised to incorporate the exception.

(c) The flowchart depicts the design exception process.

(d) The burden in the development process shall be on the applicant to demonstrate that the proposed exception, if granted, will not result in a dangerous condition as determined by the City or County. No exception shall be allowed if the resulting design is dangerous or otherwise fails to meet the fundamental needs of the community. The fundamental needs of the community shall be determined by the City or County, but primarily are the provision of safe, efficient and effective transportation.

(e) Any exceptions to the TEDS manual should be clearly proposed as early as possible in the project development and review process. Exceptions to TEDS should be identified no later than preliminary plan submittal.

(f) If a design exception is to be a permanent modification to the TEDS manual, it will be the responsibility of the City and County staff to update TEDS and disseminate the change to CDOT, other municipal or county departments and the development community.

(g) When geometric standards or other design criteria are not specifically addressed in the City or County standards, then the latest editions of the following standards and criteria shall govern the design.

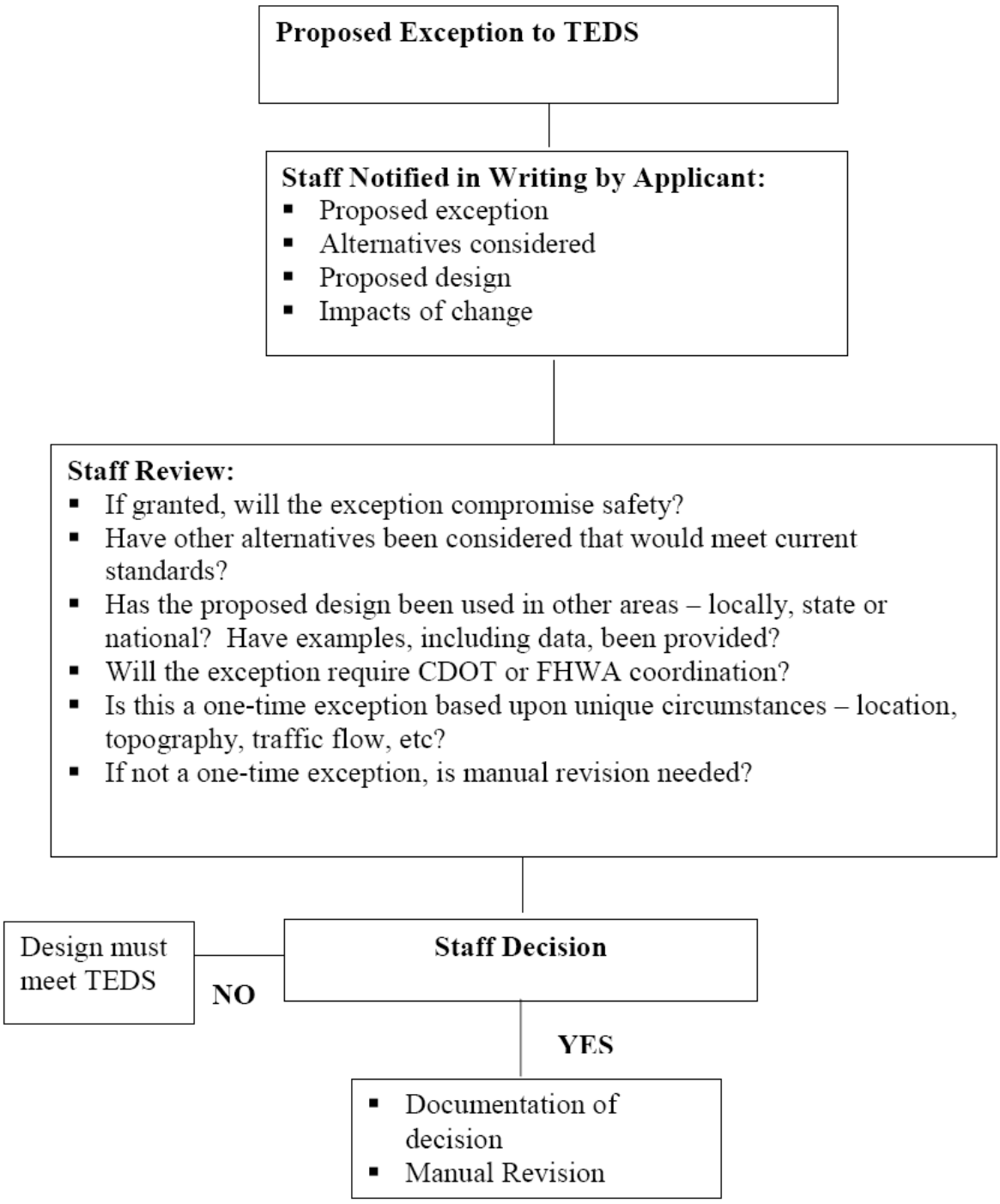
(1) Colorado State Highway Access Code.

(2) CDOT Roadway Design Manual.

(3) Institute of Transportation Engineers' "Traffic Engineering Handbook."

(4) American Association of State Highway and Transportation Officials "A Policy on Geometric Design of Highways and Streets."

Design Exception Process



(Res. 39-04 (§ 14.0), 4-21-04)

Chapter 29.68

ALTERNATE RESIDENTIAL STREET STANDARDS

Sections:
29.68.010 Intent of provisions.
29.68.020 Performance criteria.
29.68.030 Application.
29.68.040 Approval.

29.68.010 Intent of provisions.

The intent of this chapter is to provide flexibility in the creation, approval and use of public street infrastructure that varies from the cross-sectional standards provided in Chapter 29.20 GJMC, and to accommodate such proposals under administrative approval procedures. This resulting alternate street standard may be used to create neighborhood character, enhance visual appeal, and to accommodate unique topographical or site features. Further, implementation of these standards should result in "a better solution," allowing alterations to the standard street section that produce benefit to the community.

(Res. 39-04 (§ 15.0), 4-21-04)

29.68.020 Performance criteria.

All public streets considered for alternate cross-sections shall meet certain minimum performance-based standards and meet all intent for function of a public right-of-way. Each proposal must be framed within the specific context of the use.

(a) Horizontal Geometry.

(1) The horizontal geometry of street and path layouts must meet TEDS requirements elsewhere herein. The design must accommodate large vehicles such as fire trucks, trash trucks and semi trucks at an appropriate level of service.

(2) A minimum pavement width of 20 feet, from flow line of gutter to flow line of gutter, is required for all streets. Path widths or pedestrian walkways shall meet minimum widths as required in the Standard Contract Documents for Construction by path classification.

(3) Horizontal curb radii must be 15 feet minimum for chicanes, parking bulb-outs and other similar features.

(4) Intersection geometry is as required elsewhere herein.

(b) Vertical Geometry. The vertical geometry of street and path layouts must meet TEDS requirements elsewhere herein and ADA requirements.

(c) Sight Distance. The design must achieve all sight distance requirements listed elsewhere in TEDS.

(d) Connectivity.

(1) Minimum connectivity requirements remain unchanged. Provision of access to adjacent parcels is required. Additional inter- or intra-parcel connectivity may be necessary where reduced street width is considered.

(2) Example: One case where narrow streets and the concept of "queuing" are frequently and successfully used is in older downtown neighborhoods across the country. The streets typically have a grid layout, limited block length, and possibly an alley, allowing a narrow street with fairly high density and high use of on-street parking to function satisfactorily.

(e) Parking.

(1) Adequate parking must be provided both on- and off-street. Zoning and development code minimums are required on-site. The on-street parking range is required at 0.5 to 1.5 on-street parking spaces per dwelling unit. Higher density development will demand on-street parking in the upper end of that range.

(2) Clustering of on-street parking in pods is encouraged where full on-street parking is not provided. The provision of on-street parking shall consider availability of parking for long vehicles or vehicles with trailers.

(3) Adequate parking outside of the travel lane must be provided. On the other hand, excessive availability of parking contributes to higher speeds due to width of travel lane available as well as to increased construction and maintenance costs.

(f) Pedestrian Facilities.

(1) The design must provide adequate pedestrian facilities equal or better than existing adopted street sections. Detached walk and additional walk width are encouraged.

(2) Sidewalk is required to create continuous pedestrian walkways parallel with the public roadway. Generally, if lots front both sides of the street, sidewalk will be required on both sides of the street.

(g) Drainage.

(1) Curb and gutter is generally considered necessary. However, in limited instances, other options may be considered. Examples include an inverted crown as typically used in concrete alley applications and areas where attached curb and gutter may not be practical due to certain soil conditions. In these cases, adequate drainage facilities must be provided per the Stormwater Management Manual (GJMC Title 28). Alternate drainage facilities must not require additional maintenance effort above conventional facilities.

(2) Surface drainage at bulb-outs and chicanes is preferred along a continuous gutter without drain troughs or otherwise inaccessible sections of gutter.

(3) Narrower street sections will not carry the same amount of water as the standard street sections. Analysis of the street stormwater carrying capacity by use of the SWMM nomographs will not be permitted.

(h) Surfacing and Construction Requirements. Hard surfacing (Portland cement concrete or asphalt pavement) is required and shall meet the structural design requirements contained in Chapter 29.32 GJMC. Gravel surfacing is not allowed. Construction requirements are contained in the Standard Contract Documents.

(i) Right-of-Way and Multi-Purpose Easements.

(1) Right-of-way and infrastructure dimension and configuration must provide adequate room for all necessary public facilities including, but not limited to, storm drainage; water lines and meters; sanitary sewer lines; electrical, natural gas, cable, telephone supply lines, service lines, pedestals and appurtenances; traffic control signage; irrigation supply and drainage; cut or fill slopes; and other public utility lines and appurtenances.

(2) The standard 14-foot multi-purpose easement may be reduced in width if adequate space is shown to exist within the right-of-way.

(3) Right-of-way configuration must provide adequate access to public utilities. Fencing of easement areas is discouraged as it reduces access to utilities and improvements.

(j) Private Streets, Shared Drives and Alleys.

(1) Nothing in this section shall expressly prohibit the use of private streets and shared drives, as allowed elsewhere herein, to be used in conjunction with alternate standard streets.

(2) The use of alleys is likewise permitted and may be used in conjunction with alternate standard streets to achieve utility service delivery, alternate access to off-street parking or enhance connectivity.

(k) Traffic Calming. Traffic calming requirements are the same as required elsewhere herein. Elements of narrowed streets may be considered part of the traffic calming system.

(l) Other Right-of-Way Elements. All elements of the function of the right-of-way must be considered in the design process.

(1) Mail Receptacles. Streets shall include design elements necessary to meet USPS requirements for access to mail receptacles. Mail receptacles will not be permitted within sight distance triangles at intersections or located such that they interfere with the safe and normal function of the street. Parking shall be provided adjacent to the mail receptacle.

(2) Urban Trails. Where urban trails, primary school walk routes, bike lanes, or other non-motorized transportation routes are indicated on adopted City, school district, or other plans, these elements must be incorporated into the design. The design must meet all requirements of City, State and federal standards, including ADA.

(Res. 39-04 (§ 15.1), 4-21-04)

29.68.030 Application.

The applicant shall submit a written report requesting alteration of the standard as a part of a pre-application conference, preliminary plan or other application process. The applicant is encouraged to make this application as early in the process as feasible. The report and plan shall contain the following:

(a) A specific request for alteration of the standard, detailing elements of the standard that are altered and the proposed alternative.

(b) A narrative explaining the reasons for requesting the alteration and proposed benefits.

(c) A narrative, addressing design elements above.

(d) A site plan showing limits and extents of proposed alterations.

(e) A site plan indicating proposed density, approximate lot size and frontage, access locations, street network, and other pertinent elements. Approximate horizontal and vertical geometry may be required, dependent on topography or other site constraints.

(Res. 39-04 (§ 15.2), 4-21-04)

29.68.040 Approval.

The Director or his/her assigned representative(s) shall make a final determination of adequate conformance to these criteria, and have the authority to approve or reject each proposed alternative. Staff or agency members may provide comment or modification to the proposal. The Director may consult with or delegate review and approval authority to City Staff, outside review agencies, or outside consultants.

Where the proposed alternate may affect utility placement, approval of the Utility Coordinating Committee is required prior to the consideration by the Director or his designee.

Deviation from the standard street cross-sections may continue to be accomplished through a variance or a planned development procedure as permitted in the zoning and development code.

(Res. 39-04 (§ 15.3), 4-21-04)

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