SET NO. _____

PROJECT MANUAL

BID SET

CITY OF GRAND JUNCTION

2021 KANNAH CREEK FLOWLINE REPLACEMENT

MAY 2021

PROJECT MANUAL

BID SET

CITY OF GRAND JUNCTION

2021 KANNAH CREEK FLOWLINE REPLACEMENT

JVA, Inc.
817 Colorado Ave., Suite 301
Glenwood Springs, CO 81601

JVA Job No. 1071.6e

May 2021

PROJECT MANUAL

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CITY OF GRAND JUNCTION
2021 KANNAH CREEK FLOWLINE REPLACEMENT

SECTION 01010

SUMMARY OF WORK

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B. Work by others

C. Contractor use of site and premises

D. Work sequence

E. Easements and right-of-way

F. Protection of public and private property

G. Maintenance of traffic

H. Barricades and lights

I. Lines and grades

J. Regulatory requirements

K. Cutting and patching

1.2 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work will include all necessary labor, supervision, equipment, tools and materials for the installation of new raw waterlines parallel to the Kannah Creek Flowline, from the Upper Kannah Creek Flowline to a stub near the Kannah Creek Water Treatment Plant and a new inlet tower structure into the Juniata Reservoir with a feedline to the Kannah Creek Flowline. The project is generally comprised of the following components:
   1. 20-inch PVC pipe
   2. 6-inch PVC pipe
   3. Inlet tower structure into Juniata Reservoir
   4. Connection to Kannah Creek Water Treatment Plant stub
   5. Connection of parallel raw waterline to Kannah Creek Flowline

B. Contractor shall furnish and pay for all materials, equipment, supplies, appurtenances; provide all construction equipment and tools; and perform all necessary labor and supervision

C. Contractor shall coordinate the progress of the Work including coordination between trades, subcontractors, suppliers, public utilities and subsequent water treatment plant contractor performing work on site and Owner to insure the progress of Work

D. It is the intent of this contract that Work proceed in the most expeditious manner possible

E. Construct the Work under contract indicated in the Bid Form

F. The cross-referencing of specification sections under the heading "Related Sections" and elsewhere within each specification section is intended as an aid to the Contractor and shall not relieve the Contractor from his responsibility to coordinate the Work under the Contract Documents. Listings of cross-references are not intended to be comprehensive. The omission of a cross-reference to an additional or related requirement shall not relieve the Contractor of his obligation to provide a complete Project.

1.3 WORK BY OTHERS

A. Construct work to allow for work by others. Coordinate construction schedule with the Owner.

1.4 CONTRACTOR USE OF SITE AND PREMISES

A. Contractor shall limit use of the premises for Work and will use the designated staging area for field offices, equipment, and material storage. Areas have been designated on the Drawings for contractor's use

B. Coordinate use of premises under direction of Engineer and/or Owner

C. Assume full responsibility for the protection and safekeeping of equipment and products stored on site under this Contract

D. Contractor may use only those areas indicated on the Drawings for storage and such additional areas as Engineer may designate

E. Contractor should plan for normal workdays, Monday through Friday, within the hours of 7:00 am to 5:00 pm. Other work hours and days may be allowed by City and Engineer upon 48 hours written notice

1.5 OWNER USE OF SITE AND PREMISES

A. Owner shall coordinate with Contractor the entrance into work site for work performed under the Contract Documents to ensure Contractor's health and safety plans are followed

B. Existing raw waterline to remain operational during construction. All access maintained.

1.6 WORK SEQUENCE AND WORK RESTRICTIONS

A. Existing raw waterline shall remain in service until construction is complete and entire system is operational and has been accepted by the City and Engineer.

B. Provide open access for Owner to property at all times during construction. Maintain minimum width clearance for access of City and Contractor personnel and emergency vehicles at all times.

C. Contractor shall submit a detailed CPM format schedule outlining all steps required to assure complete and satisfactory construction, testing, and startup work. Address all work sequence and constraints described in this Section.

D. Sequences other than those specified will be considered by Engineer, provided they afford equivalent continuity of operations

1.7 EASEMENTS AND RIGHT-OF-WAY

A. Work shall be performed on the City's property

B. Construction access to the site is available only via Reader Mesa Road and the City's access drive along the Hallenbeck Reservoir and Juniata Reservoir. Access across private property is strictly prohibited.

C. Confine construction operations to the immediate vicinity of the location indicated on drawings and use due care in placing construction tools, equipment, excavated materials, and pipeline materials and supplies, so as to cause the least possible damage to property

D. Construction Area Limits
   1. Confine construction operations to the immediate vicinity of the location indicated on Drawings and in accordance with the Owner
   2. Areas not designated for access roads, parking areas, storage areas, existing facilities areas, and construction areas, Contractor shall not trespass in or on these areas
      a. Contractor shall be responsible for keeping all their personnel out of areas not designated for Contractor use except in case of isolated Work located within these areas for which the Contractor shall coordinate with Owner and shall not proceed with such work without Owner approval
   3. Contractor shall use due care in placing construction tools, equipment, excavated materials, and pipeline materials and supplies, so as to cause the least possible damage to property outside the Town property
      a. Responsibility for protection and safekeeping of materials and equipment on or near the work site shall be entirely that of the Contractor and no claim shall be made against the Owner for any reason
      b. If the Owner needs access to the sites occupied by stored materials or equipment, Contractor shall provide access

E. On Private Property

1. Do not enter for material delivery or occupy for any purpose with personnel, tools, equipment, construction materials, or excavated materials, any private property outside the designated construction easement without written permission of the owner and tenant

F. Within Street Right-of-Way and Utility Easement
   1. Perform all work and conduct all operations of Contractor, his employees, and his subcontractors in accordance with the requirements of the City and/or Mesa County

1.8 PROTECTION OF PUBLIC AND PRIVATE PROPERTY

A. Protect, shore, brace, support, and maintain underground conduits, drains, and other underground construction uncovered or otherwise affected by construction operations

B. Contractor shall be responsible for all damage to streets, roads, highways, shoulders, street lighting and/or signage, embankments, culverts, location or character, which may be caused by transporting equipment, materials, or personnel to or from the Work or any part or site thereof, whether by him or his subcontractors

C. Make satisfactory and acceptable arrangements with the Owner of, or the agency or authority having jurisdiction over, any damaged property concerning its repair or replacement or payment of costs incurred in connection with the damage

1.9 PROTECTION OF WORK AND FACILITIES

A. Contractor shall be solely responsible for the protection of Work until final acceptance

B. Contractor shall protect all and any previously performed Work, work in progress or completed by others, and existing facilities from damage during the performance of Work in the area

1.10 MAINTENANCE OF TRAFFIC

A. Conduct Work to interfere as little as possible with public travel, whether vehicular or pedestrian
   1. Whenever it is necessary to cross, close, or obstruct private roads, driveways, multi use paths, and walks, provide and maintain suitable and safe detours, or other temporary expedients for accommodation of private travel
   2. Maintenance of traffic is not required if Contractor obtains written permission from the owner and tenant of private property, or from the authority having jurisdiction over public property involved, to obstruct traffic at the designated point

1.11 BARRICADES AND LIGHTS

A. Protect streets, roads, highways, and other public thorough fares which are closed to traffic by effective barricades with acceptable warning and directional signs

B. Locate barricades at the street intersecting public thoroughfare on each side of the blocked section

C. Provide suitable barriers, signs, and lights to the extent required to adequately protect the public

D. Provide similar warning signs and lights at obstructions such as material piles and equipment

E. Illuminate barricades and obstructions with warning lights from sunset to sunrise

F. Store materials and conduct work to cause the minimum obstruction to the other contracts

G. Install and maintain barricades, signs, lights, and other protective devices in conformity with applicable statutory requirements including the Manual of Uniform Traffic Control Devices and as required by Mesa County

1.12 LINES, GRADES AND SURVEY

A. Construct all Work to the lines, grades, and elevations indicated on the Drawings
   1. The Owner may employ a separate surveyor to perform a verification survey to check final layout and grades.
   2. Contractor is responsible for correcting all incorrect grades or grades not meeting specified tolerances

B. Engineer has established basic horizontal and vertical control points in the Drawings
   1. Use these points as datum for the Work
   2. Provide such competent personnel and tool, stakes, and other materials as Engineer may require in establishing or designating control points, in establishing construction easement boundaries, or in checking layout survey, and measurement work performed by Contractor

C. Provide all survey, layout, and measurement work required
   1. Work performed by a qualified professional engineer or registered land surveyor acceptable to Engineer
   2. Locate and protect control points prior to starting site work, and preserve all permanent reference points during construction
      a. Make no changes or relocations without prior written notice to Engineer
      b. Report to Engineer when any reference point is lost or destroyed, or requires relocation because of necessary changes in grades or locations
      c. Require surveyor to replace Project control points which may be lost or destroyed
      d. Establish replacements based on original survey control
   3. Establish lines and levels, locate and lay out, by instrumentation and similar appropriate means
      a. Temporary project benchmark
      b. Stakes for grading, fill and topsoil placement
      c. Utility slopes and invert elevations
   4. From time to time, verify layouts by the same methods

5. Maintain a complete, accurate log of all control and survey work as it progresses
6. On request of Engineer, submit documentation to verify accuracy or field engineering work

1.13 REGULATORY REQUIREMENTS

A. Comply with all federal, state, and local laws, regulations, codes, and ordinances applicable to the Work

B. References in the Contract Document to local codes shall mean the codes in effect in the City and Mesa County according to the jurisdiction in which the Work is performed

C. Other standards and codes which apply to the Work are designated in the specific technical specifications

1.14 CUTTING AND PATCHING

A. Contractor shall be responsible for all cutting, and patching, including attendant excavation and backfill, required to complete the Work or to
   1. Uncover portions of the Work to provide for installation of ill-timed work
   2. Remove and replace defective work
   3. Remove and replace work not conforming to requirements of Contract Documents
   4. Remove samples of installed work as specified for testing

B. Provide products as specified or as required to complete cutting and patching operations

C. Inspection
   1. Inspect existing conditions of the Project, including elements subject to damage or to movement during cutting and patching
   2. After uncovering work, inspect the conditions affecting the installation of products, or performance of the work
   3. Report unsatisfactory or questionable conditions to the Engineer in writing; do not proceed with the work until the Engineer has provided further instructions

D. Preparation
   1. Provide devices and methods to protect other portions of the Project from damage
   2. Provide protection from the elements for that portion of the Project which may be exposed by cutting and patching work, and maintain excavations free from water
   3. Execute fitting and adjustment of products to provide a finished installation to comply with specified products, functions, tolerances and finishes
   4. Restore work which has been cut or removed; install new products to provide completed Work in accord with requirements of Contract Documents

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

SECTION 01020

GEOTECHNICAL REPORT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Reports of explorations and tests of subsurface conditions at the project site.

1.2 RELATED SECTIONS

A. Section 01010 – Summary of Work

B. Section 02300 – Earthwork

1.3 INVESTIGATION

A. Soil and subsurface investigations were conducted at the site, the results of which are to be found in the report issued by RockSol Consulting Group, Inc, Subsurface Investigation Report Juniata Inlet Reroute Project, December 16, 2020.

B. A reference copy of the report is included herein, Supplement A (01020)

C. Bidders are expected to examine soils investigation data and to make their own investigation of the site on or prior to the bid date.

1.4 INTERPRETATION

A. Soil investigation data is provided only for information and the convenience of bidders. Owner and Engineer disclaim any responsibility for the accuracy, true location, and extent of the soils investigation that has been prepared by others. They further disclaim responsibility for interpretations of that data by bidders, as in projecting soil-bearing values, rock profiles, soil stability and the presence, and level and extent of underground water.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

Subsurface Investigation Report
Juniata Inlet Reroute Project
Juniata Reservoir
Mesa County, Colorado

Prepared for:

City of Grand Junction
333 West Avenue, Building C
Grand Junction, Colorado 81501

Attention: Mr. John Eklund, PE, CFM

December 16, 2020

Prepared by:

RockSol Consulting Group, Inc.
566 W Crete Circle, Unit 2
Grand Junction, Colorado 81505
(970)-822-4350

RockSol Project No. 599.19

Subsurface Investigation Report
Juniata Inlet Reroute Project
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RockSol Project No. 599.19

Jacob Sphatt, EIT
Civil Engineering Associate

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Senior Geotechnical Engineer

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ATTACHMENTS

1.0 PROJECT PURPOSE AND DESCRIPTION

This report documents the subsurface investigation performed by RockSol Consulting Group, Inc. (RockSol) to assist with the excavation and installation of a new polyvinyl chloride (PVC) waterline at Juniata Reservoir in Mesa County, Colorado. Approximately 8,000 linear feet of 20-inch PVC is proposed for the new alignment. The waterline will tie into the existing infrastructure at three locations (See Appendix A, Proposed Waterline Alignment).

The scope of work for this geotechnical investigation included:

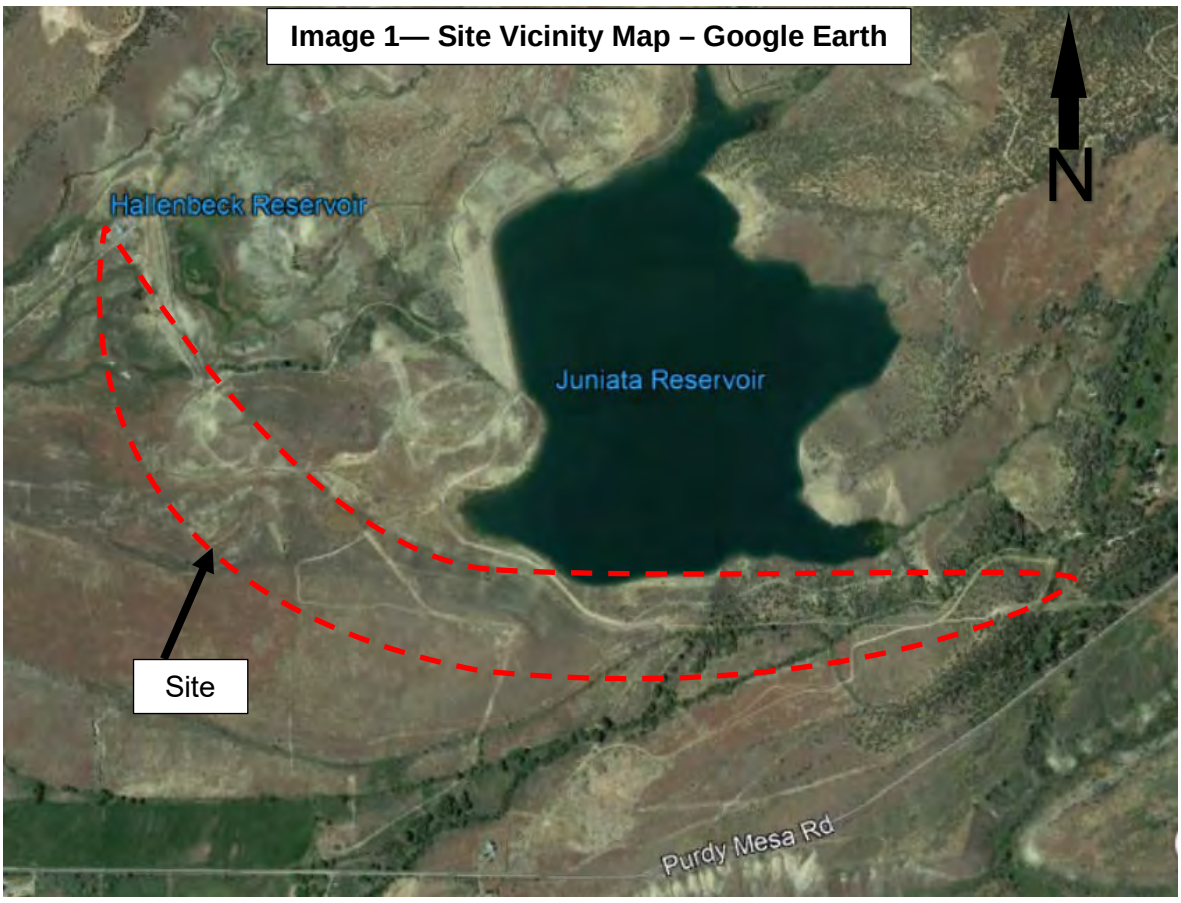
- Performing a subsurface investigation by the method of test pit excavation to observe and categorize the ease of excavation at 10 locations in close proximity to the proposed alignment.
- Obtaining soil samples for soil classification and geotechnical analysis from the test pits.
- Preparing a geotechnical report presenting the field and laboratory data obtained, geological conditions, and geotechnical recommendations for the proposed waterline excavation and backfill.

The subsurface investigation program was conducted to obtain information on the subsurface soil, groundwater if encountered, and bedrock conditions for the proposed waterline installation.

2.0 PROJECT SITE CONDITIONS

The project site is in Section 31 and 36, Township 12 South, Range 97 West of the 6th Principal Meridian in Mesa County, Colorado (see Image 1). The project site is located near the south shore of Juniata Reservoir and south and west of Hallenbeck (Purdy Mesa) Reservoir.

Image 1— Site Vicinity Map – Google Earth

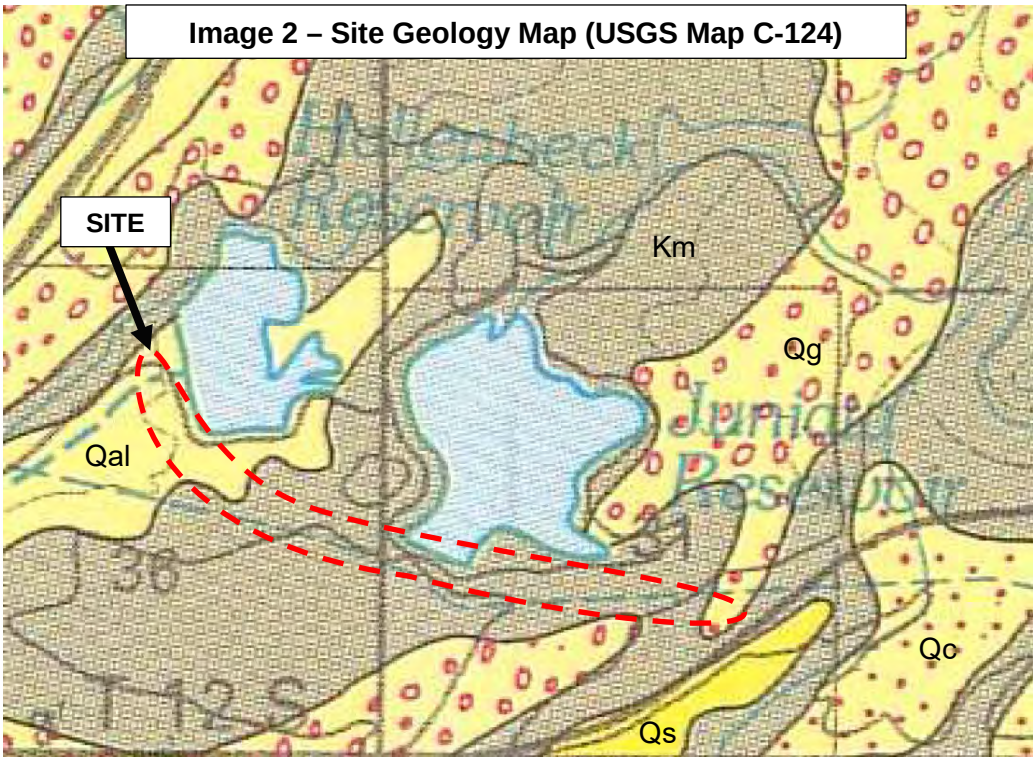


3.0 GEOLOGICAL SETTING

Geologic information about the project site and site vicinity is presented in the United States Geological Survey (USGS) *Geologic Map and Cross Sections of Parts of the Grand Junction and Delta 30' x 60' Quadrangles, West-Central Colorado (USGS Coal Investigations Map C-124)* by Margaret S. Elis and Virginia Gabaldo, dated 1989 (See Image 2, Site Geology Map below).

Based on the USGS map, the site is underlain by Mancos Shale (Km) which consists mostly of gray shale and minor sandstone, alluvial deposits (Qal) of well-rounded boulder to clay-size debris, and terrace and pediment gravel (Qg). Other deposits nearby include colluvium (Qc) and undifferentiated surficial deposits (Qs).

Image 2 – Site Geology Map (USGS Map C-124)



4.0 SUBSURFACE EXPLORATION

On November 23, 2020 RockSol observed the excavation of ten test pits to evaluate subsurface conditions at the project site. The test pit locations are identified as TP-1 through TP-10 and the approximate locations are shown in Image 3, Test Pit Location Plan (Google Earth). Test pit locations were provided to RockSol by the City of Grand Junction. RockSol then plotted these points onto Google Earth using aerial imagery landmarks to obtain GPS coordinates to locate the proposed locations in the field. TP-2, TP-4, TP-9, and TP-10 were moved slightly from the proposed locations in the field at the time of sampling. TP-2 was moved approximately 20 feet south of proposed location due to heavy brush and trees associated with the exiting ditch. TP-4 was moved approximately 30 feet north of the proposed location due to relatively steep slope conditions. TP-9 was moved approximately 200 feet from proposed location due to heavy brush and to limit disturbance without prior clearing. TP-10 was moved approximately 20 feet west of proposed location to ensure clearance around an existing marked waterline. Coordinates were located on site using a handheld GPS unit. Elevations of the ground surface at each test pit location are based on the elevation indicated by our GPS unit and must be considered as

approximate. The GPS unit is a Garmin GPSMAP 64st with a GLONASS satellite receiver and quad helix antenna. The unit displays the strength of the satellite signals received and the GPS accuracy. Generally, the accuracy ranges from 3 to 5 meters, or 10 to 16 feet. It also displays the coordinates (latitude and longitude) and elevation of the location.

Image 3 — Test Pit Location Plan (Google Earth)

A John Deere 410E Backhoe and a Caterpillar 316E Excavator, equipment owned by the City, were used to excavate the test pits. Test pits TP-1 and TP-2 were excavated with the 410E backhoe and TP-3 through TP-10 were excavated with the 316E excavator. The buckets on the backhoe and excavator were equipped with rock chisel/rock penetration type teeth. Test pits were excavated to maximum depths ranging from 5.6 to 8.0 feet below existing grades. The test pits were backfilled immediately after obtaining samples and logging the soil profile of the test pit. Test pits were logged in the field by a representative of RockSol.

Subsurface materials were obtained from the excavated material as the test pits were excavated. Excavated material was separated by a RockSol representative as the soil conditions changed with the depth of the excavation. At least one sample was obtained at each test pit location. Photographs of the test pits and the excavated material are presented in Appendix B.

Depths at which the samples were taken are shown on the Soil Logs for each test pit. Individual RockSol Test Pit Soil Logs are included in Appendix C.

5.0 LABORATORY TESTING SUMMARY

Soil samples retrieved from the test pit locations were examined by the project geotechnical engineer in the RockSol laboratory. Selected samples were tested and classified according to the Unified Soil Classification System (USCS). The following laboratory tests were performed in accordance with the American Society for Testing and Materials (ASTM), American Association of State Highway and Transportation Officials (AASHTO), and current local practices:

- Percent Passing No. 200 Sieve (ASTM D-1140)

- Liquid and Plastic Limits (ASTM D-4318)
- Soil Classification (ASTM D-2487, ASTM D-2488, and AASHTO M145)
- Gradation (ASTM D6913)

Laboratory test results were used to characterize the engineering properties of the subsurface material. For soil classification, RockSol conducted sieve analyses and Atterberg Limits tests. All laboratory tests were performed by RockSol. Laboratory test results are presented in Appendix D and are also summarized on the Test Pit Soil Logs presented in Appendix C. Please note that soil gradation curves are approximate and do not reflect all oversized material excavated and present in the site soil stratigraphy.

6.0 SITE SOIL AND BEDROCK CHARACTERIZATION

6.1 Surficial Materials

Surficial soils at test pit locations generally consist of a relatively thin cover of silty to clayey sand topsoil, approximately 2 to 6 inches in thickness and ranging from supporting a sparse to moderate cover of vegetation.

6.2 Subsurface Materials

Descriptions of the surface and subsurface conditions encountered in the test pits are provided below and are summarized in Table 6.1 – Test Pit Summary and also summarized on the Soil Logs presented in Appendix C.

Test Pit 1 (TP-1)

Fill Soils

Fill soils were not encountered at this location.

Native Soils

Native soils were encountered immediately beneath the topsoil to the total excavated depth of 5.6 feet and generally consisted of a silty to clayey fine grain sand with gravel with cobbles and boulders intermixed. Cobbles ranged from 6 to 10 inches and increased in size with excavation depth. Boulders generally ranged from 18 to 24 inches in size and were encountered approximately 4 feet blow existing grades. Excavation refusal occurred at 5.6 feet with the 410E backhoe due to boulders.

Bedrock

Bedrock was not encountered at this location to the excavated depth of 5.6 feet.

Groundwater

Groundwater was not encountered at this location at time of sampling.

Test Pit 2 (TP-2)

Fill Soils

Fill soils were not encountered at this location.

Native Soils

Native soils were encountered immediately beneath the topsoil to the total excavated depth of 7.5 feet and generally consisted of a silty to clayey fine grain sand with gravel with cobbles and boulders intermixed. Cobbles ranged from 6 to 10 inches and increased in size with excavation depth. Boulders generally ranged from 12 to 18 inches in size and were encountered approximately 4 feet blow existing grades.

Bedrock

Bedrock was not encountered at this location to the excavated depth of 7.5 feet.

Groundwater

Groundwater was not encountered at this location at time of sampling.

Test Pit 3 (TP-3)

Fill Soils

Fill soils were not encountered at this location.

Native Soils

Native soils were encountered immediately beneath the topsoil to the total excavated depth of 7.5 feet and generally consisted of a silty to clayey fine grain sand with gravel with cobbles and boulders intermixed. Mineralization was noted in the upper 2 feet of the Native material immediately below the topsoil. Cobbles ranged from 6 to 10 inches and increased in size with excavation depth. Boulders generally ranged from 18 to 24 inches in size and were encountered approximately 4 feet blow existing grades.

Bedrock

Bedrock was not encountered at this location to the excavated depth of 7.5 feet.

Groundwater

Groundwater was not encountered at this location at time of sampling.

Test Pit 4 (TP-4)

Fill Soils

Fill soils were not encountered at this location.

Native Soils

Native soils were encountered immediately beneath the topsoil to approximately 2 feet below existing grades and generally consisted of a calcareous clay, consistent with the severely weathered material of the underlying claystone bedrock.

Bedrock

Bedrock consisted of claystone and was encountered approximately 2 feet below existing grade. Mineralization and iron staining were noted during excavation. The hardness of the claystone bedrock increased with excavation depth but was easily rippable to the total excavated depth of 7.5 feet.

Groundwater

Groundwater was not encountered at this location at time of sampling.

Test Pit 5 (TP-5)

Fill Soils

Fill soils were not encountered at this location.

Native Soils

Native soils were encountered immediately beneath the topsoil to approximately 5 feet below existing grades and generally consisted of a silty to clayey fine grain sand with gravel with cobbles intermixed. Cobbles ranged from 6 to 10 inches.

Bedrock

Bedrock was encountered approximately 5 feet below existing grade and consisted of weathered claystone. Mineralization and iron staining were noted during excavation. The hardness of the claystone bedrock increased with excavation depth but was easily rippable to the total excavated depth of 7.5.

Groundwater

Groundwater was not encountered at this location at time of sampling.

Test Pit 6 (TP-6)

Fill Soils

Fill soils were not encountered at this location.

Native Soils

Native soils were encountered immediately beneath the topsoil to approximately 3.5 feet below existing grades and generally consisted of a calcareous clay, consistent with the severely weathered material of the underlying claystone bedrock.

Bedrock

Bedrock consisted of claystone and was encountered approximately 3.5 feet below existing grade. Mineralization and iron staining were noted during excavation. The hardness of the claystone bedrock increased with excavation depth but was easily rippable to the total excavated depth of 8.0 feet.

Groundwater

Groundwater was not encountered at this location at time of sampling.

Test Pit 7 (TP-7)

Fill Soils

Fill soils were not encountered at this location.

Native Soils

Native soils were encountered immediately beneath the topsoil to approximately 2 feet below existing grades and generally consisted of a calcareous clay, consistent with the severely weathered material of the underlying claystone bedrock.

Bedrock

Bedrock consisted of claystone and was encountered approximately 2 feet below existing grade. Mineralization and iron staining were noted during excavation. The hardness of the claystone

bedrock increased with excavation depth but was easily rippable to the total excavated depth of 7.5 feet.

Groundwater

Groundwater was not encountered at this location at time of sampling.

Test Pit 8 (TP-8)

Fill Soils

Fill soils were not encountered at this location.

Native Soils

Native soils were encountered immediately beneath the topsoil to approximately 3.5 feet below existing grades and generally consisted of a calcareous clay, consistent with the severely weathered material of the underlying claystone bedrock.

Bedrock

Bedrock consisted of claystone and was encountered approximately 3.5 feet below existing grade. Mineralization and iron staining were noted during excavation. The hardness of the claystone bedrock increased with excavation depth but was easily rippable to the total excavated depth of 7.5 feet.

Groundwater

Groundwater was not encountered at this location at time of sampling.

Test Pit 9 (TP-9)

Fill Soils

Fill soils were not encountered at this location.

Native Soils

Native soils were encountered immediately beneath the topsoil to approximately 3 feet below existing grades and generally consisted of a calcareous clay, consistent with the severely weathered material of the underlying claystone bedrock.

Bedrock

Bedrock consisted of claystone and was encountered approximately 3 feet below existing grade. Mineralization and iron staining were noted during excavation. The hardness of the claystone bedrock increased with excavation depth but was easily rippable to the total excavated depth of 7.0 feet.

Groundwater

Groundwater was not encountered at this location at time of sampling.

Test Pit 10 (TP-10)

Fill Soils

Fill soils were encountered immediately below the topsoil to 2 feet below existing grade and appears to be associated with grading operations associated with Hallenbeck Reservoir Dam

construction performed in 2016. Fill material generally consisted of a sandy clay with gravel and cobbles intermixed.

Native Soils

Native soils were encountered from 2 feet to approximately 4 feet below existing grades and generally consisted of a calcareous clay, consistent with the severely weathered material of the underlying claystone bedrock.

Bedrock

Bedrock consisted of claystone and was encountered approximately 4 feet below existing grade. Mineralization and iron staining were noted during excavation. The hardness of the claystone bedrock increased with excavation depth but was easily rippable to the total excavated depth of 7.5 feet.

Groundwater

Groundwater was not encountered at this location at time of sampling.

Table 6.1 – Test Pit Summary

Test Pit Number	Latitude	Longitude	Depth to Bedrock (feet) (Note 1)	Cobbles or Boulders Encountered? (Yes/No)	Excavation Refusal? (Yes/No)	Total Excavated Depth (feet)
TP-1	38.961687°	-108.273083°	Not Encountered	Yes	Yes John Deere 410E Backhoe	5.6
TP-2	38.961371°	-108.276353°	Not Encountered	Yes	No	7.5
TP-3	38.961379°	-108.281143°	Not Encountered	Yes	No	7.5
TP-4	38.962292°	-108.284269°	2.0	No	No	7.5
TP-5	38.962920°	-108.285592°	5.0	Yes	No	7.5
TP-6	38.963237°	-108.287625°	3.5	No	No	8.0
TP-7	38.964401°	-108.290732°	2.0	No	No	7.5
TP-8	38.964191°	-108.293359°	3.5	No	No	7.5
TP-9	38.966041°	-108.292880°	3.0	No	No	7.0
TP-10	38.967549°	-108.294069°	4.0	No	No	7.5

***Note 1: Depth to bedrock was determined by relative competency while excavation was taking place. Severely weathered bedrock was encountered above competent bedrock at all locations where bedrock was encountered and was composed of similar material.**

7.0 TRENCH EXCAVATION DISCUSSION

Based on information provided to RockSol, a minimum of 36-inches of cover is required over the proposed 20-inch PVC pipeline. Depending on bedding requirements for the pipeline, the depth of the of trench excavation will be approximately 5 to 5.5 feet below existing grade. Depending on backfill specifications, trench width should be sufficient for compaction equipment access on either side of the PVC pipeline (jumping jack, plate compactor, or similar equipment). For efficient excavation, an excavator (such as the one used for Test Pits TP-3 through TP-10) with a minimum bucket size of 1.0 cubic yard is suggested. In RockSol's construction observation experience, this type of excavator and bucket size should be sufficient to excavate through the cobbles and boulders of the sizes encountered at the Test Pit locations.

Proper construction practices and adherence to project plans and specifications should be followed during site preparation, earthwork, excavations, and construction of utilities, roadway surfacing, and structures for the suitable long-term performance of the proposed improvements. Excavation support should be provided to maintain onsite safety and the stability of excavations and slopes. Excavations shall be constructed in accordance with local, state, and federal regulations including OSHA guidelines. The contractor must provide a competent person to determine compliance with OSHA excavation requirements. For preliminary planning, native soils may be considered as OSHA Type C soils and the claystone bedrock/shale may be considered as OSHA Type B soil.

7.1 Subsurface Soil Variability

In general, soil types vary from a silty to clayey sand with cobbles and boulders intermixed (TP-1 through TP-3) to highly calcareous clay underlain by rippable claystone bedrock (TP-4 through TP-10). Although excavator refusal was encountered at TP-1 with the John Deere 410E Backhoe, refusal depth was approximately at the bottom of trench excavation depth.

The actual subsurface conditions between test pit locations may vary from the information obtained at specific test pit locations and described in this report.

8.0 TRENCH BACKFILL DISCUSSION

All embankment placement, subgrade preparation, and backfill placement shall be performed in accordance with City of Grand Junction's *Standard Contract Documents for Capital Improvements Construction,* Revised July 2010, or if more stringent, as specified by recommendations in this report.

8.1 Trench Foundation Preparation

Prior to pipeline construction, the excavation limits should be properly prepared by removal of all organic matter (topsoil), debris, loose material, and any deleterious material identified by the Project Engineer. The bottom of the trench should be prepared as a firm and uniform foundation.

8.2 Backfill Specifications

Backfill placement shall be performed in accordance with City of Grand Junction requirements. Sufficient bedding under the pipe and cover over the pipe should be used to prevent point-loading on the PVC pipeline from the trench foundation and overlying backfill material, if excavated (native) material is allowed for backfill material after cover over the pipeline is established. To achieve proper compaction of the excavated material significant moisture conditioning is anticipated and oversized material (greater than 6-inch diameter) may need to be segregated and not allowed to be placed in the backfill zone above the pipe.

8.3 Compaction Specifications

The minimum compaction recommended for all soil classifications for this project by RockSol is presented in Appendix E, Typical Trench Detail from City of Grand Junction's *Standard Details for Construction of Streets, Trails, Storm Drains and Utilities* within *Contract Documents for Capital Improvements Construction,* Revised July 2010. Table 8.1 summarizes the compaction and moisture requirements outlined in section 103.14 of City of Grand Junction's *Standard Specifications for Construction of Underground Utilities.*

Table 8.1 – Compaction Specifications

Type of Material	Relative Compaction Percent of Maximum	Moisture Content Deviation from Optimum
All Backfill Material	95% Min. AASHTO T-99 (Standard Proctor Method)	-2% to +2%
All Backfill Material	90% Min. AASHTO T-180 (Modified Proctor Method)	-2% to +2%

A representative of the geotechnical engineer should observe and test fill placement operations.

9.0 OTHER DESIGN AND CONSTRUCTION CONSIDERATIONS

Surface drainage patterns may be altered during construction and surface drainage must be controlled to prevent water ponding and excessive moisture infiltration into the trench profile during and after construction, especially in the bottom of the trench excavation during construction.

10.0 LIMITATIONS

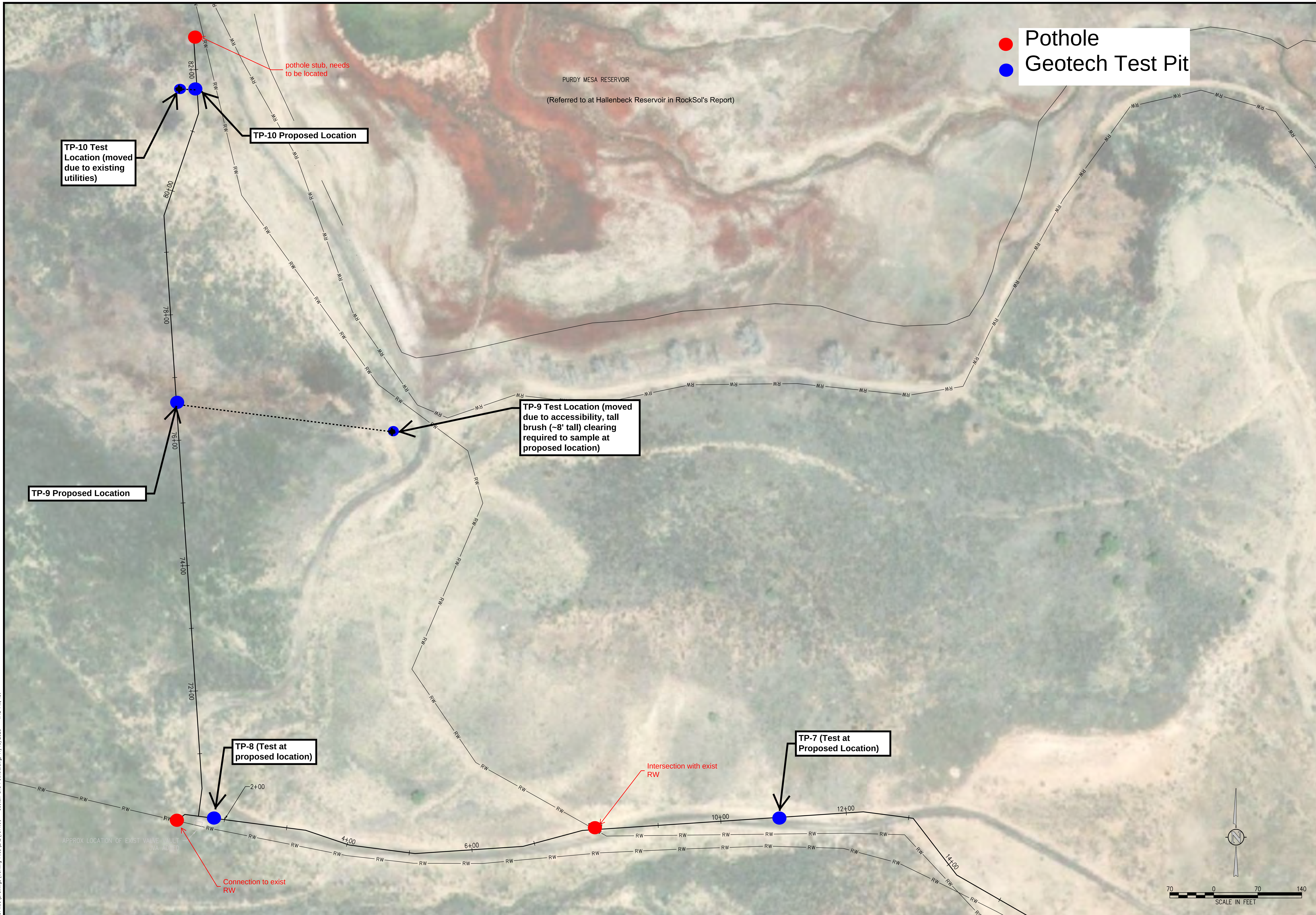
This geotechnical investigation was conducted in general accordance with the scope of work to provide geotechnical support for construction of the Juniata Inlet Reroute at Juniata Reservoir.

Surface and groundwater hydrology, hydraulic engineering, and environmental studies including contaminant characterization were not included in RockSol's geotechnical scope of work.

The geotechnical practices are similar to that used in Colorado with similar soil conditions and our understanding of the proposed work. This report has been prepared by RockSol for the City of Grand Junction exclusively for the project described in this report. The report is based on our exploratory test pits and does not take into account variations in the subsurface conditions that may exist between test pits. Additional investigation is required to address such variation. If during construction activities, materials or water conditions appear to be different from those described herein, RockSol should be advised at once so that a re-evaluation of the recommendations presented in this report can be made. RockSol is not responsible for liability associated with interpretation of subsurface data by others.

APPENDIX A

PROPOSED WATERLINE ALIGNMENT
(FIGURES 1 THROUGH 4)
(CREATED BY JVA, INC.)
PROVIDED BY THE CITY OF GRAND JUNCTION


Pothole
Geotech Test Pit
PURDY MESA RESERVOIR
(Referred to at Hallenbeck Reservoir in RockSol's Report)
pothole stub, needs to be located
TP-10 Proposed Location
TP-10 Test Location (moved due to existing utilities)
TP-9 Test Location (moved due to accessibility, tall brush (~8' tall) clearing required to sample at proposed location)
TP-9 Proposed Location
TP-8 (Test at proposed location)
TP-7 (Test at Proposed Location)
Intersection with exist RW
Connection to exist RW
82+00
80+00
78+00
76+00
74+00
72+00
2+00
4+00
6+00
10+00
12+00
14+00
RW
SCALE IN FEET

CONSULTING ENGINEERS
JVA, Inc. 817 Colorado Ave., Suite 301
Glenwood Springs, CO Zip 81601
970.404.3100
www.jvajva.com
Boulder • Fort Collins • Winter Park
Glenwood Springs • Denver

NO.	DATE	DES'D	DWN	REVISION DESCRIPTION

DESIGNED BY:	CDB/LAL
DRAWN BY:	MHT
CHECKED BY:	JJM
JOB #:	1071.6e
DATE:	OCTOBER 2020

CITY OF GRAND JUNCTION
JUNIATA RESERVOIR INLET REROUTE
GRAND JUNCTION, COLORADO

PROPOSED ALIGNMENT

SHEET NO.
FIG 1

N:\1071.6e\Drawings\Working Files\LAL\1071.6e – Geotch and Pothole.dwg, 11/13/2020 – 4:12 PM, lat

Pothole
Geotech Test Pit

TP-6 (Test at proposed Location)

TP-5 (Test at proposed Location)

TP-4 Test Location (moved due to accessibility, steepness of slope)

TP-4 Proposed Location

EXIST WATERLINE (TYP)

14+00 16+00 18+00 20+00 22+00 24+00 26+00 28+00 30+00 32+00 90+00 92+00 94+00 96+00 34+00 36+00

RW

70 0 70 140
SCALE IN FEET

JVA, Inc. 817 Colorado Ave., Suite 301
Glenwood Springs, CO Zip 81601
970.404.3100
www.jvajva.com
Boulder • Fort Collins • Winter Park
Glenwood Springs • Denver

NO.	DATE	DES'D	D'WN	REVISION DESCRIPTION

DESIGNED BY: CDB/LAL
DRAWN BY: MHT
CHECKED BY: JJM
JOB #: 1071.6e
DATE: OCTOBER 2020

CITY OF GRAND JUNCTION
JUNIATA RESERVOIR INLET REROUTE
GRAND JUNCTION, COLORADO

PROPOSED ALIGNMENT

SHEET NO.
FIG 2

N:\1071.6e\Drawings\Working Files\LAL\1071.6e - Geotech and Pothole.dwg, 11/13/2020 - 4:19 PM, lal

Pothole
Geotech Test Pit

TP-3 (Test at proposed location)

36+00 38+00 40+00 42+00 44+00 46+00 48+00 50+00 52+00 54+00

RW

70 0 70 140
SCALE IN FEET

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Glenwood Springs, CO Zip 81601
970.404.3100
www.jvajva.com
Boulder • Fort Collins • Winter Park
Glenwood Springs • Denver

NO.	DATE	DES'D	D'WN	REVISION DESCRIPTION

DESIGNED BY: CDB/LAL
DRAWN BY: MHT
CHECKED BY: JJM
JOB #: 1071.6e
DATE: OCTOBER 2020

CITY OF GRAND JUNCTION
JUNIATA RESERVOIR INLET REROUTE
GRAND JUNCTION, COLORADO

PROPOSED ALIGNMENT

SHEET NO.
FIG 3

N:\1071.6e\Drawings\Working Files\LAL\1071.6e - Geotech and Pothole.dwg, 11/13/2020 - 4:20 PM, lat

Pothole
Geotech Test Pit

TP-2 Proposed Location

TP-2 Test Location (moved due to accessibility, thick brush and trees associated with existing ditch, clearing required to sample at proposed location)

TP-1 (Test at proposed location)

Pothole at connection to RW

48+00 50+00 52+00 54+00 56+00 58+00 60+00 62+00 64+00

RW

70 0 70 140
SCALE IN FEET

JVA, Inc. 817 Colorado Ave., Suite 301
Glenwood Springs, CO Zip 81601
970.404.3100
www.jvajva.com
Boulder • Fort Collins • Winter Park
Glenwood Springs • Denver

NO.	DATE	DES'D	DWN	REVISION DESCRIPTION

DESIGNED BY: CDB/LAL
DRAWN BY: MHT
CHECKED BY: JJM
JOB #: 1071.6e
DATE: OCTOBER 2020

CITY OF GRAND JUNCTION
JUNIATA RESERVOIR INLET REROUTE
GRAND JUNCTION, COLORADO

PROPOSED ALIGNMENT

SHEET NO.
FIG 4

N:\1071.6e\Drawings\Working Files\LAL\1071.6e - Geotech and Pothole.dwg, 11/13/2020 - 4:21 PM, lot

APPENDIX B

TEST PIT SAMPLING PHOTOGRAPH SUMMARY

TP-1 (Page 1 of 2)

- Top-Left: Test Pit location looking West.
- Top-Right: Test Pit location looking North, placing excavated material on existing spoils pile.
- Bottom-Left: Test Pit location looking North, existing waterline exposed in foreground.
- Bottom-Right: Test Pit location looking North, existing concrete structure in foreground.

TP-1 (Page 2 of 2)

- Left and Right: Test Pit at total excavated depth.

TP-2 (Page 1 of 2)

- Top-Left: Test Pit location looking to the Northeast. (Proposed test location is approximately 20 feet behind the boom of the backhoe, clearing was required to sample at proposed location)
- Top Right: Test Pit location looking to the East.
- Bottom-Left: Test Pit Location looking to the Northeast.
- Bottom Right: Test Pit location looking to the West, Test Pit in the foreground.

TP-2 (Page 2 of 2)

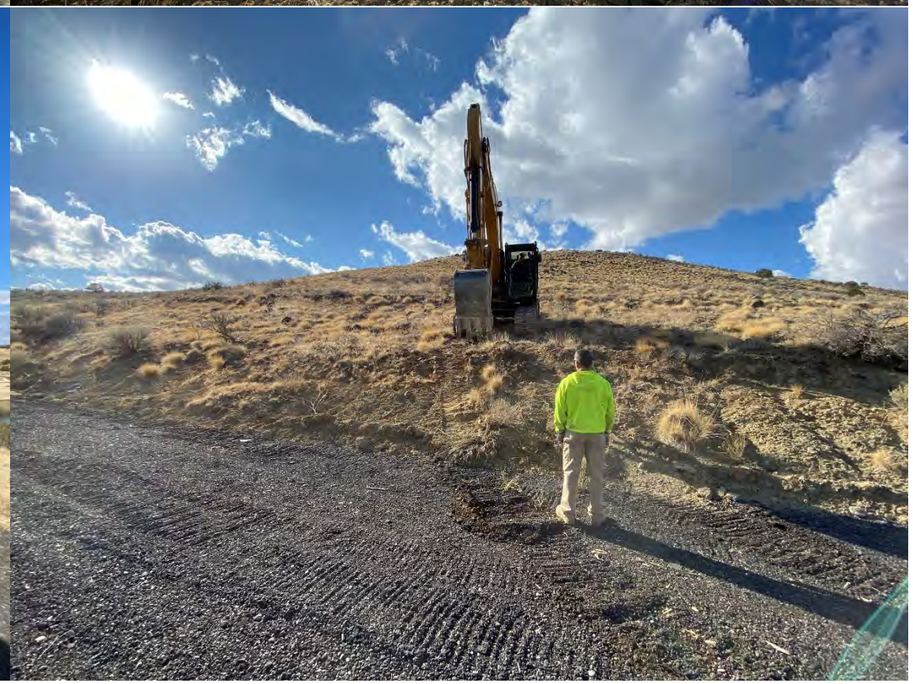
- Left: Excavated Material from Test Pit, 1.5” steel pipe was removed while excavating at an approximate depth of 1.5’ below existing grade. City of Grand Junction stated line was abandoned.
- Right: Excavated material from Test Pit.

TP-3 (Page 1 of 2)

- Top-Left: Test Pit location looking to the North.
- Top-Right: Test Pit location looking to the Northwest, Juniata Reservoir Orientation sign in the background.
- Bottom-Left: Test Pit location looking to the West, access road surfaced with recycled asphalt millings in background.

TP-3 (Page 2 of 2)

- Test Pit near total excavated depth.



TP-4 (Page 1 of 1)

- Top-Left: Test Pit location looking to the East, location at the top of the existing road cut scar associated with the access road surfaced in recycled asphalt millings.
- Top-Right: Test Pit location looking to the Southwest.
- Bottom-Left: Test Pit location looking to the East.
- Bottom-Right: Test Pit location looking to the South.
- Proposed location ~40’ further uphill, intent of moving the location downhill was to excavate the test pit while on road, but excavator was capable of traversing the slope and keeping the road surface clear of excavated material.

TP-5 (Page 1 of 2)

- Top-Left: Test Pit location looking to the Northwest.
- Top-Right: Test Pit location looking to the East, access road in the background to the South.
- Bottom-Left: Test Pit location looking to the Northeast.

TP-5 (Page 2 of 2)

- Excavated material from Test Pit

TP-6 (Page 1 of 1)

- Top-Left: Test Pit location looking to the North, access road surfaced with recycled asphalt milling in background.
- Top-Right: Test Pit location looking to the Northwest
- Bottom-Left: Test pit location looking to the Southwest, Excavated material from Test Pit in foreground.

TP-7 (Page 1 of 2)

- Top-Left: Test Pit location looking to the Northeast, location at the top of the road cut scar associated with the access road surfaced with recycled asphalt millings.
- Top-right: Test pit location looking to the East.
- Bottom-Left: Test Pit location looking to the Southeast

TP-7 (Page 2 of 2)

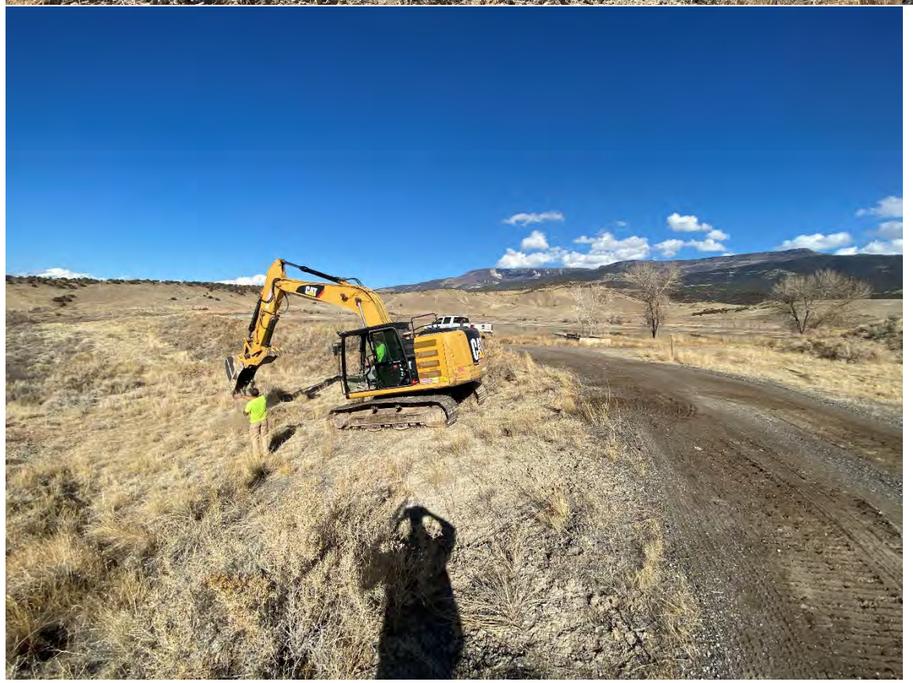
- Excavated material from Test Pit.

TP-8 (Page 1 of 2)

- Top-Left: Test Pit Location looking to the Northeast, Excavator sitting on access road while excavating for test pit.
- Top-Right: Test Pit location looking to the West.
- Bottom-Left: Test Pit location looking to the Northwest.

TP-8 (Page 2 of 2)

- Excavated Material from Test Pit



TP-9 (Page 1 of 1)

- Top-Left: Test Pit location looking to the Southwest.
- Top-Right: Test Pit location looking to the West. (Approximate proposed Test pit location is denoted with red dot)
- Bottom Left: Test Pit location looking to the North.
- Test location was moved due to tall brush between test location and proposed location. Clearing was required to sample at proposed location.

TP-10 (Page 1 of 1)

- Top-Left: Test Pit location looking to the West.
- Top-Right: Test Pit location looking to the North, City of Grand Junction facilities in the background, existing waterline marked to the East.
- Bottom-Left: Test Pit location looking to the East, backside of Hallenbeck Reservoir Dam in background.
- Proposed location was moved to ensure clearance around existing marked waterline (shown in top-right, emphasized with dotted blue line)

APPENDIX C

LEGEND
AND
INDIVIDUAL TEST PIT SOIL LOGS

RockSol Consulting Group, Inc.

LEGEND

CLIENT City of Grand Junction
PROJECT NAME Juniata Inlet Reroute Project
PROJECT NUMBER 599.19
PROJECT LOCATION Mesa County, Colorado

LITHOLOGY

- Fill - CLAY, sandy
- TOPSOIL
- Native - SAND, silty
- Native - SAND, clayey
- Native - CLAY
- Native - CLAY, sandy
- Bedrock - CLAYSTONE

SAMPLE TYPE

- Bulk Sample (Auger Cuttings)
- GRAB SAMPLE FROM CUTTINGS

Fines Content indicates amount of material, by weight, passing the US No 200 Sieve (%)

RockSol Consulting Group, Inc.

TEST PIT : TP-1

CLIENT City of Grand Junction
PROJECT NAME Juniata Inlet Reroute Project
PROJECT NUMBER 599.19
PROJECT LOCATION Mesa County, Colorado
DATE STARTED 11/23/20 **COMPLETED** 11/23/20
GROUND ELEVATION _____ **STATION NO.** _____
EXCAVATION CONTRACTOR City of Grand Junction
LATITUDE 38.961687° **LONGITUDE** -108.273083°
EXCAVATION METHOD Open Excavation **TEST PIT SIZE** N/A
BORING LOCATION: ~30' E of exist conc structure, ~20' N on exposed WL
LOGGED BY J. Sphatt **HAMMER TYPE** N/A
GROUND WATER LEVELS:
NOTES Deere 410E Backhoe
WATER DEPTH None Encountered on 11/23/20

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE	BLOW COUNTS	SWELL POTENTIAL (%)	SULFATE (%)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
	0		(Topsoil) SAND, silty with gravel, sparse vegetation cover, light reddish brown										
			(Native) SAND, clayey, with 6"-10" cobbles, slightly moist, light reddish brown	B BULK						34	18	16	23.4
			Approximate Bulk Depth 0-4 Liquid Limit= 34 Plastic Limit= 18 Plasticity Index= 16 Fines Content= 23.4										
	1												
	2												
	3												
	4		Native) SAND, clayey, with ~24" boulders, slightly moist, reddish brown										
	5												
			Bottom of test pit at 5.6 feet.										

LOG - STANDARD 599.19_JUNIATA INLET REROUTE, MESA COUNTY.GPJ 12/16/20

RockSol Consulting Group, Inc.

TEST PIT : TP-2

CLIENT City of Grand Junction
PROJECT NAME Juniata Inlet Reroute Project
PROJECT NUMBER 599.19
PROJECT LOCATION Mesa County, Colorado
DATE STARTED 11/23/20 **COMPLETED** 11/23/20
GROUND ELEVATION _____ **STATION NO.** _____
EXCAVATION CONTRACTOR City of Grand Junction
LONGITUDE 38.961371° **LONGITUDE** -108.276353°
EXCAVATION METHOD Open Excavation **TEST PIT SIZE** N/A
BORING LOCATION: ~30' S of ditch
LOGGED BY J. Sphatt **HAMMER TYPE** N/A
GROUND WATER LEVELS:
NOTES Deere 410E Backhoe
WATER DEPTH None Encountered on 11/23/20

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE	BLOW COUNTS	SWELL POTENTIAL (%)	SULFATE (%)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS			FINES CONTENT (%)
										LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
	0.0		(Topsoil) SAND, silty, sparse vegetation cover, light reddish brown	B BULK						38	23	15	28.3
			(Native) SAND, clayey with gravel, slightly moist, light reddish brown Abandoned 1.5" diameter steel pipe @ ~1' **Approximate Bulk Depth 0-4** Liquid Limit= 38 Plastic Limit= 23 Plasticity Index= 15 Fines Content= 28.3										
	2.5		(Native) SAND, clayey, with 6"-10" cobbles intermixed, slightly moist, light reddish brown										
	5.0		(Native) SAND, clayey, with 12"-18" boulders intermixed, slightly moist, light reddish brown										
	7.5		Bottom of test pit at 7.5 feet.										

LOG - STANDARD 599.19_JUNIATA INLET REROUTE, MESA COUNTY.GPJ 12/16/20

RockSol Consulting Group, Inc.

TEST PIT : TP-3

CLIENT City of Grand Junction
PROJECT NAME Juniata Inlet Reroute Project
PROJECT NUMBER 599.19
PROJECT LOCATION Mesa County, Colorado
DATE STARTED 11/23/20 **COMPLETED** 11/23/20
GROUND ELEVATION _____ **STATION NO.** _____
EXCAVATION CONTRACTOR City of Grand Junction
LATITUDE 38.961379º **LONGITUDE** -108.281143º
EXCAVATION METHOD Open Excavation **TEST PIT SIZE** N/A
BORING LOCATION: 75' E of water sign, 60' E/SE of gravel access rd curve, LT track of 2-track access rd as looking W
LOGGED BY J. Sphatt **HAMMER TYPE** N/A
GROUND WATER LEVELS:
NOTES Cat 316E Excavator
WATER DEPTH None Encountered on 11/23/20

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE	BLOW COUNTS	SWELL POTENTIAL (%)	SULFATE (%)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
	0.0		(Topsoil) SAND, silty, sparse vegetation cover, light reddish brown	BULK						40	22	18	60.1
			(Native) CLAY, sandy with gravel and cobbles, slightly moist, very light brown, high gypsum content	GB									
			Approximate Bulk Depth 0-2 Liquid Limit= 40 Plastic Limit= 22 Plasticity Index= 18 Fines Content= 60.1										
	2.5		(Native) SAND, silty with cobbles, slightly moist, light brown	BULK						NP	NP	NP	18.5
			Approximate Bulk Depth 2-7.5 Liquid Limit= NP Plastic Limit= NP Plasticity Index= NP Fines Content= 18.5										
	5.0		(Native) SAND, silty with 18"-24" boulders										
	7.5		Bottom of test pit at 7.5 feet.										

RockSol Consulting Group, Inc.

TEST PIT : TP-4

CLIENT City of Grand Junction
PROJECT NAME Juniata Inlet Reroute Project
PROJECT NUMBER 599.19
PROJECT LOCATION Mesa County, Colorado
DATE STARTED 11/23/20 **COMPLETED** 11/23/20
GROUND ELEVATION _____ **STATION NO.** _____
EXCAVATION CONTRACTOR City of Grand Junction
LATITUDE 38.962292º **LONGITUDE** -108.284269º
EXCAVATION METHOD Open Excavation **TEST PIT SIZE** N/A
BORING LOCATION: S side of gravel access rd, in road cut slope, top of excavation @ brow of cut
LOGGED BY J. Sphatt **HAMMER TYPE** N/A
GROUND WATER LEVELS:
NOTES Cat 316E Excavator
WATER DEPTH None Encountered on 11/23/20

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE	BLOW COUNTS	SWELL POTENTIAL (%)	SULFATE (%)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
	0.0		(Topsoil) SAND, silty, moderate grass cover, light brown										
			(Native) CLAY, (severely weathered CLAYSTONE), slightly moist, light brown, calcareous	B BULK						38	17	21	95.5
			Approximate Bulk Depth 0.5-2 Liquid Limit= 38 Plastic Limit= 17 Plasticity Index= 21 Fines Content= 95.5										
	2.5		(Bedrock) CLAYSTONE, weathered, slightly moist, light brown, iron staining, seams of slight mineralization	B BULK						34	16	18	79.1
			Approximate Bulk Depth 2-7.5 Liquid Limit= 34 Plastic Limit= 16 Plasticity Index= 18 Fines Content= 79.1										
	5.0												
	7.5		Bottom of test pit at 7.5 feet.										

RockSol Consulting Group, Inc.

TEST PIT : TP-5

CLIENT City of Grand Junction
PROJECT NAME Juniata Inlet Reroute Project
PROJECT NUMBER 599.19
PROJECT LOCATION Mesa County, Colorado
DATE STARTED 11/23/20 **COMPLETED** 11/23/20
GROUND ELEVATION _____ **STATION NO.** _____
EXCAVATION CONTRACTOR City of Grand Junction
LATITUDE 38.962920º **LONGITUDE** -108.285592º
EXCAVATION METHOD Open Excavation **TEST PIT SIZE** N/A
BORING LOCATION: N side of access road, ~30' N of shoulder, outside of limits of grading associated w/ access road
LOGGED BY J. Sphatt **HAMMER TYPE** N/A
GROUND WATER LEVELS:
NOTES Cat 316E Excavator
WATER DEPTH None Encountered on 11/23/20

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE	BLOW COUNTS	SWELL POTENTIAL (%)	SULFATE (%)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS			FINES CONTENT (%)
										LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
	0.0		(Topsoil) SAND, silty with gravel, moderate vegetation cover, light brown	B BULK						40	18	22	79.8
			(Native) CLAY, sandy with ~6" cobbles, slightly moist, light reddish brown, slight iron staining **Approximate Bulk Depth 0-5** Liquid Limit= 40 Plastic Limit= 18 Plasticity Index= 22 Fines Content= 79.8										
	2.5												
	5.0		(Bedrock) CLAYSTONE, (severely weathered), slightly moist, light brown **Approximate Bulk Depth** Liquid Limit= 38 Plastic Limit= 19 Plasticity Index= 19 Fines Content= 89.8	B BULK						38	19	19	89.8
	7.5		Bottom of test pit at 7.5 feet.										

RockSol Consulting Group, Inc.

TEST PIT : TP-6

CLIENT City of Grand Junction
PROJECT NAME Juniata Inlet Reroute Project
PROJECT NUMBER 599.19
PROJECT LOCATION Mesa County, Colorado
DATE STARTED 11/23/20 **COMPLETED** 11/23/20
GROUND ELEVATION _____ **STATION NO.** _____
EXCAVATION CONTRACTOR City of Grand Junction
LATITUDE 38.963237° **LONGITUDE** -108.287625°
EXCAVATION METHOD Open Excavation **TEST PIT SIZE** N/A
BORING LOCATION: 80' E of exisiting man hole, ~200' SW of gravel access road
LOGGED BY J. Sphatt **HAMMER TYPE** N/A
GROUND WATER LEVELS:
NOTES Cat 316E Excavator
WATER DEPTH None Encountered on 11/23/20

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE	BLOW COUNTS	SWELL POTENTIAL (%)	SULFATE (%)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
	0.0		(Topsoil) CLAY, sandy with gravel, sparse vegetation cover, light brown	8 BULK						42	31	11	87.9
			(Native) CLAY, (severely weathered CLAYSTONE), slightly moist, light grayish brown										
			Approximate Bulk Depth 0-3.5 Liquid Limit= 42 Plastic Limit= 31 Plasticity Index= 11 Fines Content= 87.9										
	2.5												
			(Bedrock) CLAYSTONE, (weathered), slightly moist, light brown to brown, slight mineralization, iron staining	8 BULK						38	18	20	93.1
			Approximate Bulk Depth 3.5-8 Liquid Limit= 38 Plastic Limit= 18 Plasticity Index= 20 Fines Content= 93.1										
	5.0												
	7.5												
			Bottom of test pit at 8.0 feet.										

RockSol Consulting Group, Inc.

TEST PIT : TP-7

CLIENT City of Grand Junction
PROJECT NAME Juniata Inlet Reroute Project
PROJECT NUMBER 599.19
PROJECT LOCATION Mesa County, Colorado
DATE STARTED 11/23/20 **COMPLETED** 11/23/20
GROUND ELEVATION _____ **STATION NO.** _____
EXCAVATION CONTRACTOR City of Grand Junction
LATITUDE 38.964401° **LONGITUDE** -108.290732°
EXCAVATION METHOD Open Excavation **TEST PIT SIZE** N/A
BORING LOCATION: N side of access rd, ~60' W of fence line, 10' N of shoulder, top of cut
LOGGED BY J. Sphatt **HAMMER TYPE** N/A
GROUND WATER LEVELS:
NOTES Cat 316E Excavator
WATER DEPTH None Encountered on 11/23/20

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE	BLOW COUNTS	SWELL POTENTIAL (%)	SULFATE (%)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS			FINES CONTENT (%)
										LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
	0.0		(Topsoil) CLAY, sandy with gavel, sparse vegetation cover, light brown										
			(Native) CLAY, (severely weathered CLAYSTONE), slightly moist, light brown										
	2.5		(Bedrock) CLAYSTONE, (weathered), slightly moist, light brown	BULK						31	17	14	93.0
			Approximate Bulk Depth 2-7.5 Liquid Limit= 31 Plastic Limit= 17 Plasticity Index= 14 Fines Content= 93.0										
	5.0												
	7.5		Bottom of test pit at 7.5 feet.										

RockSol Consulting Group, Inc.

TEST PIT : TP-8

CLIENT City of Grand Junction
PROJECT NAME Juniata Inlet Reroute Project
PROJECT NUMBER 599.19
PROJECT LOCATION Mesa County, Colorado
DATE STARTED 11/23/20 **COMPLETED** 11/23/20
GROUND ELEVATION _____ **STATION NO.** _____
EXCAVATION CONTRACTOR City of Grand Junction
LATITUDE 38.964191° **LONGITUDE** -108.293359°
EXCAVATION METHOD Open Excavation **TEST PIT SIZE** N/A
BORING LOCATION: S side access road, ~20' S of shoulder
LOGGED BY J. Sphatt **HAMMER TYPE** N/A
GROUND WATER LEVELS:
NOTES Cat 316E Excavator
WATER DEPTH None Encountered on 11/23/20

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE	BLOW COUNTS	SWELL POTENTIAL (%)	SULFATE (%)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
	0.0		(Topsoil) CLAY, sandy with gravel, sparse vegetation cover, light brown	B	BULK					31	17	14	89.4
			(Native) CLAY, (severely weathered CLAYSTONE), slightly moist, light brown										
			Approximate Bulk Depth 0-7.5 Liquid Limit= 31 Plastic Limit= 17 Plasticity Index= 14 Fines Content= 89.4										
	2.5												
			(Bedrock) CLAYSTONE, (weathered), slightly moist, light brown										
	5.0												
			(Bedrock) CLAYSTONE, slightly moist, light brown to brown										
	7.5		Bottom of test pit at 7.5 feet.										

RockSol Consulting Group, Inc.

TEST PIT : TP-9

CLIENT City of Grand Junction
PROJECT NAME Juniata Inlet Reroute Project
PROJECT NUMBER 599.19
PROJECT LOCATION Mesa County, Colorado
DATE STARTED 11/23/20 **COMPLETED** 11/23/20
GROUND ELEVATION _____ **STATION NO.** _____
EXCAVATION CONTRACTOR City of Grand Junction
LATITUDE 38.966041° **LONGITUDE** -108.292880°
EXCAVATION METHOD Open Excavation **TEST PIT SIZE** N/A
BORING LOCATION: ~80' W of spillway structure, W of access road
LOGGED BY J. Sphatt **HAMMER TYPE** N/A
GROUND WATER LEVELS:
NOTES Cat 316E Excavator
WATER DEPTH None Encountered on 11/23/20

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE	BLOW COUNTS	SWELL POTENTIAL (%)	SULFATE (%)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
	0.0		(Topsoil) CLAY, sandy with gravel, sparse to moderate vegetation cover										
			(Native) CLAY, (severely weathered CLAYSTONE), slightly moist, brown										
			Approximate Bulk Depth 2-5 Liquid Limit= 35 Plastic Limit= 17 Plasticity Index= 18 Fines Content= 92.4	B BULK						35	17	18	92.4
	2.5		(Bedrock) CLAYSTONE, (weathered), slightly moist, brown										
	5.0		(Bedrock) CLAYSTONE, slightly moist, brown										
			Bottom of test pit at 7.0 feet.										

RockSol Consulting Group, Inc.

TEST PIT : TP-10

CLIENT City of Grand Junction
PROJECT NAME Juniata Inlet Reroute Project
PROJECT NUMBER 599.19
PROJECT LOCATION Mesa County, Colorado
DATE STARTED 11/23/20 **COMPLETED** 11/23/20
GROUND ELEVATION _____ **STATION NO.** _____
EXCAVATION CONTRACTOR City of Grand Junction
LATITUDE 38.967549º **LONGITUDE** -108.294069º
EXCAVATION METHOD Open Excavation **TEST PIT SIZE** N/A
BORING LOCATION: ~150' W of Dam Rd, ~750' S of maint building
LOGGED BY J. Sphatt **HAMMER TYPE** N/A
GROUND WATER LEVELS:
NOTES Cat 316E Excavator
WATER DEPTH None Encountered on 11/23/20

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE	BLOW COUNTS	SWELL POTENTIAL (%)	SULFATE (%)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS			FINES CONTENT (%)
										LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
	0.0		(Topsoil) CLAY, sandy, moderate vegetation cover										
			(Fill) GRAVEL, clayey with ~4" cobbles, slightly moist, brown	BULK						38	12	26	46.9
			Approximate Bulk Depth 0-2 Liquid Limit= 38 Plastic Limit= 12 Plasticity Index= 26 Fines Content= 46.9										
	2.5		(Native) CLAY, (severely weathered CLAYSTONE), slightly moist, brown	BULK						35	16	19	94.8
			Approximate Bulk Depth 2-7.5 Liquid Limit= 35 Plastic Limit= 16 Plasticity Index= 19 Fines Content= 94.8										
	5.0		(Bedrock) CLAYSTONE, slightly moist, brown, slight iron staining										
	7.5		Bottom of test pit at 7.5 feet.										

APPENDIX D

SUMMARY OF LABORATORY TEST RESULTS

RockSol Consulting Group, Inc.

SUMMARY OF PHYSICAL & CHEMICAL TEST RESULTS

CLIENT City of Grand Junction

PROJECT NAME Juniata Inlet Reroute Project

PROJECT NUMBER 599.19

PROJECT LOCATION Mesa County, Colorado

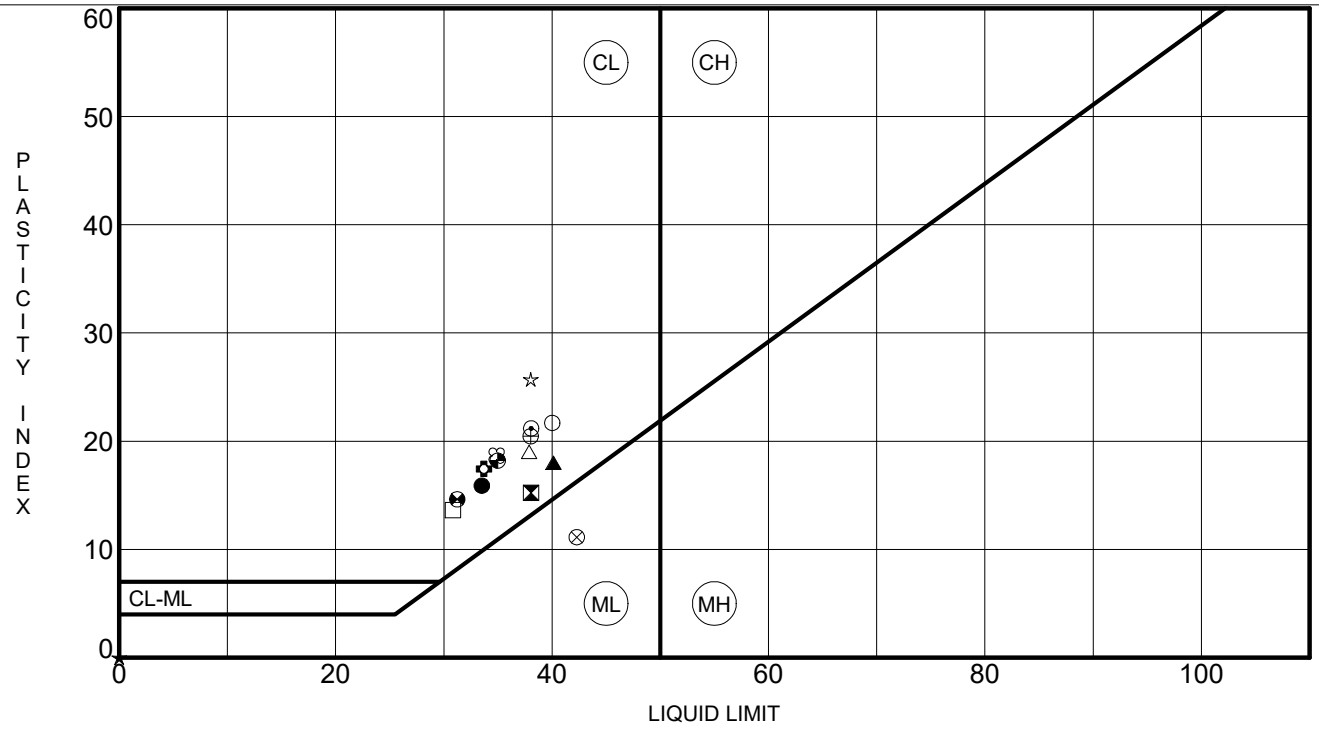
Borehole	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	Swell Potential (%)	%<#200 Sieve	Classification		Water Content (%)	Dry Density (pcf)	Unconfined Compressive Strength (psi)	Sulfate (%)	Resistivity (ohm-cm)	pH	Chlorides (%)	Proctor S=Standard M=Modified		
							USCS	AASHTO								MDD	OMC	S/M
TP-1	0-4	34	18	16		23	SC	A-2-6 (0)										
TP-2	0-4	38	23	15		28	SC	A-2-6 (1)										
TP-3	0-2	40	22	18		60	CL	A-6 (9)										
TP-3	2-7.5	NP	NP	NP		19	SM	A-1-b (0)										
TP-4	0.5-2	38	17	21		96	CL	A-6 (21)										
TP-4	2-7.5	34	16	18		79	CL	A-6 (13)										
TP-5	0-5	40	18	22		80	CL	A-6 (17)										
TP-5	5-7.5	38	19	19		90	CL	A-6 (17)										
TP-6	0-3.5	42	31	11		88	ML	A-7-5 (12)										
TP-6	3.5-8	38	18	20		93	CL	A-6 (19)										
TP-7	2-7.5	31	17	14		93	CL	A-6 (12)										
TP-8	0-7.5	31	17	14		89	CL	A-6 (11)										
TP-9	2-5	35	17	18		92	CL	A-6 (16)										
TP-10	0-2	38	12	26		47	GC	A-6 (7)										
TP-10	2-7.5	35	16	19		95	CL	A-6 (18)										

RockSol Consulting Group, Inc.

ATTERBERG LIMITS RESULTS
AASHTO T89 Method A/T90

CLIENT City of Grand Junction **PROJECT NAME** Juniata Inlet Reroute Project

PROJECT NUMBER 599.19 **PROJECT LOCATION** Mesa County, Colorado



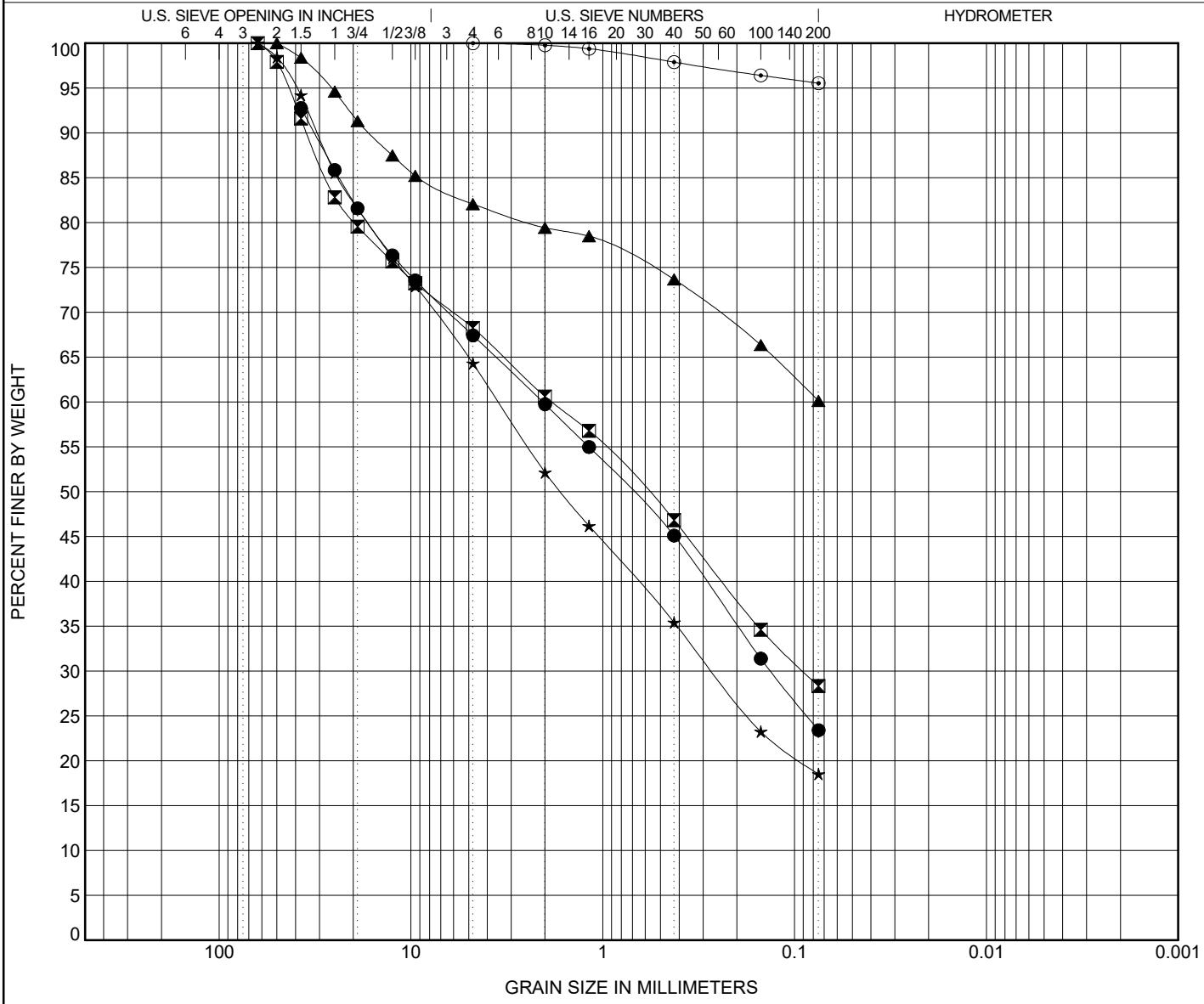
	Specimen Identification		LL	PL	PI	Fines	Classification
●	TP-1	0.0-4.0	34	18	16	23.4	CLAYEY SAND with GRAVEL (SC) (A-2-6)
⊠	TP-2	0.0-4.0	38	23	15	28.3	CLAYEY SAND with GRAVEL (SC) (A-2-6)
▲	TP-3	0.0-2.0	40	22	18	60.1	SANDY LEAN CLAY with GRAVEL (CL) (A-6)
★	TP-3	2.0-7.5	NP	NP	NP	18.5	SILTY SAND with GRAVEL (SM) (A-1-b)
⊙	TP-4	0.5-2.0	38	17	21	95.5	LEAN CLAY (CL) (A-6)
✿	TP-4	2.0-7.5	34	16	18	79.1	LEAN CLAY with GRAVEL (CL) (A-6)
○	TP-5	0.0-5.0	40	18	22	79.8	LEAN CLAY with SAND (CL) (A-6)
△	TP-5	5.0-7.5	38	19	19	89.8	LEAN CLAY (CL) (A-6)
⊗	TP-6	0.0-3.5	42	31	11	87.9	SILT (ML) (A-7-5)
⊕	TP-6	3.5-8.0	38	18	20	93.1	LEAN CLAY (CL) (A-6)
□	TP-7	2.0-7.5	31	17	14	93.0	LEAN CLAY (CL) (A-6)
⊛	TP-8	0.0-7.5	31	17	14	89.4	LEAN CLAY (CL) (A-6)
◒	TP-9	2.0-5.0	35	17	18	92.4	LEAN CLAY (CL) (A-6)
☆	TP-10	0.0-2.0	38	12	26	46.9	CLAYEY GRAVEL with SAND (GC) (A-6)
⊠	TP-10	2.0-7.5	35	16	19	94.8	LEAN CLAY (CL) (A-6)

GRAIN SIZE DISTRIBUTION

Rocksol Consulting Group

CLIENT City of Grand Junction **PROJECT NAME** Juniata Inlet Reroute Project

PROJECT NUMBER 599.19 **PROJECT LOCATION** Mesa County, Colorado



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification			Classification	LL	PL	PI	Cc	Cu
●	TP-1	0.0-4.0	CLAYEY SAND with GRAVEL (SC) (A-2-6)	34	18	16		
⊠	TP-2	0.0-4.0	CLAYEY SAND with GRAVEL (SC) (A-2-6)	38	23	15		
▲	TP-3	0.0-2.0	SANDY LEAN CLAY with GRAVEL (CL) (A-6)	40	22	18		
★	TP-3	2.0-7.5	SILTY SAND with GRAVEL (SM) (A-1-b)	NP	NP	NP		
⊙	TP-4	0.5-2.0	LEAN CLAY (CL) (A-6)	38	17	21		

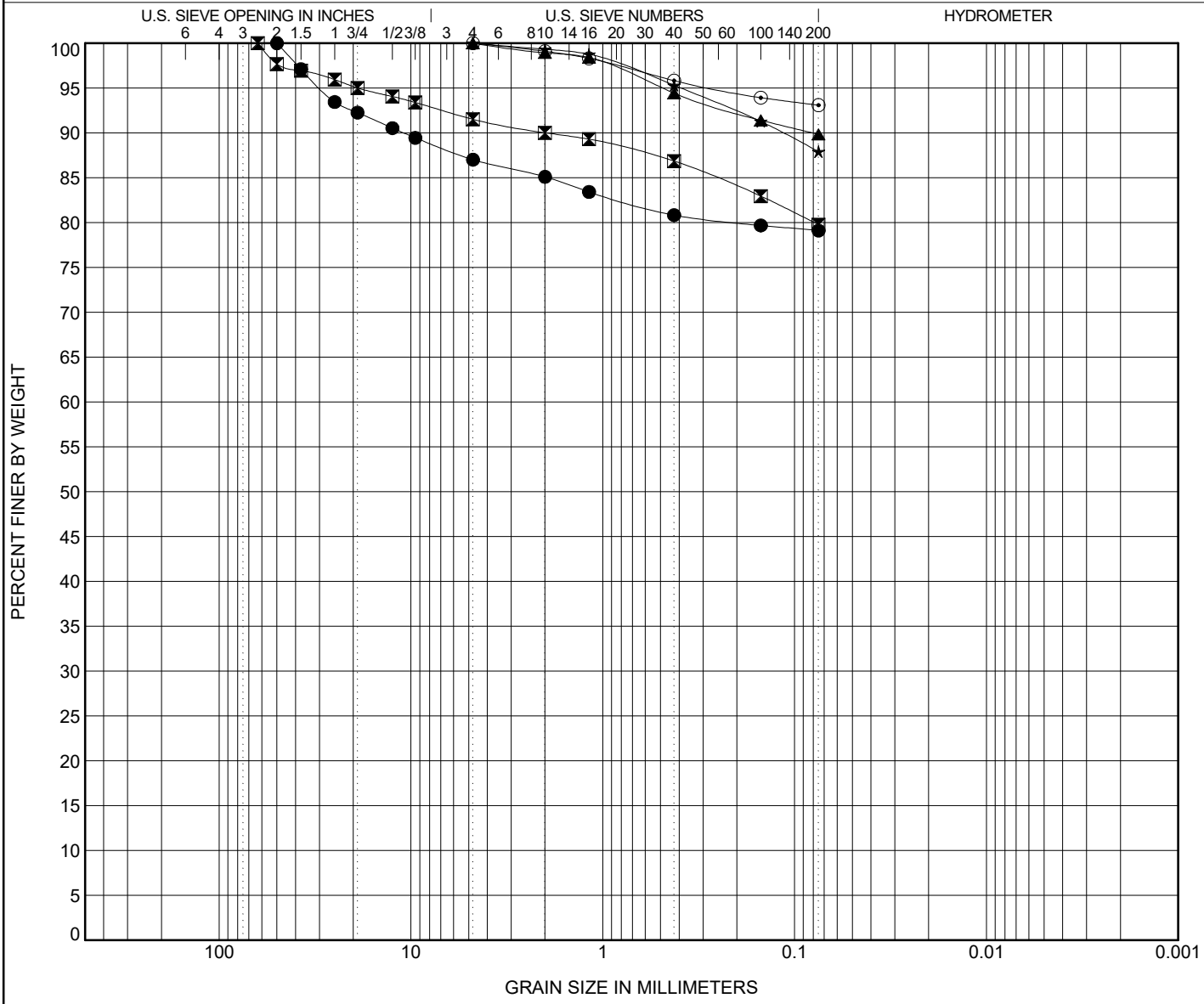
Specimen Identification			D100	D60	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
●	TP-1	0.0-4.0	37.5	2.058	0.133		33.0	14.6	21.7	23.4	
⊠	TP-2	0.0-4.0	63	1.84	0.09		39.4	13.8	18.5	28.3	
▲	TP-3	0.0-2.0	50				20.6	5.7	13.5	60.1	
★	TP-3	2.0-7.5	63	3.497	0.267		47.9	16.7	16.9	18.5	
⊙	TP-4	0.5-2.0	4.75				0.2	1.9	2.3	95.5	

GRAIN SIZE DISTRIBUTION

Rocksol Consulting Group

CLIENT City of Grand Junction **PROJECT NAME** Juniata Inlet Reroute Project

PROJECT NUMBER 599.19 **PROJECT LOCATION** Mesa County, Colorado



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	TP-4	2.0-7.5	LEAN CLAY with GRAVEL (CL) (A-6)	34	16	18		
⊠	TP-5	0.0-5.0	LEAN CLAY with SAND (CL) (A-6)	40	18	22		
▲	TP-5	5.0-7.5	LEAN CLAY (CL) (A-6)	38	19	19		
★	TP-6	0.0-3.5	SILT (ML) (A-7-5)	42	31	11		
⊙	TP-6	3.5-8.0	LEAN CLAY (CL) (A-6)	38	18	20		

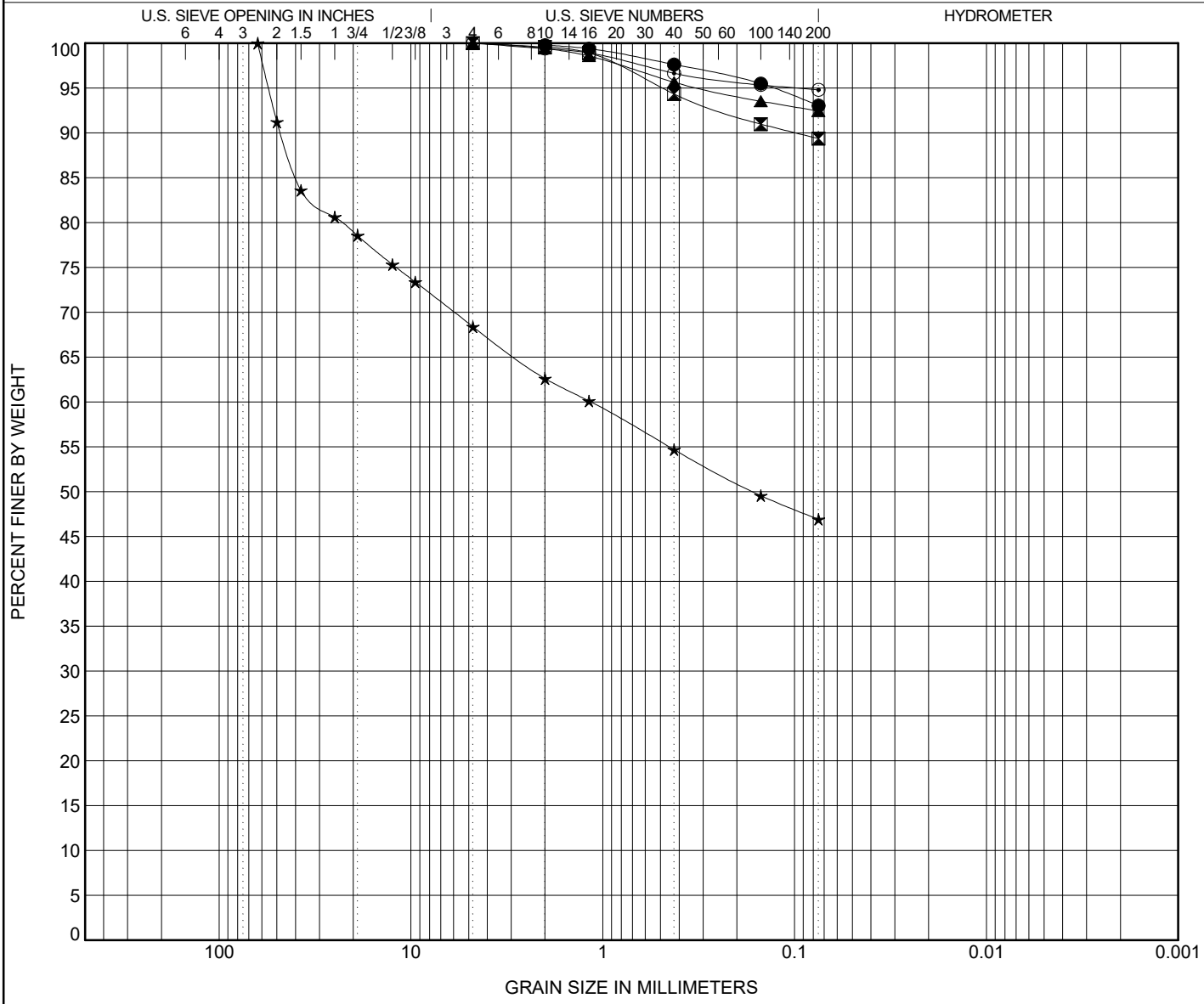
	Specimen Identification		D100	D60	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
●	TP-4	2.0-7.5	50				14.9	4.3	1.7	79.1	
⊠	TP-5	0.0-5.0	63				10.0	3.1	7.1	79.8	
▲	TP-5	5.0-7.5	4.75				1.1	4.5	4.6	89.8	
★	TP-6	0.0-3.5	4.75				0.7	4.0	7.4	87.9	
⊙	TP-6	3.5-8.0	4.75				0.9	3.3	2.7	93.1	

GRAIN SIZE DISTRIBUTION

Rocksol Consulting Group

CLIENT City of Grand Junction **PROJECT NAME** Juniata Inlet Reroute Project

PROJECT NUMBER 599.19 **PROJECT LOCATION** Mesa County, Colorado



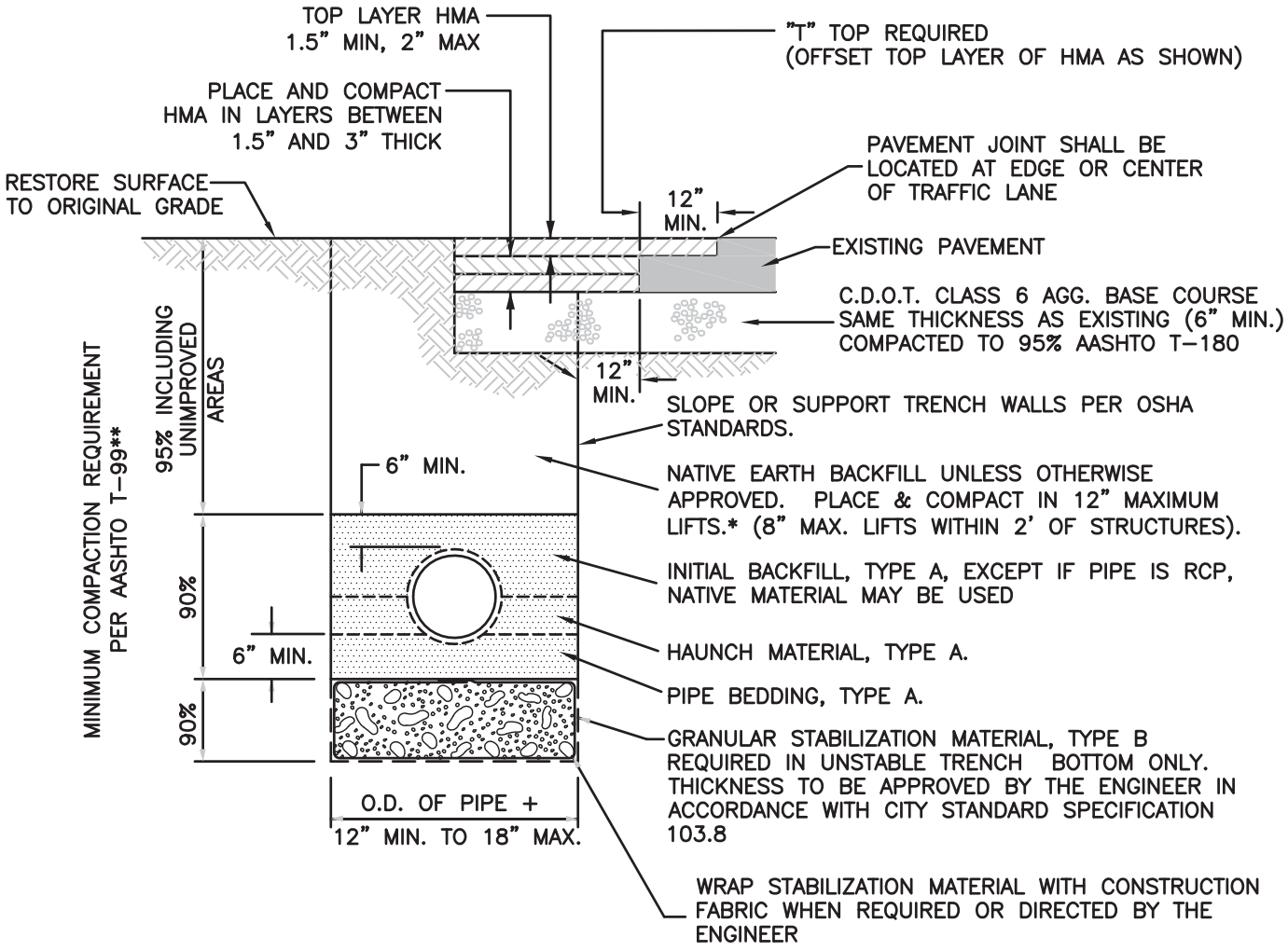
COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	TP-7	2.0-7.5	LEAN CLAY (CL) (A-6)	31	17	14		
⊠	TP-8	0.0-7.5	LEAN CLAY (CL) (A-6)	31	17	14		
▲	TP-9	2.0-5.0	LEAN CLAY (CL) (A-6)	35	17	18		
★	TP-10	0.0-2.0	CLAYEY GRAVEL with SAND (GC) (A-6)	38	12	26		
⊙	TP-10	2.0-7.5	LEAN CLAY (CL) (A-6)	35	16	19		

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
●	TP-7	2.0-7.5	2					2.2	4.6	93.0	
⊠	TP-8	0.0-7.5	4.75				0.4	5.2	5.0	89.4	
▲	TP-9	2.0-5.0	4.75				0.6	3.8	3.2	92.4	
★	TP-10	0.0-2.0	63	1.156			37.4	7.9	7.8	46.9	
⊙	TP-10	2.0-7.5	4.75				0.6	2.8	1.8	94.8	

APPENDIX E

TYPICAL TRENCH DETAIL
(CITY OF GRAND JUNCTION)



	PERCENT BY WEIGHT PASSING SQUARE MESH SIEVES		
SIEVE SIZE	PIPE BEDDING, HAUNCH & INITIAL BACKFILL MATERIAL (CRUSHED ROCK, TYPE A)	GRANULAR STABILIZATION MATERIAL (SCREENED OR CRUSHED ROCK, TYPE B)	IMPORTED BACKFILL MATERIAL (USE ONLY WHERE SPECIFIED OR DIRECTED BY THE ENGINEER
12 INCH	---	---	100
2 INCH	---	100	---
1 INCH	100	---	---
NO 4	20 MAX	15 MAX	---
NO 200	---	---	20 MAX ***

* 24" COMPACTED BACKFILL REQUIRED OVER ALL PLASTIC PIPE PRIOR TO VEHICLE OR HEAVY EQUIPMENT LOADING.

** COMPACT PER AASHTO T-180 WHEN SPECIFIED, DIRECTED OR APPROVED BY THE ENGINEER.

*** PLASTIC INDEX (PI) SHALL NOT BE MORE THAN 7.

ALL BACKFILL MATERIAL SHALL BE UNIFORMLY ADJUSTED TO WITHIN 2% OF THE OPTIMUM MOISTURE CONTENT PRIOR TO PLACEMENT AND COMPACTION.

TYPICAL TRENCH DETAIL

DEPARTMENT OF PUBLIC WORKS AND PLANNING ENGINEERING DIVISION CITY OF GRAND JUNCTION, COLORADO	GENERAL UTILITY DETAIL	APPROVED: DN REVISED: JAN 2009 DRAWN: JAH	PAGE GU-03

SECTION 01039

COORDINATION AND MEETINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. General requirements

B. Coordination

C. Field engineering

D. Alteration project procedures

E. Preconstruction conference

F. Progress meetings

G. Requests for information

1.2 RELATED SECTIONS

A. Section 01010 – Summary of Work

B. Section 01340 – Shop Drawings and Product Data

C. Section 01700 – Contract Closeout

1.3 GENERAL REQUIREMENTS

A. Refer to General Conditions for Owner meetings and other requirements

B. Engineer will schedule and administer pre-construction meeting according to agenda
   1. Prepare agenda for meetings including items required by Owner and Contractor
   2. Notify Contractor and Owner 4 days in advance of meeting date
   3. Preside at meeting

C. Contractor will schedule and administer site mobilization and weekly progress meetings. Contractor will also be responsible for coordination, field engineering, alteration, project procedures, cutting and patching procedures outlined herein. If work progress does not warrant a meeting, all parties can mutually agree to postpone meeting.
   1. Arrange for the attendance of Contractor's agents, employees, subcontractors, and suppliers as appropriate to the agenda
   2. Record the minutes; include all significant proceedings and decisions
   3. Reproduce and distribute copies of minutes within one week after each meeting
      a. To all participants in the meetings

b. To Engineer
c. To Owner

4. Owner and other inspecting parties such as the geotechnical engineer/technician as well as plant operators may attend meetings
5. Engineer will attend weekly meetings either via phone or on site

D. Representatives of contractors, subcontractors, and suppliers attending the meetings shall be qualified and authorized to act on behalf of the entity each represents

1.4 COORDINATION

A. Coordinate scheduling, submittals, and Work of the various Sections of specifications to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later by others.

B. Verify that utility requirement characteristics of operating equipment are compatible with available utilities. Coordinate work of various Sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment, and coordinate preparation of grading and other requirements for installation utility work by others.

C. Coordinate completion and clean-up of Work of separate Sections in preparation for final completion and for portions of Work designated for Owner’s use

D. After Owner occupancy of premises, coordinate access to site for correction of defective Work and Work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

1.5 FIELD ENGINEERING

A. Employ a Land Surveyor registered in the State of Colorado and acceptable to the Engineer and Owner.

B. Contractor will locate and protect survey control and reference points.

C. Control datum for survey is that established by Owner provided survey and shown on Drawings.

D. Provide field engineering services. Establish elevations, lines, and levels, utilizing recognized engineering survey practices.

1.6 ALTERATION PROJECT PROCEDURES

A. Materials: As specified in product Sections; match existing products and work for patching and extending work.

B. Where new work abuts or aligns with existing, perform a smooth and even transition. Patched work to match existing adjacent work in texture and appearance.

C. When finished surfaces are cut so that a smooth transition with new work is not possible, terminate existing surface along a straight line at a natural line of division and make recommendation to Engineer.

D. Where a change of plane of 1/4-inch or more occurs, submit recommendation for providing a smooth transition for Engineer review.

E. Patch or replace portions of existing surfaces, which are damaged, lifted, or showing other imperfections.

F. Finish surfaces as specified in individual product sections.

1.7 PRECONSTRUCTION CONFERENCE

A. Engineer will schedule a conference after Notice of Award

B. Location: On site, in conference room, or through a virtual conference call dependent on current State health code requirements

C. Attendance
1. Owner's Representative
2. Engineer and his professional consultants
3. Geotechnical Engineer
4. Contractor's Project Manager
5. Contractor's Superintendent
6. Major Subcontractors
7. Others as Appropriate

D. Agenda:
1. Execution of Owner Contractor Agreement.
2. Submission of executed bonds and insurance certificates.
3. Distribution of Contract Documents.
4. Submission of list of subcontractors and suppliers, list of products, Schedule of Values, and Construction Project Schedule in critical path format.
5. Designation of personnel representing the parties in Contractor, Owner, and the Engineer.
6. Procedures and processing of field decisions, submittals, substitutions, applications for payments, cost proposal requests, Change Orders and Contract closeout procedures.
7. Construction scheduling and updates.
8. Scheduling activities of Geotechnical Engineer, equipment manufacturers representatives, and other field tests
9. Critical work sequencing
10. Major equipment deliveries and priorities
11. Procedures for maintaining Record Documents
12. Construction facilities, controls and construction aids
13. Temporary utilities provided by Owner
14. Safety and first-aid procedures

15. Security and housekeeping procedures
16. Procedures for testing
17. QA/QC expectations
18. Inspection

1.8 PROGRESS MEETINGS

A. Contractor will schedule and administer meetings throughout progress of the Work at weekly intervals. If work progress does not warrant meeting, all parties can mutually agree to postpone the weekly meeting.

B. Location of the Meetings: The project field office of the Contractor, or other locations arranged for by Contractor, convenient to all parties

C. Contractor will make arrangements for meetings, prepare agenda with copies for participants, preside at meetings, record minutes, and distribute copies within one week to Contractor, Owner, participants, and those affected by decisions made.

D. Attendance
   1. Owner's Representative
   2. Construction Inspector
   3. Engineer, and his professional consultants as needed
   4. Contractor's Superintendent
   5. Subcontractors as appropriate to the agenda
   6. Suppliers as appropriate to the agenda
   7. Others, as appropriate

E. Suggested Agenda
   1. Review Minutes of Previous meetings
   2. Review Unresolved issues from Last Meeting
   3. Review of Work Progress
   4. Field Observations, Problems, Conflicts and Decisions
   5. RFI Review
   6. Review of Submittals Schedule and Status of Submittals
   7. Schedule
      a. General Schedule Issues
      b. Review of off-site fabrication and delivery schedules
      c. Planned progress during succeeding work period (3-week “Look ahead”)
      d. Maintenance of construction project schedule
      e. Corrective measures to regain project schedules
   8. Maintenance of Quality and Work Standards
   9. Change Orders
   10. New PR’s
   11. Accepted Change Orders
   12. Pay Requests
   13. Other Business

1.9 REQUESTS FOR INFORMATION (RFI)

A. The Contractor shall prepare and submit an RFI upon the discovery of the need for interpretation of the Contract Documents or additional information.
   1. Only the Contractor shall submit RFIs to the Engineer.
   2. RFIs shall be submitted on Engineer's RFI form. Engineer will provide a template for the Contractor upon request.

B. RFI shall include:
   1. Project Name
   2. Engineer Job Number
   3. Date
   4. Name of Contractor
   5. Name of Engineer
   6. RFI number, numbered sequentially
   7. Related specification section number, title, and related paragraphs, as needed
   8. Drawing number and detail references, as needed
   9. Field conditions
   10. Contractor's proposed solution. If the Contractor's solution(s) affect contract times or contract price, Contractor shall state the effects on the RFI.
   11. Contractor's signature
   12. Relevant attachments including but not limited to drawings, descriptions, measurements, photos, product data, and shop drawings

C. Electronically Submitted RFIs
   1. Contractor shall submit one (1) complete RFI file in Adobe Acrobat PDF format

D. Engineer's Response
   1. Engineer will review each RFI, determine action required, and respond.
   2. Engineer will review and respond to each RFI within seven (7) working days
   3. If Engineer receives an RFI after 1:00 P.M. local time, the RFI will be considered as received the following working day.
   4. Engineer will not respond to RFIs requesting approval of submittals, approval of substitutions, coordination and information already indicated in Contract Documents, adjustment in contract time or contract amount, or erroneous RFIs.
   5. Engineer may respond to RFIs on related issues with a single response.
   6. If Engineer requests additional information as a result of the RFI, any further action or RFIs submitted by the Contractor will restart a new seven (7) day review period.
   7. Contractor shall submit any request for change of contract time or contract price utilizing proper Change Order forms.

E. Contractor shall log and track all RFIs submitted organized by RFI number.
   1. RFI log shall be submitted at each progress meeting
   2. RFI log shall include:
      a. Project name
      b. Name, address, and phone number of Contractor
      c. Contractor representative name

d. RFI number
e. RFI description
f. RFI submittal date
g. RFI response date
h. Related Change Order number, as needed

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

SECTION 01200

PAYMENT PROCEDURES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and other Division 1 Specification Sections, apply to this Section.

B. This information is supplemental to the requirements as stated in the General Conditions.

1.2 SUMMARY

A. This Section includes additional administrative and procedural requirements necessary to prepare and process Applications for Payment. Refer to General Conditions for most requirements of the Owner.
   1. Unit Prices for administrative requirements governing use of unit prices
   2. Construction Progress Schedules

1.3 DEFINITIONS

A. Unit Price: An amount proposed by bidders, stated on the Bid Form, as a price per unit of measurement for materials or services.

1.4 PROCEDURES FOR UNIT PRICES

A. Unit bid prices, as quoted in the Bid Form, shall be in full compensation for labor, materials, equipment, rentals, freight, applicable taxes, overhead, profit and incidentals to complete all work for each pay item; and for all risk, loss, damage, or expense of whatever nature arising from the nature of the work or the prosecution thereof.

B. Work or materials that are essential to the work, but for which there are no pay items, will not be measured and paid for separately, but shall be included in other items of work.

C. Prices include all necessary material, for a complete installation, insurance, applicable taxes, overhead, and profit
   1. Bid Item No. 1: Mobilization/Demobilization
      a. Description: No separate measurement for payment will be made for any labor, equipment, materials, and incidental work required for this item. The lump sum price will include all of Contractor’s costs. This bid item includes but is not limited to the following items installed or conducted in accordance with the Drawings and Specifications or as otherwise directed by Engineer: preparing and installing temporary fencing around project work and staging areas, and any other fencing/security items as deemed necessary by Contractor and not covered by another bid item; establishing Contractor’s staging area, construction trailers,

offices, buildings, other necessary facilities, and temporary power and communications; obtaining permits; providing required bonds and insurance; preparing the project schedule. Item also includes demobilization at the completion of the project including the removal of the Contractor's equipment, supplies, temporary facilities, excess materials, and cleaning up the site; and providing all other related and necessary labor, equipment, and materials to complete the Work not covered by other items in this section.

b. Unit of Measurement: The total bid amount for mobilization and demobilization shall not exceed eight percent (8%) of the total bid price. Bids received that exceed this amount may be grounds for rejection of the total bid. No measurement for payment will be made for this work. It shall be paid for at the Contract Lump Sum Price based upon the percentage completed and accepted of the work required by this bid item. Fifty percent (50%) of the lump sum price will be paid at the time of the first monthly progress payment; an additional thirty percent (30%) will be paid when one-half of the original Contract amount is earned. The remaining twenty percent (20%) will be paid upon final acceptance of the Project.

2. Bid Item No. 2: Erosion and Sediment Control
   a. Description: No separate measurement for payment will be made for any labor, equipment, and materials required for this item. The measurement for payment will be the total number listed in the bid schedule and will include all of Contractor's costs. This bid item includes but is not limited to the following items installed or conducted in accordance with the Drawings and Specifications or as otherwise directed by Engineer: furnishing and installing all materials including concrete washout areas, inlet protection, outlet protection, silt fence, curb socks, sediment control logs, vehicle tracking control, and any other materials required to complete the Work; providing all materials, fabricating, and installing erosion and sediment control measures; excavation and backfill, as required for installation; providing and installing all ancillary erosion control items specified in the Drawings, and all other means and methods specified in the erosion control drawings; obtaining required permits; inspecting; and providing all other related and necessary labor, equipment, and materials to complete the Work not covered by other items in this section.
   b. Unit of Measurement: No measurement for payment will be made for this work. It shall be paid for at the Contract Lump Sum Price based upon the percentage completed and accepted of the work required by this bid item. One-third of the lump sum price for this item will be paid after twenty-five percent (25%) of the original Contract amount has been earned; the second third will be paid after fifty percent (50%) of the original Contract amount has been earned; and the final third upon final acceptance of the Project.
3. Bid Item No. 3: Construction Surveying and As-Built Drawings
   a. Description: No separate measurement for payment will be made for any labor, equipment, and materials required for this item. The lump sum price will include all of Contractor's costs. This bid item includes but is not limited to the following items installed or conducted in accordance with the Drawings and Specifications or as otherwise directed by Engineer: all construction surveying, locating, referencing, calculating, and staking necessary for the construction of the Work

record drawings, and creation of As-Built Drawings in accordance with the Drawings and Specifications and in conformance with the CDOT Survey Manual. In addition to Items I and II in the General Contract Conditions, Section 54, As-Built record information will be provided to, and approved by City staff prior to Final Acceptance of the Project. Information to be provided must be in electronic format (e.g. AutoCAD and/or survey files) along with a PDF set of As-Built drawings. As-Built electronic files must contain information suitable for the City to maintain Utility records to the standards set forth in the new Colorado 811 One Call/Subsurface Utility Law (effective August 8, 2018) and standards as described in the American Society of Civil Engineers (ASCE) Standard Guidelines for the Collection and Depiction of Existing Subsurface Utility Data (ASCE 38-02). Electronic information for As-Built records shall include, but is not limited to, verification of all horizontal and vertical changes in pipe alignments, elbows, tees, manholes, valves, control structures, service taps, service pipe (horizontal and vertical deflections to ROW line, meter pits, or clean-outs, whichever is closer), beginning and ending of slip-lined segments, tie-in or connection to existing infrastructure, etc. Distance between As-Built data points along pipe alignment is dependent on the amount of deflection used to install the pipe in the field. There must be sufficient point data to create a plan and profile of all infrastructure accurate to within eighteen inches (18") of the physical structures anywhere along the project. The cost for surveying all fittings, both sewer and water, shall be incidental to the project cost and will not be paid for separately.

b. Unit of Measurement: No measurement for payment will be made for this work. It shall be paid for at the Contract Lump Sum Price based upon the percentage completed and accepted of the work required by this bid item. One-third of the lump sum price for this item will be paid after twenty-five percent (25%) of the original contract amount has been earned; the second third will be paid after fifty percent (50%) of the original contract amount has been earned; and the final third upon final acceptance of the project.

4. Bid Item No. 4: Seeding and Revegetation

Description: The measurement for payment for this item will be on an acreage basis, complete in place, in accordance with the Drawings or Specifications or as otherwise directed by Engineer. The measurement for payment for this item will be the total number listed in the bid schedule and will include all of Contractor's costs associated with seeding/sod/landscaping/ topsoil/re-vegetation, watering, planting, edging, plastic weed barrier, cleanup, haul, and any replacement of existing conditions, to existing condition or better, to Owner's/Engineer's satisfaction. Reseeding all areas disturbed by the Work per the seed mix requirements as specified on the Construction Documents including seed bed preparation, fertilization, seeding, and all other costs not included under other bid items. Inspecting and providing all other related and necessary labor, equipment, and materials to complete the Work not covered by other items in this section.

a. Unit of Measurement: Per actual number of acres of ground surface seeded. Payment will be based on units completed and accepted of the Work required by this bid item.

5. Bid Item No. 5: Rock Removal
    a. Description: The measurement for payment for this item will be on a cubic yard basis, complete in place, in accordance with the Drawings or Specifications or as otherwise directed by Engineer. The measurement for payment for this item will be the total number listed in the bid schedule and will include all of Contractor's costs. This bid item consists of all items related to the excavation of rock material in the pipeline alignment as defined in Section 02300, including excavation, trenching, mechanical removal, loading, hauling, disposal, repair to any and all related structures, facilities, underground and above ground utilities, property, landscaping, streets, drives and pavements as a result intentional and unintentional rock excavation activities, effects and consequences. Volume measurement will be based on in situ dimensions described as follows: For installation of pipelines and fittings the horizontal rock measurement shall be three feet on center of the pipe.
        i) Contractor shall have Engineer verify that rock material, as defined by Section 02300, is present and in need of removal
        ii) Contractor shall present to Engineer accurate and detailed records delineating the horizontal and vertical extents of rock to be removed. Acceptable records shall include, but not be limited to, photographs with scale for reference, field survey notes and record drawings indicating where rock was present.
        iii) No payment for rock excavation shall be made without the prior written approval from Engineer stating where rock excavation shall be required and permitted.
    b. Unit of Measurement: Per actual cubic yards of rock excavated. Payment will be based on units completed and accepted of the Work required by this bid item.
6. Bid Item No. 6: Demolition of Exist Vault
    a. Description: The measurement for payment for this item will be on a lump sum basis, complete in place, in accordance with the Drawings or Specifications or as otherwise directed by Engineer. The measurement for payment for this item will include all of Contractor's costs associated with protecting all existing aboveground and underground utilities, items, materials, and surfaces not to be demolished along and around the item; cutting and plugging the existing pipe end into and out of the vault with concrete, filling the vault full with gravel; hauling, and disposing of debris, excess excavated material, and damaged materials off-site in accordance with the Drawings and Specifications and any applicable local, state or federal requirements; clean up; and providing all other related and necessary labor, equipment, and materials to complete the Work not covered by other items in this section.
    b. Unit of Measurement: No measurement for payment will be made for this work. It shall be paid for at the Contract Lump Sum Price based upon the percentage completed and accepted of the work required by this bid item.
7. Bid Item No. 7: Connect to Existing Raw Waterline
    a. Description: The measurement for payment for this item will be on a per-each basis, complete in place, in accordance with the Drawings or Specifications or as otherwise directed by Engineer. The unit price will include all of Contractor's costs associated with protecting all existing aboveground and underground

utilities, items, materials, and surfaces along and around the item; adjusting location of any existing small utilities and valves; furnishing, transporting, and installing all materials including any sheeting and/or bracing required for support trenches; tapping connection; valve; vent pipe; marker post; bedding; excavating, including exploratory excavation; backfilling, and compacting, including imported backfill material and flowfill; dewatering, dewatering permit and associated water discharge requirements; removing and replacing pavement, base course, subbase material, sod, and other surfacing material outside of the prescribed trench width which is not paid for under another section of this Specification; protecting aboveground and underground utilities and service connections; disposing of debris, pipe, excess excavated material, and damaged materials; testing; inspecting; and providing all other related and necessary labor, equipment, and materials to complete the Work not covered by other items in this section.

b. Unit of Measurement: Per actual number of connections to the existing waterlines. Payment will be based on units completed and accepted of the Work required by this bid item.

8. Bid Item No. 8: PVC C900 DR18 Raw Waterline Pipe – (20-inch)
   a. Description: No separate measurement for payment will be made for any labor, equipment, and materials required for this item. The measurement for payment for this item will be on a linear foot basis, complete in place, in accordance with the Drawings or Specifications or as otherwise directed by Engineer. The measurement for payment for this item will be the number of linear feet of pipe as listed in the bid schedule. The unit price will include all of Contractor's costs which are not specifically measured and paid for under other bid items. This bid item includes but is not limited to the following items installed or conducted in accordance with the Drawings and Specifications or as otherwise directed by Engineer: locating and protecting all existing above and below ground utilities and connections along and around the item; topsoil removal, stockpiling, and replacement; excavating, backfilling, and compaction of excavations with suitable material(s); rock and muck excavation and backfill with suitable material(s); furnishing, transporting, and installing all pipe and materials as indicated; pipe restraint is only required for pipes with a slope greater than 33 percent. The preferred pipe restraint is either Megalug collars or Cetra-Lok pipe; pipe bells should be oriented downhill for all slopes steeper than 15%; adjusting location of existing small utilities and valves; tapping and/or connecting to pipes or structures and repairing all structures as necessary; furnishing, transporting, and installing special fittings or items not otherwise provided for elsewhere in the Drawings and Specifications; furnishing, transporting, and installing joining materials including O-rings, gaskets, bolts, joint restraints, connecting bands, and other miscellaneous items, tapping and/or connecting pipes or structures and repairing all structures as necessary; removing and replacing surfacing materials, as required; excavating, including exploratory excavation; constructing the specific bedding including the furnishing, placing, and compacting of flowfill, sand, gravel, and rock; supporting trenches as required; disposing of debris, pipe, excess excavated material, and damaged materials; testing; inspecting; and providing all other related and

necessary labor, equipment, and materials to complete the Work not covered by other items in this section.

b. Unit of Measurement: Per actual number of linear feet of pipe installed. Payment will be based on the units completed and accepted of the Work required by this bid item.

9. Bid Item No. 9: PVC C900 DR18 Raw Waterline - Pipe Installation Only (6-inch)
   a. Description: No separate measurement for payment will be made for any labor, equipment, and materials required for this item. The measurement for payment for this item will be on a linear foot basis, complete in place, in accordance with the Drawings or Specifications or as otherwise directed by Engineer. The measurement for payment for this item will be the number of linear feet of pipe as listed in the bid schedule. The unit price will include all of Contractor's costs which are not specifically measured and paid for under other bid items. This bid item includes but is not limited to the following items installed or conducted in accordance with the Drawings and Specifications or as otherwise directed by Engineer: locating and protecting all existing above and below ground utilities and connections along and around the item; topsoil removal, stockpiling, and replacement; excavating, backfilling, and compaction of excavations with suitable material(s); rock and muck excavation and backfill with suitable material(s); installing all pipe and furnishing, transporting, and installing all materials as indicated; pipe restraint is only required for pipes with a slope greater than 33 percent. The preferred pipe restraint is either Megalug collars or Cetra-Lok pipe; pipe bells should be oriented downhill for all slopes steeper than 15%; adjusting location of existing small utilities and valves; tapping and/or connecting to pipes or structures and repairing all structures as necessary; furnishing, transporting, and installing special fittings or items not otherwise provided for elsewhere in the Drawings and Specifications; furnishing, transporting, and installing joining materials including O-rings, gaskets, bolts, joint restraints, connecting bands, and other miscellaneous items; removing and replacing surfacing materials, as required; excavating, including exploratory excavation; constructing the specific bedding including the furnishing, placing, and compacting of flowfill, sand, gravel, and rock; supporting trenches as required; disposing of debris, pipe, excess excavated material, and damaged materials; testing; inspecting; and providing all other related and necessary labor, equipment, and materials to complete the Work not covered by other items in this section. The furnished material does not include the 6" pipe material as specified on the bid schedule which will be provided by the Owner.
   b. Unit of Measurement: Per actual number of linear feet of pipe installed. Payment will be based on the units completed and accepted of the Work required by this bid item.

10. Bid Item No. 10: 20-inch Direct Bury Butterfly Valve - Installation Only
    a. Description: The measurement for payment for this item will be on a per-each basis, complete in place, in accordance with the Drawings or Specifications or as otherwise directed by Engineer. The unit price will include all of Contractor's costs. This bid item includes but is not limited to the following items: locating and protecting all existing utilities along and around the item; adjusting location of

any existing small utilities and valves; furnishing, transporting, and installing all materials including any sheeting and/or bracing required for support trenches; constructing required connections to existing and new pipes; excavating, backfilling, and compacting, including imported backfill material and flowfill; removing pavement, base course, subbase material, sod, and other surfacing material outside of the prescribed trench width which is not paid for under another section of this Specification; protecting aboveground and underground utilities and service connections; disposing of debris, pipe, excess excavated material, and damaged materials; testing; inspecting; and providing all other related and necessary labor, equipment, and materials to complete the Work not covered by other items in this section. The furnished material does not include the valve as specified on the bid schedule which will be provided by the Owner.

b. Unit of Measurement: Per actual number of direct bury butterfly valves installed. Payment will be based on units completed and accepted of the Work required by this bid item.

11. Bid Item No. 11: 20-inch Actuated Butterfly Valve and 8 Foot Manhole
    a. Description: The measurement for payment for this item will be on a per-each basis, complete in place, in accordance with the Drawings or Specifications or as otherwise directed by Engineer. The unit price will include all of Contractor's costs. This bid item includes but is not limited to the following items: locating and protecting all existing utilities along and around the item; adjusting location of any existing small utilities and valves; furnishing, transporting, and installing all materials including the valve and manhole; any sheeting and/or bracing required for support trenches; constructing required connections to existing and new pipes; excavating, backfilling, and compacting, including imported backfill material and flowfill; removing pavement, base course, subbase material, sod, and other surfacing material outside of the prescribed trench width which is not paid for under another section of this Specification; protecting aboveground and underground utilities and service connections; disposing of debris, pipe, excess excavated material, and damaged materials; testing; inspecting; and providing all other related and necessary labor, equipment, and materials to complete the Work not covered by other items in this section. The City will install all electric components, conduit and work required for the installation of the actuated butterfly valve to provide power to the valve.
    b. Unit of Measurement: Per actual number of direct bury butterfly valves installed. Payment will be based on units completed and accepted of the Work required by this bid item.
12. Bid Item No. 12: 6-inch Gate Valve with Box
    a. Description: The measurement for payment for this item will be on a per-each basis, complete in place, in accordance with the Drawings or Specifications or as otherwise directed by Engineer. The unit price will include all of Contractor's costs. This bid item includes but is not limited to the following items: locating and protecting all existing utilities along and around the item; adjusting location of any existing small utilities and valves; furnishing, transporting, and installing all materials including any sheeting and/or bracing required for support trenches; constructing required connections to existing and new pipes; excavating,

backfilling, and compacting, including imported backfill material and flowfill; removing pavement, base course, subbase material, sod, and other surfacing material outside of the prescribed trench width which is not paid for under another section of this Specification; protecting aboveground and underground utilities and service connections; disposing of debris, pipe, excess excavated material, and damaged materials; testing; inspecting; and providing all other related and necessary labor, equipment, and materials to complete the Work not covered by other items in this section.

b. Unit of Measurement: Per actual number of gate valves installed. Payment will be based on units completed and accepted of the Work required by this bid item.

13. Bid Item Nos. 13 - 17: Fittings (Bends, Tees, and Plugs) 6" and 20"
    a. Description: The measurement for payment for this item will be on a per-each basis, complete in place, in accordance with the Drawings or Specifications or as otherwise directed by Engineer. The unit price will include all of Contractor's costs associated with protecting all existing aboveground and underground utilities, items, materials, and surfaces along and around the item; adjusting location of any existing small utilities and valves; furnishing, transporting, and installing all materials including any sheeting and/or bracing required for support trenches; constructing required connections to existing and new pipes; mechanical joint restraints associated with fitting, kick block associated with fitting per detail on Drawings; excavating, backfilling, and compacting, including imported backfill material and flowfill; dewatering, dewatering permit and associated water discharge requirements; removing pavement, base course, subbase material, sod, and other surfacing material outside of the prescribed trench width which is not paid for under another section of this Specification; protecting aboveground and underground utilities and service connections; disposing of debris, pipe, excess excavated material, and damaged materials; testing; inspecting; and providing all other related and necessary labor, equipment, and materials to complete the Work not covered by other items in this section.
    b. Unit of Measurement: Per actual number of fittings, plugs, and tees installed. Payment will be based on units completed and accepted of the Work required by this bid item.
14. Bid Item Nos. 18 - 20: Fittings (Tees) - Installation Only
    a. Description: The measurement for payment for this item will be on a per-each basis, complete in place, in accordance with the Drawings or Specifications or as otherwise directed by Engineer. The unit price will include all of Contractor's costs associated with protecting all existing aboveground and underground utilities, items, materials, and surfaces along and around the item; adjusting location of any existing small utilities and valves; furnishing, transporting, and installing all materials including any sheeting and/or bracing required for support trenches; constructing required connections to existing and new pipes; mechanical joint restraints associated with fitting, kick block associated with fitting per detail on Drawings; excavating, backfilling, and compacting, including imported backfill material and flowfill; dewatering, dewatering permit and associated water discharge requirements; removing pavement, base course, subbase material, sod, and other surfacing material outside of the prescribed trench width which is not

paid for under another section of this Specification; protecting aboveground and underground utilities and service connections; disposing of debris, pipe, excess excavated material, and damaged materials; testing; inspecting; and providing all other related and necessary labor, equipment, and materials to complete the Work not covered by other items in this section. The furnished material does not include the fittings as specified on the bid schedule which will be provided by the Owner.

b. Unit of Measurement: Per actual number of fittings, plugs, and tees installed. Payment will be based on units completed and accepted of the Work required by this bid item.

15. Bid Item Nos. 21: 20”x18” Dresser Reducing Coupling - Installation Only
    a. Description: The measurement for payment for this item will be on a per-each basis, complete in place, in accordance with the Drawings or Specifications or as otherwise directed by Engineer. The unit price will include all of Contractor’s costs associated with protecting all existing aboveground and underground utilities, items, materials, and surfaces along and around the item; adjusting location of any existing small utilities and valves; furnishing, transporting, and installing all materials including any sheeting and/or bracing required for support trenches; constructing required connections to existing and new pipes; mechanical joint restraints associated with fitting, kick block associated with fitting per detail on Drawings; excavating, backfilling, and compacting, including imported backfill material and flowfill; dewatering, dewatering permit and associated water discharge requirements; removing pavement, base course, subbase material, sod, and other surfacing material outside of the prescribed trench width which is not paid for under another section of this Specification; protecting aboveground and underground utilities and service connections; disposing of debris, pipe, excess excavated material, and damaged materials; testing; inspecting; and providing all other related and necessary labor, equipment, and materials to complete the Work not covered by other items in this section. The furnished material does not include the 20”x18” Dresser Reducing Coupling as specified on the bid schedule which will be provided by the Owner.
    b. Unit of Measurement: Per actual number of fittings, plugs, and tees installed. Payment will be based on units completed and accepted of the Work required by this bid item.
16. Bid Item No. 22: Waterline Drain (6” Pipe and gravel Stilling Well)
    a. Description: No separate measurement for payment will be made for any labor, equipment, and materials required for this item. The lump sum price will include all of Contractor’s costs. This bid item includes but is not limited to the following items installed or conducted in accordance with the Drawings and Specifications or as otherwise directed by Engineer: protecting all existing aboveground and underground utilities, items, materials, and surfaces along and around the item; adjusting location of any existing small utilities and valves; furnishing, transporting, and installing all materials including any sheeting and/or bracing required for support trenches; 6-inch drain pipe; riprap protection; gravel stilling well; bedding; excavating, including exploratory excavation; backfilling, and compacting, including imported backfill material and flowfill; dewatering, dewatering permit and associated water discharge requirements; removing and

replacing pavement, base course, subbase material, sod, and other surfacing material outside of the prescribed trench width which is not paid for under another section of this Specification; protecting aboveground and underground utilities and service connections; disposing of debris, pipe, excess excavated material, and damaged materials; testing; inspecting; and providing all other related and necessary labor, equipment, and materials to complete the Work not covered by other items in this section.

b. Unit of Measurement: No payment for the waterline drain greater than the rate shown on the Bid Form will be made unless written prior approval is obtained from the Engineer. No measurement for payment will be made for this work. It shall be paid for at the Contract Price based upon the percentage completed and accepted of the work required by this bid item. A schedule of values specific to the waterline drain is required for the percentage of work completed to be determined.

17. Bid Item No. 23: 8-inch Discharge Pipe to Secret Ditch
    a. Description: The measurement for payment for this item will be on a lump sum basis, complete in place, in accordance with the Drawings or Specifications or as otherwise directed by Engineer. The lump sum price will include all of Contractor's costs associated with protecting all existing aboveground and underground utilities, items, materials, and surfaces along and around the item; adjusting location of any existing small utilities and valves; furnishing, transporting, and installing all materials including any sheeting and/or bracing required for support trenches; 8-inch gate valve; 8-inch PVC C900 or DR25 pipe; 8-inch fittings; 8-inch duckbill Check Valve; bedding; excavating, including exploratory excavation; backfilling, and compacting, including imported backfill material and flowfill; dewatering, dewatering permit and associated water discharge requirements; removing and replacing pavement, base course, subbase material, sod, and other surfacing material outside of the prescribed trench width which is not paid for under another section of this Specification; protecting aboveground and underground utilities and service connections; disposing of debris, pipe, excess excavated material, and damaged materials; testing; inspecting; and providing all other related and necessary labor, equipment, and materials to complete the Work not covered by other items in this section.
    b. Unit of Measurement: No payment for the 8-inch Discharge Pipe to Secret Ditch greater than the rate shown on the Bid Form will be made unless written prior approval is obtained from the Engineer. No measurement for payment will be made for this work. It shall be paid for at the Contract Price based upon the percentage completed and accepted of the work required by this bid item. A schedule of values specific to the 8-inch discharge pipe to Secret Ditch is required for the percentage of work completed to be determined.
18. Bid Item No. 24: Air Vac/Release Valve and Vault
    a. Description: The measurement for payment for this item will be on a per-each basis, complete in place, in accordance with the Drawings or Specifications or as otherwise directed by Engineer. The unit price will include all of Contractor's costs associated with protecting all existing aboveground and underground utilities, items, materials, and surfaces along and around the item; adjusting

location of any existing small utilities and valves; furnishing, transporting, and installing all materials including any sheeting and/or bracing required for support trenches; tapping connection; valve; vent pipe; marker post; bedding; new concrete vault and lid; excavating, including exploratory excavation; backfilling, and compacting, including imported backfill material and flowfill; dewatering, dewatering permit and associated water discharge requirements; removing and replacing pavement, base course, subbase material, sod, and other surfacing material outside of the prescribed trench width which is not paid for under another section of this Specification; protecting aboveground and underground utilities and service connections; disposing of debris, pipe, excess excavated material, and damaged materials; testing; inspecting; and providing all other related and necessary labor, equipment, and materials to complete the Work not covered by other items in this section.

b. Unit of Measurement: Per actual number of new air release valve assemblies and vaults. Payment will be based on units completed and accepted of the Work required by this bid item.

19. Bid Item No. 25: Groundwater Barrier
    a. Description: The measurement for payment for this item will be on a per-each basis, complete in place, in accordance with the Drawings or Specifications or as otherwise directed by Engineer. The measurement for payment for this item will be the total number listed in the bid schedule and will include all of Contractor's costs associated with transporting and installing clay cutoff walls as shown on drawings; protecting all existing aboveground and underground utilities, items, materials, and surfaces not to be demolished along and around the item; providing all other related and necessary labor, equipment, and materials to complete the Work not covered by other items in this section.
    b. Unit of Measurement: Per actual number of clay cutoff walls provided. Payment will be based on units completed and accepted of the Work required by this bid item.
20. Bid Item No. 26: Slope Stability
    a. Description: The measurement for payment for this item will be on a cubic yard basis, complete in place, in accordance with the Drawings or Specifications or as otherwise directed by Engineer. The measurement for payment for this item will be the total number listed in the bid schedule and will include all of Contractor's costs associated with transporting and installing slope stability of Type L riprap as shown on drawings; protecting all existing aboveground and underground utilities, items, materials, and surfaces not to be demolished along and around the item; providing all other related and necessary labor, equipment, and materials to complete the Work not covered by other items in this section.
    b. Unit of Measurement: Per actual cubic yards of rock installed. Payment will be based on units completed and accepted of the Work required by this bid item.
21. Bid Item No. 27: Inlet Tower Structure including diffuser, riprap, and geotextile fabric
    a. Description: No separate measurement for payment will be made for any labor, equipment, and materials required for this item. The lump sum price will include all of Contractor's costs. This bid item includes but is not limited to the following

items installed or conducted in accordance with the Drawings and Specifications or as otherwise directed by Engineer: protecting all existing aboveground and underground utilities, items, materials, and surfaces along and around the item; adjusting location of any existing small utilities and valves; furnishing, transporting, and installing all materials including any sheeting and/or bracing required for support trenches; constructing required connections to existing and new pipes; construction and installation of the inlet tower structure 96" manhole with designed diffusers; installation of the riprap stability area with geotextile fabric; excavating, backfilling, and compacting, including imported backfill material and flowfill; dewatering, dewatering permit and associated water discharge requirements; removing pavement, base course, subbase material, sod, and other surfacing material outside of the prescribed inlet tower structure and riprap stability area which is not paid for under another section of this Specification; protecting aboveground and underground utilities and service connections; disposing of debris, pipe, excess excavated material, and damaged materials; testing; inspecting; and providing all other related and necessary labor, equipment, and materials to complete the Work not covered by other items in this section.

b. Unit of Measurement: No payment for the Inlet Tower Structure greater than the rate shown on the Bid Form will be made unless written prior approval is obtained from the Engineer. No measurement for payment will be made for this work. It shall be paid for at the Contract Price based upon the percentage completed and accepted of the work required by this bid item. A schedule of values specific to the Inlet Tower Structure is required for the percentage of work completed to be determined.

22. Bid Item No. 28: Dewatering and Shoring Allowance

a. Description: No separate measurement for payment will be made for any labor, equipment, and materials required for this item. The lump sum price will include all of Contractor's costs. The lump sum price will include all of Contractor's costs items installed or conducted with shoring and dewatering of the area directly around the inlet tower structure and riprap stability area to complete the construction of the inlet tower structure and riprap stability area in accordance with the Drawings and Specifications or as otherwise directed by Engineer. The measurement for payment for this item will be the total number listed in the bid schedule and will include all of Contractor's costs associated with transporting, installing, using and removing dewatering and shoring equipment as shown on drawings; protecting all existing aboveground and underground utilities, items, materials, and surfaces not to be demolished along and around the item; providing all other related and necessary labor, equipment, and materials to complete the Work not covered by other items in this section.

b. Unit of Measurement: No payment for the shoring and dewatering allowance greater than the rate shown on the Bid Form will be made unless written prior approval is obtained from the Engineer. No measurement for payment will be made for this work. It shall be paid for at the Contract Price based upon the percentage completed and accepted of the work required by this bid item. A

schedule of values specific to the Inlet Tower Structure dewatering and shoring is required for the percentage of work completed to be determined.

D. Measurement and Payment: Refer to bid form and 1.5 (A) of this Section for establishment of unit prices

E. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and to have this work measured, at Owner's expense, by an independent surveyor.

1.5 APPLICATION FOR PAYMENTS

A. General
   1. Submit itemized payment request as required in General Conditions together with Schedule of Values and other submittals as specified herein
   2. Contractor shall not "project" work completed beyond the date of Application for Payment submittal for the purpose of payment request

B. Each Application for Payment shall be consistent with previous applications and payments as certified by the Engineer and paid for by the Owner.
   1. The initial Application for Payment, the Application for Payment at time of Substantial Completion, and the final Application for Payment involve additional requirements

C. Payment Application Times: Each progress payment date is as indicated in the Agreement. The period of construction Work covered by each Application for Payment is the period indicated in the Agreement

D. Application Preparation: Complete every entry on the form, including execution by person authorized to sign legal documents on behalf of the Owner. Incomplete applications will be returned without action.
   1. Entries shall match data on the Schedule of Values and Contractor's Construction Schedule. Use updated schedules if revisions have been made.
   2. Include amounts of Change Orders issued prior to the last day of the construction period covered by the application

E. Transmittal
   1. Submit copy of each Application for Payment to the Engineer by means ensuring receipt within 24 hours
   2. Transmit each copy with a transmittal form listing attachments, and recording appropriate information related to the application in a manner acceptable to the Engineer

F. Initial Application for Payment
   1. Administrative actions and submittals that must precede or coincide with submittal of the first Application for Payment include the following:
      a. List of subcontractors
      b. List of principal suppliers and fabricators

c. Schedule of Values
d. Contractor's Construction Schedule (preliminary if not final)
e. Schedule of principal products
f. List of Contractor's staff assignments
g. Copies of building permits
h. Copies of authorizations and licenses from governing authorities for performance of the Work
i. Certificates of insurance and insurance policies required at time of contract execution
j. Performance and payment bonds required at time of contract execution

G. Application for Payment at Substantial Completion
1. Following issuance of the Certificate of Substantial Completion, submit an Application for Payment. This application shall reflect any Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of Work
a. Administrative actions and submittals that shall precede or coincide with this application include:
i) Occupancy permits and similar approvals
ii) Warranties (guarantees) and maintenance agreements
iii) Test/adjust/balance records
iv) Maintenance instructions
v) Meter readings
vi) Start-up performance reports
vii) Change-over information related to Owner's occupancy, use, operation and maintenance
viii) Final cleaning
ix) Advice on shifting insurance coverages

H. Application for Final Payment
1. Prepare Application for Final Payment as specified for progress payments, identifying total adjusted Contract Price, previous payments, and sum remaining due.
2. Application for Final Payment will not be considered until the following have been accomplished:
a. Completion of Project closeout requirements
b. Completion of items specified for completion after Substantial Completion
c. Assurance that unsettled claims will be settled
d. All Work must be complete and accepted
e. Transmittal of required Project construction records to Owner
f. Proof that taxes, fees and similar obligations have been paid
g. Removal of temporary facilities and services
h. Removal of surplus materials, rubbish and similar elements

1.6 PROCEDURES FOR THE CONSTRUCTION PROGRESS SCHEDULE

A. Coordination: coordinate preparation and updates of Contractor’s Construction Schedule with the preparation of Schedule of Values.

1. Correlate line items in the Construction Schedule with required project tasks, including the following:
    a. Mobilization/demobilization
    b. Permits and regulatory requirements
    c. Submittals
    d. Equipment
    e. O&M Manuals
    f. Work breakdown of major project work
    g. Major subcontractors work
    h. Startup and commissioning
    i. Training
    j. Substantial completion
    k. Final completion
    l. Milestones and operational shutdown requirements

B. Utilize the Critical Path Method (CPM) type construction schedule to establish preliminary progress schedule and track Work progress
    1. After acceptance by Engineer of preliminary Progress Schedule submitted per requirements of General Conditions, set preliminary Progress Schedule as the Construction Baseline Schedule
    2. Update and submit the construction progress schedule on a monthly basis with the pay application
        a. Monthly submittal should indicate progress of tasks, changes to baseline schedule logic, work additions such as change orders, milestone and contract date changes
        b. Submit two (2) color print copies, 11” x 17” size, and one Adobe pdf copy
        c. Upon request provide copy of project schedule CPM data file

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

A. Provide a list of unit prices as indicated in Section 00310 – Bid Form

END OF SECTION

SECTION 01340

SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Submission of all shop drawings and product data as required by the Contract Documents for all equipment and materials to be furnished under this contract unless specifically indicated otherwise

1.2 RELATED SECTIONS

A. Section 01600 – Materials and Equipment

B. Section 01730 – Operations and Maintenance Data

C. Specification Divisions 2 thru 16

1.3 SUBMITTALS

A. Definitions
   1. Technical submittals: Shop drawings, product data and samples prepared by Contractor, subcontractors, suppliers, or manufacturers
      a. Shall be submitted by the Contractor to Engineer for approval for the use of Equipment and Materials to complete the Work or as needed to describe the following:
         i) Operation and maintenance
         ii) Technical properties
         iii) Installation
      b. Shop drawings: Custom prepared data for the Project and Work including performance and capacity curves, diagrams, bills of material, instructions, and other information
      c. Product data: Non-custom prepared printed information for the Project and Work on materials and products
      d. Samples: Fabricated and non-fabricated tangible samples of products and material
         i) Used for visual inspection and testing and analysis
   2. Informational submittals: Reports, administrative informational submittals, certification and guarantees not including and defined as shop drawings, samples and product data
      a. Reports: Include laboratory reports and tests, technical procedures and records and design analysis
      b. Administrative informational submittals: Submittals necessary for administrative records such as construction photographs, work records, schedules, standards, record project data, safety data, and similar information submittals
      c. Certification: Includes manufacturer or supplier certificates and guarantees

B. General Requirements
   1. Quality
      a. Shall be of suitable quality for legibility and reproduction purposes
      b. Shall be useable for reproduction yielding legible hard copy
      c. Submittals not conforming to specified requirements herein and as specified in Divisions 2 through 16 shall be subject to rejection by Engineer and upon Engineer request, Contractor shall resubmit documents that are in conformance
   2. Dimensions
      a. English units shall be provided on submittals
      b. Metric units are acceptable in addition to English units
      c. English units shall govern
   3. Form of submittals
      a. Submittals shall be transmitted in electronic format as specified herein
      b. Scanned submittals are acceptable
      c. Electronic project documents and submittals shall be transmitted in the following format:
         i) Native electronic format, nonproprietary
         ii) Adobe PDF produced from native electronic format
      d. Filename:
         i) Shall be consistent for the initial and any subsequent submission revisions for a single submittal
         ii) Contractor shall use a consistent naming convention for all submittals
            a) Use number of original submittal followed directly by a capital letter corresponding to the number of times a submittal is resubmitted (i.e., #001, #001A, #001B, etc.)
   4. Non-conforming submittals shall be subject to rejection by Owner and/or Engineer
   5. Submittal completion requirements
      a. Submittals shall include design criteria, dimensions, construction materials and all other information specified for a complete submittal to facilitate Engineer review of the submittal information adequately
      b. In the event various drawings are included a submittal for a class of Equipment, Contractor shall annotate clearly which parts apply to furnished Equipment
         i) Information not pertaining to the submittal shall be clearly annotated. Highlighting of such information will cause rejection of the submittal by the Engineer
      c. Contract Drawings
         i) Copies or portions thereof will not be allowed as acceptable fabrication or erection drawings
         ii) In the event Contract Drawings are used by the Engineer for erection drawings to annotate information on erection or identify reference details, Engineer title block and professional seal shall be removed and replaced with the Contractor's title block on the Contract Drawing(s). Contractor shall revise such erection drawings for subsequent revisions by the Engineer to Contract Drawings

C. Preparation
   1. Shop Drawings

a. Drawings shall be presented in a clear and thorough manner:
b. Identify details by reference to sheet and detail, schedule or room numbers shown on Contract Drawings
c. Identify equipment by reference to equipment name and tag number shown on Contract Drawings
d. Scale and Measurements: Make drawings accurate to a scale with sufficient detail to show the kind, size, arrangement and function of component materials and devices
e. Minimum sheet size: 8.5" by 11"
f. Fabrication drawing size: 11" by 17" or 24" by 36"

2. Product Data
   a. Clearly mark each copy to identify pertinent products or models submitted for review
   b. Identify equipment by reference to equipment name and P&ID number
   c. Catalog cut sheets: Cross-out or hatch irrelevant data

D. Technical Submittals: Shop Drawings and Product Data Submittal Requirements
   1. Shop Drawings and Product Data shall include the following, at a minimum:
      a. Specifications of manufacturer(s)
      b. Equipment parts and catalogs
      c. Bills of materials, material lists, and schedules
      d. Shop erection and fabrication drawings
      e. Drawings shall include equipment dimensions, weights, installation location requirements, plates required, main components, support details, anchor bolt details/sizes/locations, support base sizes, baseplate sizes, spacing and clearance requirements for installation, erection, operation and maintenance disassembly
      f. Electrical requirements:
         i) Shall include schematic diagrams including one-line diagrams, terminal block numbers, internal wiring diagrams, external connections, controls, and any other information as requested in individual specification sections
      g. List of spare parts
      h. Instruction and Operation and Maintenance (O&M) manuals
         i) As specified herein and in Specification Section 01730
      i. Manufacturer’s performance testing of equipment
      j. Concrete mix design data and information
      k. Performance characteristics and capacities
      l. External connections, anchorages, and supports required
      m. Other drawings, parts, catalogs, specifications, samples, or data necessary for the Engineer to determine conformance with Contract Documents
   2. Samples – Office samples shall be of sufficient size and quantity to clearly illustrate:
      a. Functional characteristics of the product, with integrally related parts and attachment devices
      b. Full range of color, texture and pattern
      c. Comply with requirements identified in individual specification sections

E. Construction Schedule: Designate in the construction schedule, or in a separate coordinated shop drawing schedule, the dates for submission and the dates that reviewed Shop Drawings and Product Data will be needed, if accelerated review is requested

F. Field samples and Mock-ups:
   1. Contractor shall erect, at the Project Site, at a location acceptable to the Engineer and Owner
   2. Size or area: as specified in the respective specification section
   3. Fabricate each sample and mock-up complete and finished
   4. Remove mock-ups at conclusion of Work or when acceptable to Engineer

1.4 CONTRACTOR RESPONSIBILITIES

A. Review shop drawings and product data prior to submission for accuracy and completeness of each submission

B. Approve and stamp each submission before submitting to Engineer

C. Determine and verify:
   1. Field measurements
   2. Field construction criteria
   3. Catalog numbers and similar data
   4. Conformance with specifications and identification of all deviations
   5. Confirm assignment of unit responsibility

D. Prior to each submission, carefully review and coordinate all aspects of each item being submitted

E. Verify that each item and the corresponding submittal conform in all respects with specified requirements of the Work and of the Contract Documents with respect to means, methods, techniques, sequences, and operations of construction, and safety precautions and programs incidental thereto

F. Make submissions promptly in accordance with Construction Schedule, and in such sequence as to cause no delay in the Work or in the work of any other Contractor

G. Limit requirement for accelerated submittal review by Engineer to no more than 10% percent of total number of submittals
   1. Accelerated submittal review period: less than 14 calendar days

H. Notify Engineer in writing, at time of submission, of any deviations in the submittals from Contract Document requirements:
   1. Identify and tabulate all deviations in transmittal letter
   2. Indicate essential details of all changes proposed, including modifications to other facilities that may be a result of the deviation
   3. Include required piping and wiring diagrams

1.5 SUBMISSION REQUIREMENTS

A. Make submissions far enough in advance of scheduled dates for installation to provide time required for reviews, for securing necessary approvals, for possible revisions and resubmissions, and for placing orders and securing delivery

B. In scheduling, allow fourteen (14) calendar days for review by Engineer following receipt of submission in Engineer's office:
   1. Time required to mail submissions or resubmissions is not considered a part of review period

C. Submittal Naming and Numbering
   1. Assign a unique number to include all shop drawings, product data and other information required for individual specification sections, beginning with #001.
   2. Resubmissions shall have the original number with a letter, starting with "A". If the first submittal required resubmission, it would be labeled #001A.
   3. Each specification section may still have more than one submittal number for later submissions (i.e., Preliminary O&M Manuals, Final O&M Manuals, etc.)
   4. Contractor shall use a consistent naming convention for all submittals

D. Quantity of Submittals Required
   1. Shop Drawings and Product Data:
      a. Initial submittal:
         i) Electronic – One (1) copy to Engineer
      b. Resubmittal:
         i) Electronic – One (1) copy to Engineer
      c. Final Submittal for Distribution
         i) Paper hard copy - Maximum of two (2) copies for Contractor's use, plus a maximum of three (3) copies which will be distributed by Engineer when approved. Do not submit more than five (5) copies
         ii) One (1) electronic copy to Engineer
      d. As –constructed document submittals
         i) Paper hard copy – Maximum of two (2) copies for Contractor's use, plus a maximum of three (3) copies which will be distributed by Engineer when approved. Do not submit more than five (5) copies
         ii) Electronic – One (1) copy to Engineer and one (1) copy to Owner
   2. Samples
      a. Initial submittal:
         i) Submit three (3) of each sample unless specified otherwise in individual specification section
      b. Resubmittal:
         i) Submit three (3) to Engineer
      c. One (1) sample of approved sample submittal will be returned to Contractor
   3. Informational submittals
      a. Technical reports and administrative submittals
         i) Electronic – One (1) copy to Engineer
         ii) Paper: Three (3) copies to Engineer
      b. Certificates and guarantees:

i) Electronic – One (1) copy to Engineer
ii) Paper: Three (3) copies to Engineer

c. Test reports
i) Paper
a) Owner: Two (2) copies
b) Engineer: One (1) copy
c) Contractor: Two (2) copies
d) Manufacturer/supplier: One (1) copy

4. Instruction and O&M manuals
a. In accordance to Specification Section 01730
5. At no additional cost to the Owner and whether or not submittals are copyrighted, the Owner may copy and use for staff training and/or internal operations any submittals approved for final distribution as well as required by this Contract

E. Submittal Transmittal Requirements
1. Accompany each submittal with a letter of transmittal showing all information required for identification and checking
2. Shall include:
a. Drawing numbers and titles
b. Revision number
c. Electronic filename
d. Deviations from Contract Documents: As specified herein
e. Submittals unidentifiable will be returned for proper identification
f. Date

F. Submittals Requirements
1. Submittal number
2. Date of submission and dates of any previous submissions
3. Project title and number
4. Owner Contract identification number if applicable
5. Names of:
a. Contractor
b. Supplier
c. Manufacturer
6. Identification of the product, with the specification section number
7. Field dimensions, clearly identified as such
8. Relation to adjacent or critical features of the Work or materials
9. Applicable standards, such as ASTM or Federal Specification numbers
10. Identification of deviations from Contract Documents:
a. If Contractor proposes to provide material or equipment of Work which deviates from the Project Manual, Contractor shall indicate so under “deviations” on the transmittal form accompanying the submittal copies
b. Identify all requested deviations as specified and on the copies of Specifications and Drawings required by paragraph below.
11. Confirmation of compliance with Contract Documents and, if applicable, identification of deviations from Contract Documents:

a. Provide the following documents to demonstrate compliance with the contract specifications:
    i) A copy of the relevant Drawing(s) with all addendum updates that apply to the equipment in various Divisions marked to show specific changes necessary for the equipment proposed in the Contractor's submittal
        a) If no changes are required, the Drawing(s) shall be clearly marked "No Changes Required"
        b) Failure to include copies of relevant Drawing(s) with the submittal, whether changes are required or not, shall be cause for rejection of the entire submittal with no further review by Engineer
        c) Relevant Drawing(s) include as a minimum the control diagrams, process and instrumentation diagrams (P&IDs), and Process (P) drawings.
    ii) A copy of each pertinent specification section with all addendum updates included, all referenced and applicable specifications sections, with their respective addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate the requested deviations from the specification requirements:
        a) If deviations from the specifications are indicated and, therefore requested, by the Contractor, the submittal shall be accompanied by a detailed, written justification for each deviation
        b) Failure to include a copy of the marked up specification sections, along with justification for any requested deviations to the specification requirements, with the submittal shall be cause for rejection of the entire submittal with no further review by Engineer

12. Identification of revisions on resubmissions
13. An 8" by 4" blank space for Contractor's and Engineer's stamps
14. Stamp cover sheet of each submittal as identified in letter of transmittal
15. Contractor's stamp: Initialed or signed, certifying review and approval of submittal, verification of products, field measurements and field construction criteria, and coordination of the information within the submittal with requirements of the Work and of Contract Documents. Use stamp to include wording similar to the following:

This submittal has been reviewed by [*Name of Contractor*] and approved with respect to the means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incidental thereto. [*Name of Contractor*] also warrants that this submittal complies with contract documents and comprises no deviations thereto: Section No:____ Submittal No: Date:_____ By:

G. For equipment that is provided directly by manufacturer without specification provide:
    1. Shop drawings: Illustrate complete assembly of products; foundation, installation and anchor requirements; dimensions and total weights of each, electrical wiring diagrams

2. Product data: Provide manufacturer’s literature including general assembly, materials of construction, model and type, detailed data describing parts and accessories, sufficient data to verify compliance with specifications
3. Manufacturer’s installation instructions: Provide detailed connection requirements and startup instructions
4. Manufacturer’s field report: Indicate personnel present and actual start-up procedures that were performed by manufacturer’s representative
5. Field report and test results shall be submitted to the Engineer by the Contractor

H. Submittal Log:
1. Maintain an accurate submittal log for duration of the Work showing current status of all submissions
2. Show submittal number, section number, section title, submittal description, dates and disposition of submittal
3. Make submittal log available to Engineer for Engineer's review upon request

I. Unless specified otherwise, make submissions in groups to facilitate efficient review and approval:
1. Include all associated items from individual specification sections to assure that all information is available for checking each item when it is received
2. Submit a complete initial submittal including all components when an item consists of components from several sources
3. Partial submittals may be rejected as not complying with provisions of the Contract
4. Engineer will not be held liable for delays due to poorly organized or incomplete submissions
5. Do not include items from more than one specification section for any one submittal number

J. Contractor may require subcontractors to provide drawings, setting diagrams and similar information to help coordinate the Work, but such data shall remain between Contractor and his subcontractors and will not be reviewed by Engineer unless specifically called for within the Contract Documents

K. All submittals for each component of multi-component systems shall be compiled and submitted through the Contractor to the Engineer by the manufacturer having System Responsibility

1.6 DISPOSITION OF SHOP DRAWINGS, PRODUCT DATA, AND INFORMATION SUBMITTALS

A. "No Exceptions Taken": Approved with No Corrections Noted
1. One copy sent to Owner
2. One copy sent to Resident Project Representative
3. One copy retained in Engineer's file
4. Remaining copies returned to Contractor for his use
   a. One copy to be kept on file at Contractor's office at job site
   b. Remaining copies for Contractor's office file, suppliers, or subcontractors

5. No corrections or comments noted on the submittal or on a Submittal Response Summary Sheet
6. Issues or miscellaneous comments pertaining to other related items of the Work may be included in transmittal letter
7. Resubmission not required

B. "Exceptions Noted": Approved with Corrections Noted
1. One copy sent to Owner
2. One copy sent to Resident Project Representative
3. One copy retained in Engineer's file
4. Remaining copies returned to Contractor for his use
    a. One copy to be kept on file at Contractor's office at job site
    b. Remaining copies for Contractor's office file, suppliers or subcontractors
    c. Copies of submittal data in operation and maintenance manuals to be revised according to corrections
5. Comply with corrections or comments as noted on the submittal or on a Submittal Response Summary Sheet
6. Resubmission not required

C. "Revise And Resubmit": Incorrect information provided or Significant Information Still Required
1. One copy sent to Resident Project Representative
2. One copy retained in Engineer's file
3. All remaining copies returned to Contractor for revision and re-submittal
4. Copy of transmittal letter and/or Submittal Response Summary Sheet sent to Owner. A "No Exceptions Taken" or "Exceptions Noted" submittal it will be forwarded to Owner after review per above disposition requirements
5. Submittal is either: incorrectly annotated; specific comments need to be addressed and incorporated in re-submittal; and/or additional information may be required as noted on the submittal or on a Submittal Response Summary Sheet
6. Submitted information may not include or address specific item required per the specification as identified on the submittal or on a Submittal Response Summary Sheet
7. Specific information related to identified item may be required for final approval of submittal
8. Resubmission of entire submittal may be required or resubmission of specific item may be required as identified on the submittal or on a Submittal Response Summary Sheet

D. "Rejected": Returned for Correction
1. One copy sent to Resident Project Representative
2. One copy retained in Engineer's file
3. All remaining copies returned to Contractor
4. Copy of transmittal letter and/or Submittal Response sent to Owner
5. Contractor required to resubmit complete submittal package in accordance with Contract Documents
6. Submittal does not comply with provisions of Contract Documents as noted on the submittal or on a Submittal Response Summary Sheet

7. Resubmission required

E. “Receipt Acknowledged”: For Reference Purposes Only, or for Record Copy:
   1. Applicable to manufacturer or Contractor provided calculations and other miscellaneous documentation no subject to Engineer review and approval
   2. One copy sent to Resident Project Representative
   3. One copy retained in Engineer's file
   4. One copy returned to Contractor
   5. Copy of transmittal letter sent to Owner
   6. Remaining submittal copies destroyed
   7. Detailed review and comment by Engineer not required
   8. Resubmission not required

1.7 DISPOSITION OF SAMPLES

A. "No Exceptions Taken": Approved with No Corrections Noted
   1. One sample sent to Owner
   2. One sample sent to Resident Project Representative
   3. One sample retained in Engineer's file
   4. Acknowledgement: Copy of transmittal letter sent to Contractor
   5. Resubmission not required

B. "Exceptions Noted": Approved with Corrections Noted
   1. One sample sent to Owner
   2. One sample sent to Resident Project Representative
   3. One sample retained in Engineer's file
   4. Acknowledgement: Copy of transmittal letter sent to Contractor
   5. Work performed or products furnished to comply with exceptions noted in acknowledgement
   6. Resubmission not required

C. "Rejected": Returned for Correction
   1. One sample retained in Engineer's file
   2. Remaining samples sent to Contractor for resubmittal and compliance with the Contract Documents as noted in transmittal letter
   3. Copy of transmittal letter sent to Owner
   4. Resubmission required

1.8 RESUBMISSION REQUIREMENTS

A. Make any corrections or changes in submittals required by Engineer and resubmit until approved

B. Transmit each resubmission under new letter of transmittal. Use number of original submittal followed directly by a capital letter corresponding to the number of times a submittal is resubmitted (i.e., #001, #001A, #001B, etc.)

C. Shop Drawings and Product Data

1. Revise initial drawings or data and resubmit as specified for the initial submittal
2. Indicate any changes which have been made other than those requested by Engineer

D. Samples: Submit new samples as required for initial submittal

E. Reimbursement of Resubmission Review Costs:
1. Review of first submittal and one resubmittal will be performed by Engineer at no cost to Contractor
2. Cost for review of subsequent resubmissions will be directly paid by Contractor
3. Engineer will document work-hours required for review and costs for Engineer review will be deducted from payments due Contractor as Change Order deducts
4. Charges for review of resubmissions will include Engineer at maximum rate of $150 per hour and administrative staff at maximum rate of $75 per hour

1.9 PROJECT RECORD SUBMITTALS

A. After completion of the Work and prior to final payment, Contractor shall furnish record documents and final approved shop drawings and samples (as-constructed shop drawings and samples) in the number of copies specified herein.
1. Contractor shall provide additional copies of final approved shop drawings and samples for insertion in Equipment instruction and O&M manuals as required
2. All copies shall be clearly marked “Project Record”

1.10 ENGINEER'S OR CITY PROJECT ENGINEER’S DUTIES

A. Review submittals with reasonable promptness and in accordance with approved submission schedule provided that each submittal has been called for by the Contract Documents and is stamped by Contractor as indicated above
1. No extensions of time are allowed due to Engineer’s or City Project Engineer’s delay in reviewing submittals unless all the following criteria are met:
a. Contractor has notified Engineer or City Project Engineer in writing that timely review of particular submittal in question is critical to the progress of the Work and Contractor has identified the requested submittal return date.
b. Engineer or City Project Engineer has failed to return submittal within 21 days of receipt of the submittal or receipt of said notice, whichever is later
c. Contractor demonstrates that delay in progress of the Work was directly attributable to Engineer’s or City Project Engineer’s failure to return submittal within 21 days
2. No extensions of time are allowed due to delays in progress of the Work caused by rejection and subsequent resubmission of data, including multiple resubmissions
3. Engineer’s or City Project Engineer’s review shall not extend to means, methods, techniques, sequences, construction operations, and safety precautions and programs incidental thereto. No information regarding these items will be reviewed whether or not included in submittals
4. In the event that Engineer or City Project Engineer will require more than 21 calendar days to perform review, Engineer or City Project Engineer shall so notify Contractor

B. Review drawings and data submitted only for general conformity with Contract Documents
   1. Engineer's or City Project Engineer's review of drawings and data returned marked No Exceptions Taken or Exceptions Noted does not indicate a thorough review of all dimensions, quantities, and details of material, equipment device or items shown
   2. Engineer's or City Project Engineer's review does not relieve Contractor of responsibility for errors, omissions or deviations nor responsibility for compliance with the Contract Documents

C. Assume that no shop drawing or related submittal comprises a deviation to the Contract Documents unless Contractor advises Engineer or City Project Engineer otherwise in writing which is acknowledged by Engineer or City Project Engineer in writing:
   1. Consider and review only those deviations from the Contract Documents clearly identified as such on the submittal and tabulated on the Contractor's transmittal sheet.

D. Review informational submittals for indications of Work or Material deficiencies and will respond to Contractor regarding such deficiencies

E. Return submittals to Contractor for distribution or for resubmission

F. Transmit, unreviewed, to Contractor all copies of submittals received directly from suppliers, manufacturers and subcontractors

G. Transmit, unreviewed, to Contractor all copies of submittals not called for by the Contract Documents or which have not been approved by Contractor

H. Engineer or City Project Engineer's will not review uncalled-for shop drawings or product data except by special arrangement

I. Affix stamp and indicate approval for submittal or resubmission requirements with the following stamp:

☐ NO EXCEPTIONS TAKEN ☐ EXCEPTIONS NOTED
☐ REVISE & RESUBMIT ☐ REJECTED
This review was performed only for general conformance with the design concept of the project and general compliance with the information given in the Contract Documents. Modifications or comments made on the shop drawings and product data during this review do not relieve Contractor from responsibility for compliance with the requirements of the plans and specifications. Contractor is responsible for: dimensions and quantities; information that pertains solely to the fabrication processes or to the means, methods, of construction; coordination of the work of all trades.

JVA, Inc.

Date_____ By_____

1.11 SUBMITTAL SCHEDULE

A. Unless indicated otherwise, provide all submittals required by individual sections of the Contract Documents to establish compliance with the specified requirements.

B. Contractor to produce schedule of submittals for Engineer review

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

SECTION 01380

CONSTRUCTION PHOTOGRAPHS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Construction record photographs prior to commencing and during the course of the Work

1.2 RELATED SECTIONS

A. Section 01010 – Summary of Work

B. Section 01700 – Contract Closeout: Project Record Documents

1.3 PHOTOGRAPHY REQUIRED

A. Take photographs of the existing conditions prior to commencing work to document existing conditions

B. Take photographs on the date on which each scheduled Application for Payment is due. Intent is for digital photos to be kept as project record

C. CD, hard drive, or cloud drive sharing of Digital photos become the property of Owner

1.4 COSTS OF PHOTOGRAPHY

A. Pay all costs for specified photography and printing
   1. Parties requiring additional photography or prints will pay for them directly

1.5 DELIVERY OF PHOTOS

A. Submit digital photos to the Engineer with monthly pay requests or within 20 days of photo date

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 TECHNIQUE

A. Factual Presentation

B. Correct Exposure and Focus
   1. High resolution and sharpness

2. Maximum depth-of-field
3. Minimum distortion

3.2 VIEWS REQUIRED

A. Photograph from locations to adequately illustrate the condition of construction and the state of the Project
   1. Photographic survey of the existing site
      a. Show all areas to be modified
      b. Show all areas in which Contractor will conduct operations or store equipment
   2. Weekly photographs
      a. Minimum of eight (8) views weekly until final acceptance
      b. Views as designated by the Engineer or Owner

3.3 PHOTOGRAPH REQUIREMENTS FOR PROGRESS SITE PHOTOGRAPHS

A. Responsibility
   1. Site photographs for Owner record of construction progress shall be the responsibility of the Contractor
   2. Contractor shall be responsible for site photographs including the existing and progress of Work

B. Photographs shall include, but not limited to, the following:
   1. Existing site: Photographs of existing site conditions before site work commences
      a. Number of views shall be sufficient to cover the existing site conditions
   2. Progress of work: Shall include photographs from clearing throughout construction
      a. Number of views shall be sufficient to cover progress in Work and shall include a minimum of eight (8) different views
   3. After completion of Work: Shall be sufficient to show completed and finished Work

C. Digital images
   1. Provide images in uncompressed JPEG format
   2. Minimum resolution: 1500 x 2200
   3. Submitted digital images shall not be cropped

D. Identify each digital image file
   1. Name of project
   2. Orientation and description of view
   3. Date and time of exposure

3.4 ADDITIONAL PHOTOGRAPHS

A. Contractor shall provide additional photographs upon the request of the Engineer

B. Additional photographs may include, but not limited to, the following:
   1. Publicity photographs
   2. Special events at Project site
   3. Major phase of Work

4. Substantial Completion
5. Follow-up investigations for on-site events such as construction damage or losses
6. Additional record photographs during final acceptance

3.5 PROJECT RECORD

A. Submit CD of all photos, grouped by date

B. Engineer will distribute, after review
   1. One copy of each view to Owner
   2. One copy of each view to Engineer's file
   3. One copy of each view returned to Contractor for inclusion in Project Record Document

END OF SECTION

SECTION 01400

QUALITY CONTROL

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Quality assurance / Control of installation

B. Inspection and testing laboratory services

C. Qualification of laboratory

D. Laboratory duties

E. Limitations of authority of testing laboratory

F. Contractor's responsibilities

G. Field testing

H. Testing and services schedule

1.2 RELATED SECTIONS

A. Section 01010 - Summary of Work

B. Section 01340 - Shop Drawings, Product Data, and Samples

C. Section 01600 - Material and Equipment

1.3 REFERENCES

A. Conform to reference standard by date of issue current on date of Contract Documents

B. Obtain copies of standards when required by Contract Documents

C. Where specified reference standards conflict with Contract Documents, request clarification from Engineer before proceeding

D. The contractual relationship of the parties to the Contract shall not be altered from the Contract Documents by mention or inference otherwise in any reference document

1.4 SUBMITTALS

A. Submit under provisions of Section 01340

B. Provide copies of written reports for materials, equipment or systems as scheduled at the end of this section. Reference each report by respective section number.

C. Laboratory Test Reports: Provide written reports of each test and inspection to Engineer. Each report shall include:
   1. Date issued
   2. Project title and number
   3. Testing laboratory name, address and telephone number
   4. Name and signature of laboratory inspector
   5. Date and time of sampling or inspection
   6. Record of temperature and weather conditions
   7. Date of test
   8. Identification of product and specification section
   9. Location of sample or test in the Project
   10. Type of inspection or test
   11. Results of tests and compliance with Contract Documents
   12. Interpretation of test results when requested by Engineer

D. Shop Test Reports: Provide reports detailing results of tests and certification from manufacturer to verify compliance with specifications

E. Field Test Reports: Provide reports detailing results of the tests. Indicate compliance or non-compliance with Contract Documents. Identify corrective action for materials and equipment which fails to pass field tests.

1.5 QUALITY ASSURANCE/CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship to produce Work of specified quality

B. Comply fully with manufacturer's instructions, including each step in sequence

C. Should manufacturer's instructions conflict with Contract Documents, request clarification from Engineer before proceeding

D. Comply with specified standards as a minimum quality for the Work except when more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship

E. Secure Products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion or disfigurement

F. Inspections and testing required by laws, ordinances, rules, regulations, orders or approvals of public authorities: Conditions of the Contract

G. Certification of products: Respective sections of specifications

H. Laboratory tests required and standards for testing: Respective sections of specifications

1.6 INSPECTION AND TESTING LABORATORY SERVICES

A. Owner will employ and pay for the services of a testing agency to perform specified laboratory testing of materials where the technical specifications specifically obligate the Owner to provide the services
   1. It is the Contractor’s responsibility to initiate and coordinate all required tests and inspections including conformance with requirements of all applicable public agencies and authorities. Contractor will be responsible for coordinating the testing requirement with testing agency and provide the testing agency no less than two (2) working days advance notification to schedule tests.
   2. Employment of the testing agency shall in no way relieve Contractor's obligations to perform the Work of the Contract
   3. Contractor shall employ and pay for the services of a testing agency to perform all specified services and testing not specifically identified in the technical specifications to be provided by Owner related to the design of mixes, products and equipment, to Engineer's review of proposed materials and equipment before, during and after incorporation in the Work and to retest materials and equipment which fail original tests

B. Retesting required because of non-conformance to specified requirements shall be performed by the same testing agency on instructions by the Engineer. Payment for retesting will be charged to the Contractor by deducting inspection or testing charges from the Contract Sum/Price

1.7 QUALIFICATION OF TESTING AGENCY

A. Meet "Recommended Requirements for Independent Laboratory Qualification", published by American Council of Independent Laboratories

B. Meet basic requirements of ASTM E 329, "Standards of Recommended Practice for Inspection and Testing Agencies for Concrete and Steel as Used in Construction" as applicable

C. Authorized to operate in the State in which the Project is located

1.8 TESTING AGENCY DUTIES

A. Cooperate with Engineer and Contractor; provide qualified personnel after due notice

B. Perform specified inspections, sampling, and testing of materials and methods of construction
   1. Comply with specified standards
   2. Ascertain compliance of materials with requirements of Contract Documents

C. Promptly notify Engineer and Contractor of observed irregularities or deficiencies of work or products

1.9 LIMITATIONS OF AUTHORITY OF TESTING AGENCY

A. Testing Agency Is Not Authorized To
   1. Release, revoke, alter or enlarge on requirements of Contract Documents
   2. Approve or accept any portion of the Work
   3. Owner employed testing agency shall not perform any duties of the Contractor

1.10 CONTRACTOR'S RESPONSIBILITIES

A. Cooperate with laboratory and testing agency personnel and provide access to Work

B. Secure and deliver to the laboratory adequate quantities of representative samples of materials proposed to be used and which require testing

C. Provide to the laboratory the preliminary design mix proposed to be used for concrete and other material mixes which require control by the testing laboratory

D. Furnish copies of product test reports as required

E. Furnish Incidental Labor and Facilities
   1. To provide access to Work to be tested
   2. To obtain and handle samples at the project site or at the source of the product to be tested
   3. To facilitate inspections and tests
   4. For storage and curing of test samples

F. Cooperate with testing agency; furnish samples of materials, design mix, equipment, tools, storage and assistance as requested
   1. Notify Engineer and testing agency 24 hours prior to expected time for operations requiring services to allow for scheduling of tests and laboratory assignment of personnel
   2. Make arrangements with testing agency and pay for additional samples and tests required for Contractor's use

1.11 FIELD TESTING

A. Contractor shall pay all costs associated with standard field testing of materials as detailed in these specifications. Contractor shall pay all costs for testing of piping and equipment as detailed in these specifications. Owner’s testing agency will take concrete samples, cure and break samples and report results. Owner's testing agency will also provide compaction testing and proctors for backfill operations. Contractor shall pay for all retesting due to tests indicating failed conditions.

B. Provide all required materials, labor, equipment, water, and power required for testing

C. Perform all tests in presence of Engineer and provide one copy of field test results to Engineer same day of tests

D. Repair with no additional compensation all materials and equipment which fail during testing

1.12 LABORATORY TESTING AND SERVICES SCHEDULE

A. Testing laboratory services shall be provided for, but shall not be limited to, the following:

Specification Section	Type of Material, Equipment, or System	Quality Assurance(QA) or Quality Control (QC)	Owner (O) or Contractor (C) Provided
02300	Earthwork	QA	O
02300	Earthwork	QC	C

1.13 FIELD TESTING AND SERVICES SCHEDULE

A. Field testing shall be provided for, but shall not be limited to, the following:

Specification Section	Type of Material, Equipment, or System	Quality Assurance(QA) or Quality Control (QC)	Owner (O) or Contractor (C) Provided
02300	Earthwork	QA	O
02300	Earthwork	QC	C
02510	Water Distribution System	QA	O
02510	Water Distribution System	QC	C
02676	Disinfection of Water System	QA	O
02676	Disinfection of Water System	QC	C

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

SECTION 01500

CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Temporary Utilities: Electricity, lighting, heating, ventilating, telephone service, water and sanitary facilities

B. Temporary Controls: Barriers, enclosures and fencing, protection of the Work, and water control.

C. Construction Staging Facilities: Access roads, parking areas, progress cleaning, project signage, storage and temporary buildings.

1.2 GENERAL REQUIREMENTS

A. Furnish, install and maintain all temporary utilities to assure continuous service required for the Work, except as allowed herein, and remove on completion of Work. Modify and extend systems, as work progress requires.

B. Furnish, install and maintain all construction aids required for the Work, except as allowed herein, and remove on completion of the Work

C. Furnish, install and maintain fences and barriers as required for protection of the public, property and the Work

D. Contractor may use existing roadways for access and parking only where designated by Owner.

E. Provide a field office for the use of the Contractor's Superintendent, Owner' Representatives, and Engineer in the designated staging area

F. Products may be new or used, but must be serviceable, adequate for the intended purpose, and must not violate the requirements of any applicable codes or standards

G. Clean and repair damage caused by temporary installations or use of temporary facilities. Grade and seed all disturbed areas not detailed on the drawings for other treatment

H. Provide contractor information sign posted at accessible location with contractor name and emergency phone contact information.

1.3 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies

1. Comply with applicable Federal and State rules and regulations, local codes and ordinances
2. Comply with utility company requirements

1.4 TEMPORARY ELECTRICITY

A. Contractor shall pay all costs associated with power service to the field offices and pay all costs for energy used.

B. Arrange for and pay all costs associated with temporary power service either from the local utility or a portable engine-generator

C. Provide power outlets for construction operations, with branch wiring and distribution boxes located at the site. Provide flexible power cords as required

D. Provide main service disconnect and over current protection at convenient location

E. Pay all costs for installation and removal of temporary electrical service

1.5 TEMPORARY LIGHTING

A. Provide and maintain lighting to exterior staging and storage areas after dark for security purposes as required

B. Provide branch wiring from power source to distribution boxes with lighting conductors, pigtails, and lamps as required

C. Maintain lighting and provide routine repairs

1.6 TEMPORARY WATER SERVICE

A. Potable water does exist on the site. Provide and pay for all temporary potable water.

B. Provide all drinking water required by construction personnel and Owner's representatives. Pay all costs for temporary water service.

1.7 TEMPORARY SANITARY FACILITIES

A. Provide sanitary facilities at staging area
1. As required by laws and regulations
2. Not less than 1 facility

B. Service, clean and maintain facilities and enclosures

1.8 CONSTRUCTION AIDS

A. Provide construction aids and equipment required by personnel and to facilitate the execution of the Work: scaffolds staging, ladders, stairs, ramps, runways, platforms, railways, hoists, cranes, chutes and other such facilities and equipment

B. Relocate construction aids as required by progress of construction, by storage or work requirements, and to accommodate legitimate requirements by Owner

C. Completely remove temporary materials, equipment, and services at completion of the Project

D. Clean, repair damage caused by installation or by use of temporary facilities
   1. Remove foundations and underground installations for construction aids
   2. Grade the areas for the site affected by temporary installations to required elevations and slopes and clean the area and seed unless specified as shown on the drawings to be different

1.9 BARRIERS

A. Provide barriers to prevent unauthorized entry to construction areas and to protect existing facilities and adjacent properties from damage from construction operations and demolition

B. Provide suitable barriers as required for public protection of Owner's employees

C. Protect non-owned vehicular traffic, stored materials, site and structures from damage

D. Install facilities of a neat and reasonable uniform appearance, structurally adequate for the required purposes

E. Relocate barriers as required by progress of construction

F. Completely remove barriers, including foundations, when construction has progressed to the point that they are no longer needed

G. Clean and repair damage caused by installation, fill and grade the areas of the site to required elevations and slopes and clean the area

1.10 TEMPORARY FENCING

A. Construction: Commercial grade chain link fence

B. Provide additional fencing to protect stored materials & products or to insure public safety and the safety of Owner's employees

C. Provide Owner two (2) keys to lock(s)

D. The site of the work is fenced

1.11 STORMWATER MANAGEMENT

A. Refer to SWMP in the drawings and comply with all conditions of CDPHE Stormwater Discharge Permit. Contractor responsible for both permit filing and any required reporting.

B. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment as necessary.

C. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.

D. Perform work in phases and restore areas where work is complete.

1.12 FUGITIVE DUST PERMIT

A. Comply with all conditions of CDPHE Fugitive Dust Permit. Contractor responsible for both permit filing and any required reporting.

B. Contractor to pay for all metered water used in dust abatement

1.13 CONSTRUCTION DEWATERING

A. Comply will all conditions and requirements of CDPHE Construction Dewatering Permit. The Contractor shall be responsible for any permit filing and reporting necessary.

1.14 EROSION AND SEDIMENT CONTROL

A. Install sediment control fencing at site perimeter where necessary to prevent erosion and sedimentation from occurring off site.

B. During and after site grading, maintain a roughened surface on all disturbed areas to minimize erosion potential.

C. Construct and maintain drainage swales with staked straw bale barriers to control drainage patterns and minimize erosion.

D. Provide and maintain gravel sediment traps at inlets to prevent siltation.

E. Provide and maintain rock check dams if required.

F. Soils can be stockpiled on site as directed by Owner. Rock to be hauled off not crushed and stockpiled onsite.

1.15 PROTECTION OF INSTALLED WORK

A. Protect installed Work and provide special protection where specified in individual specification Sections

B. Provide temporary and removable protection for installed Products. Control activity in immediate work area to minimize damage

C. Protect finished driving surfaces, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects

D. Prohibit construction traffic from entering future landscaped areas after grades have been established and topsoil restored

1.16 SECURITY

A. Provide security and facilities to protect Work from unauthorized entry, vandalism, or theft

B. Coordinate with Owner's security program

1.17 ACCESS ROADS

A. Maintain existing roads accessing public thoroughfares to construction staging area.

B. Extend and relocate as Work progress requires. Provide detours necessary for unimpeded traffic flow

C. Provide and maintain access to existing fire hydrants free of obstructions

D. Provide means of removing mud from vehicle wheels before entering public paved streets as required by SWMP and Owner

1.18 PARKING

A. Paved and unpaved surfaces adjacent to the staging area can accommodate construction personnel until the designated building staging area has been established

B. If staging area space is not adequate, provide additional off-site parking at location designated by Owner

1.19 PROGRESS CLEANING

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition

B. Remove waste materials, debris, and rubbish from site periodically and dispose off-site in accordance with local and state regulations. Due to high winds experienced at the site, waste removal must be done immediately after it is generated
   1. It is not permissible to bury waster, debris, rubbish underground whether in the trench or elsewhere

1.20 FIELD OFFICES AND SHEDS

A. Construction
   1. Structurally sound, weather-tight, with floors raised above ground
   2. Temperature transmission resistance: Compatible with occupancy and storage requirements
   3. At Contractor's option, portable or mobile buildings modified for office use may be used

4. Fill and grade sites for temporary structures to provide surface drainage
5. Construct temporary field offices and storage sheds on proper foundations, provide connections for utility services
    a. Secure portable or mobile buildings for winds to 110 mph
    b. Provide steps and landings at entrance door
6. Mount thermometer at convenient outside location, not in direct sunlight
7. Provide periodic maintenance and cleaning for temporary structures, furnishings, equipment and services
8. Remove temporary field offices, contents, and service at a time they are no longer needed
9. Remove storage sheds when they are no longer needed
10. Remove foundations and debris; grade the site to required elevations and clean the areas

B. Contractor's Office and Facilities
    1. Size: As required for general use and to provide space for project progress meetings
    2. Furnishings in meeting area
        a. Conference table and chairs for at least 12 persons
        b. Racks and files for project record documents in, or adjacent to, the meeting area
        c. Engineer and Owner will have use of meeting area and telephone when on site. Meeting area: 200 square feet minimum, minimum dimension 8 feet
    3. Other furnishings: Contractor's option
    4. One 10-inch outdoor-type thermometer

C. Existing facilities at the site shall not be used for field offices or storage. Coordinate with water department staff for location.

D. Fire protection equipment. Contractor shall provide and maintain fire extinguishers and active fire hydrants where indicated, maintain fire lanes to hydrants, and provide other equipment as necessary for proper fire protection during construction. Such equipment shall be for fire protection only.

1.21 REMOVAL OF TEMPORARY UTILITIES, FACILITIES, AND CONTROLS

A. Remove temporary above grade or buried utilities, equipment, facilities, materials, prior to Final Application for Payment

B. Remove underground installations to a minimum depth of 2 feet. Grade site as indicated

C. Clean and repair damage caused by installation or use of temporary work

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

SECTION 01700

CONTRACT CLOSEOUT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Substantial completion

B. Final acceptance

C. Project record documents

D. Closeout procedures

E. Final cleaning

F. Final adjustment of accounts

G. Final application for payment

1.2 RELATED SECTIONS

A. Section 00700 – General Conditions

B. Section 01500 – Construction Facilities and Temporary Controls

C. Section 01340 – Shop Drawings and Product Data

1.3 SUBSTANTIAL COMPLETION

A. Preliminary Procedures: Prior to requesting inspection for certification of Substantial Completion, complete the following and list exceptions in the request:
   1. In the Application for Payment that coincides with, or first follows, the date Substantial Completion is claimed, show 100% completion for the portion of the Work claimed as Substantially Complete
      a. Include supporting documentation for completion as indicated in these Contract Documents and a statement showing an accounting of changes to the Contract Price
      b. If 100% completion cannot be shown, include a list of incomplete items, the value of incomplete Work, and reasons the Work is not complete. All items remaining outstanding on the Contractor's punch list shall include a projected date of completion and/or correction with an explanation of why such item is not presently completed
   2. Advise Owner of pending insurance changeover requirements
   3. Submit specific warranties, workmanship Bonds, maintenance agreements, final certifications, and similar documents

4. Obtain and submit releases enabling Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases
5. Submit record drawings, instruction books and operating manuals, final project photographs, damage or settlement surveys, property surveys, and similar final record information
6. Deliver tools, spare parts, extra stock, and similar items
7. Make final changeover of permanent locks and transmit keys to Owner. Advise Owner's personnel of changeover in security provisions
8. Complete final clean up requirements, including touch-up painting. Touch-up and otherwise repair and restore marred exposed finishes

B. Inspection Procedures: On receipt of a request for inspection, Engineer and City Inspector will either proceed with inspection or advise Contractor of unfilled preliminary procedure requirements.
   1. Engineering will repeat inspection when requested and assured by Contractor that the Work is Substantially Complete.
   2. Results of the completed inspection will form the basis of requirements for final acceptance

1.4 FINAL ACCEPTANCE

A. Preliminary Procedures: Before requesting final inspection for certification of final acceptance and final payment, complete the following. List exceptions in the request.
   1. Submit the final payment request with releases and supporting documentation not previously submitted and accepted. Include insurance certificates for products and completed operations where required
   2. Submit an updated final statement, accounting for final additional changes to the Contract Price
   3. Submit a certified copy of Engineer’s final inspection list of items to be completed or corrected, endorsed and dated by Engineer. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance and shall be endorsed and dated by Engineer.
   4. Submit final meter readings for utilities, a measured record of stored fuel, and similar data as of the Date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work
   5. Advertisement for Final Payment - 30 days
   6. Submit consent of surety to final payment
   7. Submit evidence of final, continuing insurance coverage complying with insurance requirements

B. Reinspection Procedure: Engineer will reinspect the Work upon receipt of notice that the Work, including inspection list items from earlier inspections, has been completed, except for items whose completion is delayed under circumstances acceptable to Engineer.
   1. Upon completion of reinspection, Engineer will prepare a certificate of final acceptance. If the Work is incomplete, Engineer will advise Contractor of Work that

is incomplete or of obligations that have not been fulfilled but are required for final acceptance
2. If necessary, reinspection will be repeated, but at the expense of the Contractor who will reimburse the Owner for these services by the Engineer

1.5 PROJECT RECORD DOCUMENTS

A. General
1. Do not use record documents for construction purposes; protect from deterioration and loss in a secure, fire-resistive location; provide access to record documents for the Engineer's reference during normal working hours
2. Maintain on site, one set of the following record documents; record actual revisions to the Work:
   a. Contract Drawings
   b. Specifications
   c. Addenda
   d. Change Orders and other Modifications to the Contract
   e. Reviewed shop drawings, product data, and samples
   f. Field test reports
   g. Construction photographs
3. Store Record Documents and samples separate from documents used for construction
   a. Provide files and racks for storage of documents
   b. Provide locked cabinet or secure storage space for samples

B. Record Drawings
1. Maintain a clean, undamaged set of blue or black line white-prints of Contract Drawings and Shop Drawings
2. Mark the set to show the actual installation where the installation varies substantially from the Work as originally shown
3. Mark which drawing is most capable of showing conditions fully and accurately. Where Shop Drawings are used, record a cross-reference at the corresponding location on the Contract Drawings
4. Give particular attention to concealed elements that would be difficult to measure and record at a later date
   a. Record information concurrently with construction progress
   b. Mark record sets with red erasable pencil. Use other colors to distinguish between variations in separate categories of the Work. Mark each document "Project Record" in neat, large, printed letters
   c. Mark new information that is important to Owner but was not shown on Contract Drawings or Shop Drawings
   d. Note related Change Order numbers where applicable
   e. Organize record drawing sheets into manageable sets. Bind sets with durable-paper cover sheets; print suitable titles, dates, and other identification on the cover of each set
   f. Upon completion of the Work, submit record drawings to Engineer for Owner's records

g. In addition to Items I and II in the General Contract Conditions, Section 54, As-Built record information will be provided to, and approved by City staff prior to Final Acceptance of the Project. Information to be provided must be in electronic format (e.g. AutoCAD and/or survey files) along with a PDF set of As-Built drawings. As-Built electronic files must contain information suitable for the City to maintain Utility records to the standards set forth in the new Colorado 811 One Call/Subsurface Utility Law (effective August 8, 2018) and standards as described in the American Society of Civil Engineers (ASCE) Standard Guidelines for the Collection and Depiction of Existing Subsurface Utility Data (ASCE 38-02).
h. Electronic information for As-Built records shall include, but is not limited to, verification of all horizontal and vertical changes in pipe alignments, elbows, tees, manholes, valves, control structures, service taps, service pipe (horizontal and vertical deflections to ROW line, meter pits, or clean-outs, whichever is closer), beginning and ending of slip-lined segments, tie-in or connection to existing infrastructure, etc. Distance between As-Built data points along pipe alignment is dependent on the amount of deflection used to install the pipe in the field. There must be sufficient point data to create a plan and profile of all infrastructure accurate to within eighteen inches (18") of the physical structures anywhere along the project.

5. Contract Drawings and approved Shop Drawings: Legibly mark each item to record actual construction, including:
   a. Measured depths of elements of foundation in relation to finish grade or first floor datum
   b. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvement
   c. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of construction.
   d. Field changes of dimensions and details
   e. Changes made by Addenda or Change Order(s), if any
   f. Details not on original Contract Drawings
   g. References to related Shop Drawings and Modifications

C. Record Specifications: Maintain one complete copy of the Project Manual including addenda. Include with the Project Manual one copy of other written construction documents, such as Change Orders and Modifications issued in printed form during construction
   1. Mark these documents to show substantial variations in actual Work performed in comparison with the text of the Specifications and modifications.
   2. Give particular attention to substitutions and selection of options and information on concealed construction that cannot otherwise be readily discerned later by direct observation.
   3. Note related record drawing information and product data.
   4. Upon completion of the Work, submit record Specifications to Engineer for Owner's records

D. Record Product Data: Maintain one copy of each product data Submittal. Note related Change Orders and markup of record drawings and specifications.

1. Mark record documents to show significant variations in actual Work performed in comparison with information submitted. Include variations in products delivered to the Site and from the manufacturer's installation instructions and recommendations.
2. Give particular attention to concealed products and portions of the Work that cannot otherwise be readily discerned later by direct observation.
3. Upon completion of markup, submit complete set of record product data to Engineer for Owner's records
4. Legibly mark and record at each Product section description of actual Products installed, including the following:
    a. Manufacturer's name, product model, number, trade name and supplies
    b. Product substitutions or alternates utilized
    c. Changes made by Addenda, field order or change order

E. Record Samples Submitted: Immediately prior to Substantial Completion, Contractor shall meet with Engineer and Owner's personnel at the Project Site to determine which Samples are to be transmitted to Owner for record purposes. Comply with Owner's instructions regarding packaging, identification, and delivery to Owner.

F. Miscellaneous Record Submittals: Refer to other Specification Sections for requirements of miscellaneous record keeping and Submittals in connection with actual performance of the Work. Immediately prior to the date or dates of Substantial Completion, complete miscellaneous records, and place in good order. Identify miscellaneous records properly and bind or file, ready for continued use and reference. Submit to Engineer for Owner's records

G. Maintenance Manuals: Contractor shall organize operation and maintenance data as specified in Section 01730

H. Submit documents to Engineer with claim for final Application for Payment

I. Maintain documents in a clean, dry, legible condition and in good order. Do not use record documents for construction purposes

J. Make documents and samples available at all times for inspection by Engineer

K. Label each document "Project Record" in neat, large printed letters

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 CLOSEOUT PROCEDURES

A. General
1. Comply with requirements stated in the Owner's General Conditions of the Contract and in these specifications for administrative procedures in closing out the Work

2. Submit written certification that Contract Documents have been reviewed, Work has been inspected, and that Work is complete in accordance with Contract Documents and ready for Engineer's inspection
3. Provide submittals to Engineer/Owner that are required by governing or other authorities
4. Submit final Application for Payment identifying total adjusted Contract Sum, previous payments, and sum remaining due

B. Operation and Maintenance Instructions: Arrange for each installer of Equipment that requires regular maintenance to meet with Owner's personnel at Project Site to provide instruction in proper operation and maintenance. Provide instruction by manufacturer's representatives if installers are not experienced in operation and maintenance procedures. Include a detailed review of the following items:
1. Maintenance manuals
2. Record documents
3. Spare parts, materials and tools
4. Lubricants and fuels
5. Identification systems
6. Control sequences
7. Hazards, hazardous chemicals data sheets
8. Cleaning
9. Warranties and bonds
10. Maintenance agreements and similar continuing commitments

C. As part of instruction for operating Equipment, demonstrate the following procedures:
1. Startup
2. Shutdown
3. Emergency operations
4. Noise and vibration adjustments
5. Safety procedures
6. Economy and efficiency adjustments
7. Effective energy utilization

3.2 FINAL CLEANING

A. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to the condition expected in a normal, commercial building cleaning and maintenance program. Comply with manufacturer's instructions.
1. Complete the following cleaning operations before requesting inspection for Certification of Substantial Completion
    a. Remove labels that are not permanent labels
    b. Clean exposed exterior and interior hard-surfaced finishes to a dust-free condition, free of stains, films, and similar foreign substances. Restore reflective surfaces to their original condition
    c. Wipe surfaces of mechanical and electrical Equipment. Remove excess lubrication and other substances

2. Removal of Protection: Remove temporary protection and facilities installed for protection of the Work during construction
3. Compliance: Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from the Site and dispose of lawfully.
    a. Where extra materials of value remaining after completion of associated Work become Owner's property. Dispose of these materials as directed by Owner

3.3 CONTRACTOR'S CLOSEOUT SUBMITTALS

A. Evidence of Payment and Release of Liens: As specified in the General Conditions

B. Final inspection reports by all regulatory agencies demonstrating the agencies' final approval

C. At Contract close-out, deliver Record Documents to Engineer for the Owner

D. Accompany Submittal with Transmittal Letter in Duplicate, Containing
1. Date
2. Project title and number
3. Contractor's name and address
4. Title and number of each Record Document
5. Signature of Contractor or his authorized representative

3.4 FINAL ADJUSTMENTS OF ACCOUNTS

A. Submit a Final Statement of Accounting to Engineer

B. Statement Shall Reflect All Adjustments to the Contract Sum
1. The original Contract Sum
2. Additions and deductions resulting from
    a. Previous Change Orders
    b. Deductions for uncorrected Work
    c. Deductions for liquidated damages
    d. Deductions for reinspection payments
    e. Other adjustments
3. Total Contract Sum, as adjusted
4. Previous payments
5. Sum remaining due

3.5 FINAL APPLICATION FOR PAYMENT

A. Contractor shall submit the final Application for Payment in accordance with procedures and requirements stated in the General Conditions of the Contract

B. City Warranty period is 1 year from date of Final Acceptance

END OF SECTION

SECTION 02300

EARTHWORK

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, and Division One and other related specification sections apply to work of this section.

1.2 SECTION INCLUDES

A. Clearing, grubbing and site preparation

B. Removal and disposal of debris

C. Handling, storage, transportation, and disposal of excavated material

D. Sheeting, shoring, bracing and protection work

E. Pumping and dewatering as required or necessary

F. Backfilling

G. Pipe embedment

H. Construction of fills and embankments

I. Trench Stabilization

J. Final grading

K. Slope Stabilization

L. Appurtenant work

1.3 RELATED SECTIONS

A. Section 01020 – Geotechnical Report

B. Section 02370 – Erosion and Sedimentation Control

C. Section 02950 – Seeding

1.4 REFERENCES

A. American Association of State Highway and Transportation Officials (AASHTO)

B. American Society for Testing and Materials (ASTM):
   1. C33 – Concrete Aggregates
   2. C136 – Sieve Analysis of Fine and Coarse Aggregates
   3. D698 – Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 5.5 lb. Rammer and 12-Inch Drop
   4. D1241 – Material for Soil Aggregate Subbase, Base and Surface Courses
   5. D1557 – Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort
   6. D4253 – Test Methods for Maximum Index Density of Soils and Unit Weight of Soils Using a Vibratory Table
   7. D4254 – Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density
   8. D4318 – Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
   9. D6938 – Test Method for In-Place Density and Water Content of Soil and Soil Aggregate by Nuclear Methods (Shallow Depth)

C. American Concrete Institute (ACI):
   1. 229 – Controlled Low-Strength Materials

D. Council of American Building Officials/American National Standards Institute (CABO/ANSI):
   1. A117.1 – Accessible and Useable Buildings and Facilities Standards

E. Colorado Department of Transportation (CDOT)

F. Occupational Safety and Health Administration (OSHA):
   1. Part 1926 – Safety and Health Regulations for Construction

1.5 SUBMITTALS

A. Submit under provisions of Division One specifications.

B. Product Data: Submit on all products or materials supplied herein

C. Test Reports: Indicate supplier, sieve analysis, optimum moisture content and density in accordance with ASTM D698 if appropriate for crushed rock or gravel, pipe embedment and material for fills and embankment

1.6 REGULATORY REQUIREMENTS

A. Burning will not be allowed on-site. Comply with all applicable codes, regulations, and laws.

B. Comply with applicable requirements of CABO/ANSI A117.1 for accessibility requirements related to walks, ramps, parking areas, drives, curb ramps, etc.

C. Obtain and comply with all requirements of Owner and CDPHE Stormwater and/or Groundwater Discharge Permits, as required.

D. For public improvements only, in the event of a conflict between municipal standards and this specification, municipal standards for products and installation will govern.

E. Excavation work will be performed in compliance with Owner and current OSHA requirements.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Protect adjacent structures and surrounding areas from damage during excavation, filling, and backfilling

B. Protect work from erosion or other similar types of damage until the project has been accepted. Leave protection in place for subsequent contractors' use.

C. Do not backfill or construct fills during freezing weather. Backfill or construct fills only when temperature is 35°F and rising

D. Do not use frozen materials, snow, or ice in any backfill or fill area

E. Do not backfill or construct fill on frozen surfaces

F. Protect excavated material from becoming frozen

G. Do not backfill or construct fills or embankments during periods of heavy rainfall or precipitation when soil moisture conditions will not allow proper compaction to be achieved

H. Do not remove trees from outside excavation or fill areas unless authorized by the Owner; protect from permanent damage by construction activities

I. Provide temporary bridges for roadways, walkways, driveways, etc.

1.8 QUALITY ASSURANCE

A. All imported material to be free of hazardous and organic wastes, "clean" as defined by EPA, and approved for its intended use by the Owner or project Geotechnical Engineer.

PART 2 PRODUCTS

2.1 MATERIALS

A. General - Soil materials, whether from sources on or off the site must be approved by the Geotechnical Engineer as suitable for intended use and specifically for required location or purpose.

B. Classification of Excavated Materials:
1. No classification applies. Remove and handle all excavated materials regardless of its type, character, composition, condition, or depth. This includes all material that is not

classified as rock excavation as described in Paragraph 2.1.B.2 Rock Excavation is included herein.

2. Rock Excavation: classified as removal of solid material that by actual demonstration, in the Engineer's opinion, cannot be reasonably loosened or ripped by either a single-tooth, hydraulically operated ripper mounted on a crawler tractor in good condition rated at a minimum 300 flywheel horsepower or excavated with a minimum 325 flywheel horsepower hydraulic excavator in good condition equipped with manufacturer's standard boom, two rippers and rock points, or
   a. Material that for convenience or economy is loosened by drilling, or the use of pneumatic tools, is not considered rock excavation
   b. Removal of boulders larger than 1 cubic yard will be classified as rock excavation, if drilling or breaking them apart with power operated hammer, hydraulic rock breaker, expansive compounds, or similar means is both necessary and actually used for their removal
   c. Contractor to inform Engineer when rock excavation is required prior to performing Work
   d. Contractor to provide accurate records of excavated rock to confirm quantity of rock excavated.
3. Excavation of rock that cannot be excavated as outlined above will be considered rock excavation and may require alternative means that may include drilling, blasting, or expansive compounds.
4. Waste Materials:
   a. Waste materials are considered unacceptable materials for compaction or placement fill. Site fills will not include environmental pollutants, hazardous substances or waste, hazardous products or by-products.
   b. Transport and properly dispose of any rubble and waste materials found in excavation off the Owner’s property
   c. If hazardous, transite or asbestos containing materials are found in excavation, stop work immediately and notify the Owner within one hour of discovery. Comply with special handling requirements.

C. Fills and Embankments
   1. To the maximum extent practical use excess earth from onsite excavation for fills and embankments.
   2. Free from rocks or stones larger than 12 inch in greatest dimension and free from brush, stumps, logs, roots, debris, and organic and other deleterious materials
   3. Fill and embankment material must be acceptable to Engineer
   4. No rocks or stones larger than 6 inch in upper 18 inches of fill or embankment. Where allowed, distribute rocks and stones through the fill to not interfere with compaction.

D. Topsoil
   1. Topsoil is defined as fertile, friable, natural loam, surface soil, reasonably free of subsoil, clay lumps, brush, weeds and other litter, and free of rocks, stumps, stones larger than 2 inches in any dimension, and other extraneous or toxic matter harmful to plant growth for areas to be seeded or planted. Coordinate testing requirements with Owner.

2. Clean topsoil free of plants and seeds will be spread to 4-inch minimum depth or as specified by Drawings, whichever is greater.

E. Grubbings
1. Grubbings are defined as the first 1 inch of surface vegetation and topsoil consisting of primarily existing grass groundcover free of roots, brush, and other objectionable material and debris.
2. Reuse grubbing and surface topsoil containing plants and seeds in designated revegetation areas only.

F. Pipe Embedment: Graded gravel
1. Comply with City of Grand Junction requirements for pipe embedment for public utilities.

2. 1-1/2" Washed rock

Sieve Size (Inch)	Percent Passing by Weight
2"	100
1-1/2"	95-100
1"	80-95
3/4"	30-45
1/2"	10-25
3/8"	<1

3. 3/4" – 1" Crushed rock – AASHTO 57/67

Sieve Size (Inch)	Percent Passing by Weight
1	100
3/4"	90-100
1/2"	25-60
3/8"	20-55
NO. 4	0-10
NO. 8	0-5
NO. 200	0-2

4. Well-Graded Sand

Sieve Size	Percent Passing by Weight
3/8"	100
No. 4	95-100
No. 8	80-100
No. 16	50-85
No. 30	25-60
No. 50	10-30
No. 100	10-30
No. 200	2-10

G. Compacted Trench Backfill
   1. Job excavated material finely divided, free of debris, organic material, and stones larger than 6 inches in greatest dimension without masses of moist, stiff clay, or topsoil
   2. In upper 18 inches, no rock or rock excavated detritus, larger than 6 inches except with specific approval from Geotechnical Engineer.
   3. No rock greater than 3 inches in greatest dimension within 3 feet of top of pipe
   4. Graded gravel: as specified or shown on Drawings for pipe embedment

H. Coarse Base Rock
   1. Granular material, maximum 3 inches, less than 10% passing 1-inch sieve.
   2. Free of trash, clay and dust
   3. Compaction as specified by Geotechnical Engineer

I. Road Base
   1. Will meet ASTM specification for Class II aggregate base and CDOT Class 6 gradation

Sieve Size	Percent Passing by Weight
1”	100
3/4"	90-100
No. 4	35-55
No. 30	10-30
No. 200	2-9

2.2 ACCESSORIES

A. Controlled Low Strength Material (Flow Fill)
   1. Comply with City of Grand Junction requirements and ACI 229 for the use of flowable fill within the right-of-way or for public utility trench backfill.
   2. Product will be a lean, sand-cement slurry, “flowable fill” or similar material with a 28-day unconfined compressive strength between 50 and 200 psi.

B. Non-woven geotextile fabric
   1. Needle-punched nonwoven geotextile composed of polypropylene fibers, which are formed into a stable network such that the fibers retain their relative position. Product must be inert to biological degradation and resists naturally encountered chemicals, alkalis, and acids. Product must meet AASHTO M288-06 Class 3 for elongation > 50%.
      a. Mirafi 140N or accepted substitution

PART 3 EXECUTION

3.1 EXAMINATION

A. Field verify the location of all underground utilities, pipelines and structures prior to excavation

3.2 PERFORMANCE — GENERAL

A. Contractor to verify quantities of cuts and fills and perform all earthwork required to meet the grades as shown on the Drawings, including but not limited to, additional import or export required to handle compaction, building and pavement subgrade preparation, and pipe bedding.

B. Perform work in a safe and proper manner with appropriate precautions against hazard

C. Provide adequate working space and clearances for work performed within excavations and for installation and removal of utilities

D. Contain all construction activity on the designated site and within the limits of work. Cost of restoration offsite will be the responsibility of the Contractor

E. Maintain service to pipelines and utilities indicated on Drawings during construction

3.3 PREPARATION

A. Clearing and Grubbing
   1. Clear all site areas within the limits of work of grasses, roots, brush, and other objectionable material and debris.
   2. Strip subgrade for fills and embankments of surface vegetation, sod, tree stumps and organic topsoil. Strip and stockpile all on-site material meeting the topsoil definition for all areas receiving grading where shown on Drawings
   3. Remove all waste materials from site and dispose. Stockpile all acceptable grubbings for reuse in revegetation areas.
   4. Remove and dispose of tree stumps and roots over 3 inches in diameter to a minimum depth of 18 inches below the natural surface or 5 feet below finished surface level, whichever is lower.
   5. Remove debris including all demolished trees, underbrush, stumps, roots and other combustible materials from site and dispose of off-site; on-site burning is not permitted
   6. Backfill all excavated depression include grub holes with approved material

B. Preservation of Trees
   1. Do not remove trees outside fill or excavated areas, except as authorized by Engineer
   2. Protect trees and their roots within the drip line that are to remain from permanent damage by construction operation
   3. Trim standing trees in conflict with construction operations as directed by Owner and Engineer.

C. Topsoil Stripping
   1. Strip onsite material meeting the topsoil definition to minimum depth of 4 inches from areas to receive grading as shown on Drawings.
   2. Stockpile topsoil in areas designated by Owner and indicated on Drawings where it will not interfere with construction operations and activities and existing facilities
   3. At the completion of work in each area, place and grade topsoil to maintain gradient as indicated and required. Roughen surface as required for erosion control.
   4. Provide separate stockpiles of topsoil for Contractor of quantity and location designated on the Drawings

D. Waste and Debris
   1. Stockpile all acceptable grubbing for reuse in native revegetation areas
   2. Remove and dispose of all waste materials and debris from clearing, grubbing, stripping and demolition off site

E. Stockpiles
   1. Segregate materials suitable for the following:
      a. Topsoil
      b. Embankments and fills
      c. Backfill
      d. Spoils and waste only
   2. No excavation will be deposited or stockpiled at any time so as to endanger stability of banks or structures, health of trees and shrubs to be protected, or portions of the Work, either by direct pressure or indirectly by overloading banks contiguous to the operation
   3. Stockpile soil materials away from edge of excavations
   4. Do not obstruct or prevent access to roads, driveways, ditches, natural drainage channels, and utility control devices
   5. If in result of adjacent structures, easement limitations, or other restrictions sufficient storage is not available within Project limits, Contractor will arrange for off-site areas for stockpiling and for moving material to and from the storage area at no additional cost to the Owner

3.4 PROTECTION OF EXISTING UTILITIES AND STRUCTURES

A. Excavation and backfill operations will be performed in such a manner to prevent cave-ins of excavations or the undermining, damage or disturbing of existing utilities and structures or of new work.

B. Backfill will be placed and compacted so as to prevent future settlement or damage to existing utilities and structures and new work

C. Any excavations improperly backfilled or where settlement occurs will be reopened to the depth required then refilled with approved materials and compacted, and the surface restored to the required grade and condition, at no additional costs to the Owner

D. Any damage due to excavation, backfilling, or settlement of the backfill, or injury to persons or damage to property occurring as a result of such damage will be the responsibility of the Contractor. All costs to repair such damage, in a manner satisfactory to the Engineer, will be borne by the Contractor at no additional expense to the Owner

3.5 DEWATERING

A. General
   1. All dewatering activities in accordance with all federal, state, and local regulations regarding site drainage, dewatering, and erosion and sediment control including permitting requirements
   2. Design and provide dewatering system using accepted and professional methods consistent with current industry practice to eliminate water entering the excavation under hydrostatic head from the bottom and/or sides. Design system to prevent differential hydrostatic head, which would result in floating out soil particles in a manner, termed as a "quick" or "boiling" condition. System will not be dependent solely upon sumps and/or pumping water from within the excavation where differential head would result in a quick condition, which would continue to worsen the integrity of the excavation's stability
   3. Provide and maintain adequate dewatering equipment including power supply, if necessary, to remove and dispose of surface and groundwater entering excavations, trenches, and other parts of the Work
   4. Provide dewatering system of sufficient size and capacity to prevent ground and surface water flow into the excavation and to allow all Work to be installed in a dry condition
   5. Control groundwater in a manner that preserves strength of foundation soils, does not cause instability or raveling of excavation slopes, and does not result in damage to existing structures. Where necessary to these purposes, lower water level in advance of excavation, utilizing wells, wellpoints, jet educators, or similar positive methods
   6. Keep each excavation dry during subgrade preparation and continually thereafter until the structure to be built or the pipe to be installed is completed to the extent that no damage from hydrostatic pressure, flotation, or other cause will result
   7. Dewater excavations which extend to or below groundwater by lowering and keeping the groundwater level beneath such excavation at least 12 inches below the bottom of the excavation
   8. Design, furnish, install, test, operate, monitor and maintain dewatering system of sufficient scope, size and capacity to control hydrostatic pressures and to lower, control, remove, and dispose of groundwater and permit excavation and construction to proceed on dry, stable subgrades
   9. Divert surface water or otherwise prevent it from entering excavated areas or trenches to the extent practical without damaging adjacent property
   10. Maintain all drainage pipes, keep clean and free of sediment during construction and final cleanup
   11. Open pumping with sumps and ditches will be allowed, provided it does not result in boils, loss of fines, softening of the ground, or instability of slopes
   12. No additional payment will be made for any supplemental measures to control seepage, groundwater, or artesian head

13. Dewatering to surface waterways requires Colorado Department of Public Health and Environment dewatering permit. Contractor must obtain dewatering permit and comply with discharge requirements therein, including water treatment prior to discharge, if necessary

B. Design
   1. Contractor will be responsible for the accuracy of the Drawings, design data, and operational records required
   2. Contractor will be solely responsible for the design, installation, operation, maintenance, and any failure of any component of the system

C. Damages
   1. Contractor will be responsible for and will repair without cost to the Owner any damage to work in place, or other contractor's equipment, utilities, residences, highways, roads, railroads, private and municipal well systems, adjacent structures, natural resources, habitat, existing wells, and the excavation including, damage to the bottom due to heave and including but not limited to, removal and pumping out of the excavated area that may result from Contractor's negligence, inadequate or improper design and operation of the dewatering system, and any mechanical or electrical failure of the dewatering system
   2. Remove sub grade materials rendered unsuitable by excessive wetting and replace with approved backfill material at no additional cost to the Owner

D. Maintaining Excavation in Dewatered Condition
   1. Dewatering will be a continuous operation. Interruptions due to power outages, or any other reason will not be permitted
   2. Continuously maintain excavation in a dry condition with positive dewatering methods during preparation of subgrade, installation of pipe, and construction of structures until the critical period of construction and/or backfill is completed to prevent damage of subgrade support, piping, structure, side slopes, or adjacent facilities from flotation or other hydrostatic pressure imbalance
   3. Provide standby equipment on site, installed, wired, and available for immediate operation if required to maintain dewatering on a continuous basis in the event any part of the system becomes inadequate or fails. If dewatering requirements are not satisfied due to inadequacy or failure of dewatering system, perform such work as may be required to restore damaged structures and foundation soils at no additional cost to Owner
   4. System maintenance will include supervision by personnel skilled in the operation, maintenance, and replacement of system components, and any other work required to maintain excavation in dewatered condition

E. System Removal
   1. Remove dewatering equipment from the site, including related temporary electrical service
   2. Wells will be removed or cut off a minimum of 3 feet below final ground surface, capped, and abandoned in accordance with regulations by agencies having jurisdiction

3.6 SHEETING, SHORING AND BRACING

A. All sheeting, shoring and bracing in accordance with OSHA and IBC requirements

B. Prevent undermining and damage to all structures, buildings, underground facilities, pavements and slabs

C. Contractor will responsible for obtaining all required permits or easements for encroachments into the public right-of-way and for coordinating any encroachments onto adjacent properties.

D. If sheet pile cut off walls are required, submit design calculations, stamped by a Colorado licensed Professional Engineer

E. Contractor will be solely responsible for proper design, installation, operation, maintenance, and any failure of any system component
   1. Engineer review of Contractor's design and data does not relieve the Contractor from full responsibility for errors or from the entire responsibility for complete and adequate design and performance of the sheeting, shoring and bracing system

F. Provide proper and substantial sheeting, shoring, and bracing, in accordance with OSHA Standards as required, to prevent caving or sliding, to protect workmen and the Work, and to protect existing structures and facilities

G. Design, furnish, build, maintain and subsequently remove, to extent required a system of temporary supports for cut and cover, open cut, temporary bypass road, or trench excavations, including bracing, dewatering, and all associated items to support the sides and ends of excavations where excavation slopes may endanger in-place or proposed improvements, extend beyond construction right-of-ways or as otherwise specified or indicated in the Drawings
   1. Design and build sheeting, shoring, and bracing to withstand all loads that might be caused by earth movement or pressure
   2. Design and build sheeting, shoring and bracing to be rigid, maintain shape and position under all circumstances.

H. Design excavation support system and components for the following to allow safe and expeditious construction of permanent structures without movement/settlement of the ground and to prevent damage to or movement of adjacent buildings, structures, other improvements and underground facilities
   1. To support lateral earth pressures
   2. Loads from utilities, traffic, construction, buildings and surcharge loads

I. Provide sheeting, shoring and bracing equipment and materials onsite prior to start of excavation in each section, making adjustments as required to meet unexpected conditions

J. Contractor will make his own assessment of existing conditions including adjacent property, the possible effects of his proposed temporary works and construction methods,

and will select and design support systems, methods, and details as will assure safety to the public, adjacent property, and the completed Work.

K. Employ caution in areas of underground facilities, which will be exposed by hand or other excavation methods acceptable to Owner or Engineer.

L. Space and arrange sheeting and bracing as required to exclude adjacent material and according to the stability of excavation slopes

M. Do not pull trench sheeting before backfilling

N. Do not brace sheeting left in place against the pipe, but support it in a manner that precludes concentrated loads or horizontal thrusts on pipe

O. Cross braces installed above the pipe to support sheeting may be removed after pipe embedment is completed

P. Damages
   1. Contractor will document and all existing damage to adjacent facilities and submit written documentation to Owner and Engineer prior to performing any excavation. Documentation will include written description of existing damages, measurements, diagrams, maps and associated photographs
   2. Repair all damage resulting from excavation and remove and place any existing structure or underground facility damaged during shoring and sheeting and all undermined pavements with Owner-approved equal, concrete or asphalt, at no cost to the Owner.

3.7 TRENCH STABILIZATION

A. Thoroughly compact and consolidate subgrades for concrete structures, precast structures, and utility trench bottoms so they remain firm, dense and intact during required construction activities

B. Remove all mud and muck during excavation

C. Reinforce subgrades with crushed rock or gravel if they become mucky during construction activities

D. Finished elevation of stabilized subgrades are to be at or below subgrade elevations indicated on Drawings

E. Allow no more than ½ inch depth of mud or muck to remain on trench bottoms when pipe bedding material is placed thereon

F. Scarify trench subgrade to a depth of 6 to 8 inches before compaction

3.8 FILLS AND EMBANKMENTS

A. Using suitable approved materials, shape, trim, and finish cut slopes to conform with contours and elevations indicated on Drawings

B. Suitable materials will consist of excavations or borrow areas
   1. Borrow
      a. Borrow areas will be arranged by Contractor at no additional cost to Owner and will be subject to approval by Engineer or Geotechnical Engineer
      b. Includes all topsoils and fill materials from approved offsite locations

C. Place in layers from 4 to 8 inches where high degree of compaction is required. Otherwise, place in 8 to 12-inch layers. Will be placed on subgrades approved by Engineer or Geotechnical Engineer

D. Will not be placed on frozen surface. Do not place snow, ice or frozen materials in fill

E. Level and roll subgrade so surface materials will be compact and bond with the first layer of fill or embankment
   1. Plow and scarify subgrade to a minimum depth of 6 inches until uniform and free of large clods

F. Place in horizontal layers at maximum uncompacted depth per compaction specifications herein.

G. Spread and level material deposited in piles and windrows before compacting

H. Thoroughly compact each layer by rolling or other means acceptable to Geotechnical Engineer to meet the moisture and compaction specifications herein.

I. Alter compaction methods if material fails to meet specified density

J. Where a trench passes through a fill or embankment, place and compact fill or embankment to 12 inch above the top of the pipe before excavating the trench

K. Add water and harrow, disc, blade, or otherwise work each layer to obtain the uniform moisture content and adequate compaction

L. Refer to geotechnical report for additional requirements for fill and embankment preparation requirements.

3.9 COMPACTION

A. Place backfill and fill materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill materials evenly on all sides of structures to required elevations. Place backfill and fill uniformly along the full length of each structure as described herein.

C. Refer to geotechnical report for additional requirements for site development material, subexcavation, compaction and related earthwork operations.

D. Percentage of Maximum Dry Density Requirements: Moisture treat and compact soil to not less than the following percentages of maximum dry density and to within the specified moisture content range of optimum moisture content according to ASTM D698 as follows:

Surface Improvement	Compaction %	Moisture Content
All Backfill Material	95% (Standard Proctor Method)	-2 to +2
All Backfill Material	90% (Modified Proctor Method)	-2 to +2
Public Right-of-way	Per municipal standards	

1. Do not deposit or compact tamped or otherwise mechanically compacted backfill if frozen or if in water.
2. Take particular care to compact backfill which will be beneath slabs, pipes, drives, roads, parking areas, curb, gutters, or other surface construction.

3.10 BORROW OR SPOIL AREA

A. Obtain suitable material required to complete fill and embankments from excavation, on-site areas.

B. The location, size, shape, depth, drainage, and surfacing of borrow or spoil pits will be acceptable to Owner.

C. Make all areas regular in shape with graded and surfaced side and bottom slopes when completed

D. Cut side slopes not steeper than 1:1 and uniform for the entire length of any one side

E. Final grade disturbed areas of borrow to uniform slope (maximum slope = 4:1, minimum slope = 50:1).

F. Use material free of debris and deleterious material

G. Contractor is responsible for compliance with Colorado Discharge Permit System and local erosion control permitting requirements for any and all onsite and offsite, disturbed spoil and borrow areas. Upon completion of spoil and/or borrow operations, clean up spoil and/or borrow areas in a neat and reasonable manner to the satisfaction of the offsite property owner, Owner and Engineer.

3.11 DISPOSAL OF EXCESS EXCAVATED MATERIALS

A. Use excess excavated materials in fills and embankments as indicated on the Drawings to the extent needed. Coordinate with Owner and Engineer on locations for excess material placement.

B. The Contractor is responsible for disposing of all excess excavated materials from the site to a location approved by the Owner or Engineer and permitted with the local authorities.

C. Excess material may be spread onsite at locations acceptable to the Owner and the Engineer. Final quantity, location and grade to be determined prior to placement of excess material.
   1. Distribute excess earth from excavations of the site to location/s over unimproved areas of the site identified by the Owner for such purpose. Otherwise, stockpile in neat piles at locations directed by the Owner and the Engineer.
      a. Carefully finish material thus wasted with a drag, blade machine, or other suitable tool to a smooth, uniform surface without obstructing drainage at any point
      b. Do not waste excess excavated material in the above manner where the new fill crosses drainages, driveways or other improvements
      c. Distribute and level to thickness indicated on Drawings

D. At the Owner's discretion and with the Engineer's approval, suitable excess excavated materials from onsite may be disposed offsite at locations directed by Owner

E. Remove debris, junk, broken concrete, broken asphalt, rock, stones, stumps, logs, roots, and other unsuitable material from the site and dispose of it.

3.12 BLASTING

A. Blasting or other use of explosives is not permitted without City of Grand Junction approval

3.13 TRENCH EXCAVATION

A. Establish alignment and grade or elevation from offset stakes provided by the Contractor's surveyor.

B. Excavate trenches so pipes can be laid straight at uniform grade without dips or bumps, between the terminal elevations indicated on the Drawings

C. Comply with pipe specification sections regarding vertical and horizontal alignment and maximum joint deflection

D. Where grades or elevations are not fixed on the Drawings, excavate trenches to provide a minimum depth of backfill cover over the top of pipe as follows. Coordinate depth of cover with utility owners. Increase depth as required by utility owner and at crossings. Minimum depths are:
   1. 3 feet minimum for water piping as shown on the Drawings

2. Increase depth as required at vertical curves and for clearance beneath existing pipes, conduits, drains, drainage structures, or other obstructions encountered at normal pipe grades

E. Measure pipe cover depth vertically from top of pipe to finished ground or surface elevation

F. Do not open more trench in advance of pipe laying than is necessary to expedite the work; not more than 200 feet

G. Total length of open trench will be limited to 200 feet unless otherwise approved by the Engineer

H. Except where tunneling or boring is indicated on the Drawings, specified, required by jurisdictional agency or permitted by Engineer, excavate trenches by open cut from the surface

I. Limiting trench widths
1. Excavate to a width which will provide adequate working space and pipe clearances for proper pipe installation, jointing, embedment
2. If needed to reduce earth loads to prevent sliding, cut banks back on slopes which extend not lower than 1 foot above the top of the pipe
3. Stipulated minimum clearances are minimum clear distances, not minimum average distances
4. Maximum trench width from six inches above the top of pipe to trench bottom is the pipe outside diameter plus 18 inches
5. Limiting trench widths and permissible clearances from 6 inches above top of pipe to trench bottom for installed pressure and non-pressure piping

Pipe Size (inch)	Minimum Trench Width	Maximum Trench Width
3	1’ 3”	1’ 9”
4	1’ 4”	1’ 10”
6	1’ 6”	2’ 0”
8	1’ 8”	2” 2”
10	1’ 10”	2’ 4”
12	2’ 0”	2’ 6”
16	2’ 4”	2’ 10”
18	2’ 6”	3’ 0”
20	2’ 8”	3’ 2”
24	3’ 0”	3’ 6”
36	4’ 0”	4’ 6”

6. If the width of the lower portion of the trench exceeds the maximum permitted, provide special pipe embedment, or concrete encasement as required by loading conditions
7. No excessive trench widths will be allowed to avoid the use of sheeting or shoring and bracing

J. Trench Side Walls
   1. Will be sloped, shored, sheeted, braced, or otherwise supported by means of sufficient strength to protect workmen in accordance with applicable rules and regulations established for construction by the federal, state, and local ordinances and regulations
   2. Sheet and brace where necessary and as specified herein
   3. Excavate without undercutting

K. Trench Bottom
   1. Will be thoroughly protected and maintained when suitable natural materials are encountered
   2. Will be thoroughly compacted and in approved condition prior to placing gravel bedding, if required
   3. Where in earth, trench bottoms for 6 inches and smaller pipe may be excavated below pipe subgrade and granular embedment provided or the trench may be graded to provide uniform and continuous support between bell holes or end joints of the installed pipe at the Contractor's option
   4. Whenever so directed by Engineer, excavate to such depth below grade as Engineer directs and bring the trench bottom to grade with such material approved by Engineer
   5. Do not allow any part of bells or couplings to contact the trench bottom, walls, or granular embedment when pipe is joined
   6. PVC pipe will not be laid directly on trench bottom

L. Mechanical excavation
   1. Do not use where its operation would damage buildings, culverts, or other existing property, structures, or utilities above or below ground; hand excavate only in such areas
   2. Use mechanical equipment of a type and design which can be operated to provide the following:
      a. Rough trench bottom to a controlled elevation
      b. Uniform trench widths and vertical sidewalls are obtained from 1 foot above the top of the installed pipe to the bottom of the trench
      c. Trench alignment is such that pipe is accurately laid to specified alignment and is centered in the trench with adequate clearance between pipe and trench sidewalls
   3. Do not undercut trench sidewalls
   4. Recompact trench bottom disturbed by bucket teeth prior to placement of embedment material

M. Except as otherwise required, excavate trenches below the underside of pipes as indicated in the Drawings to provide for installation of granular embedment pipe foundation material

N. Whenever so directed by Engineer, excavate to such depth below grade as Engineer directs and bring the trench bottom to grade with such material as Engineer may direct

O. For unstable soils, provide concrete or other bedding as directed by Engineer

P. Do not allow any part of bells or couplings to contact the trench bottom, walls, or granular embedment when pipe is joined

Q. Cuts in existing surface construction
   1. No larger than necessary to provide adequate working space
   2. Cut a clean groove not less than 1½ inch deep along each side of trench or around perimeter of excavation area
   3. Remove pavement and base pavement to provide shoulder not less than 6 feet wide between cut edge and top edge of trench
   4. Do not undercut trenches, resulting in bottom trench width greater than top widths
   5. Make pavement cuts to and between straight or accurately marked curved lines parallel to trench centerline or limits of excavation
   6. Remove pavement for connections to existing lines or structures only to the extent required for the installation
   7. Replace the pavements between saw cuts to match original surface construction

3.14 PIPE EMBEDMENT

A. Embed pipes above and below the bottom of pipe as indicated on the Drawings and as specified herein

B. Granular embedment
   1. Spread and surface grade granular embedment to provide continuous and uniform support beneath pipe at all points between pipe joints.
      a. Level bottom layer at proper grade to receive and uniformly support pipe barrel throughout length
      b. Barrel of pipe will have a bearing for its full length
   2. Form depressions under each joint to permit the proper jointing. No part of joint will be in contact with trench when pipe is placed in position
   3. After grading, aligning, and placing pipe in final position, and shoring home, deposit and compact sufficient embedment under and around each side of the pipe to hold the pipe in proper position and alignment during subsequent operations
   4. Place and compact embedment material uniformly and simultaneously on both sides of pipe to prevent displacement
   5. Complete embedment promptly after jointing operations and approval to proceed by Engineer
   6. Granular embedment compaction by slicing with shovel or vibrating
      a. Maximum uncompacted thickness of layers: 6 inch
   7. Compacted embedment will be compacted to 90 percent maximum density per ASTM D1557
      a. Maximum uncompacted depth thickness of horizontal layers: 8-inch

C. Arch and concrete encasement
   1. Include in locations indicated on Drawings or where over-width trench conditions need correction as approved by Engineer
   2. Install and form as indicated on Drawings or as specified
   3. Concrete will have a 28-day minimum 3,000 psi compressive strength

D. Do not backfill until tests and inspections have been made and backfilling is authorized by Engineer. Use care in backfilling to avoid damage or displacement of pipe systems

3.15 TRENCH BACKFILL

A. Backfilling will be conducted in a continuous manner to prevent damage to the pipe and its coating and kept as close to the pipe laying operation as possible. Backfilling procedures will be in accordance with additional requirements, if any, of local authorities or private right-of-way agreements.

B. Compacted backfill
   1. Provide full depth of trench above embedment at all locations
   2. Beneath pavements, surfacing, driveways, curbs, gutters, walks or other surface construction or structures
   3. In street or highway shoulders
   4. Beneath fills and embankments

C. Where the trench for one pipe passes beneath the trench of another pipe, compact the backfill for the lower trench to the bottom of the upper trench

D. Site excavated materials
   1. Place job excavated materials in 8 inches maximum uncompacted thickness, uniform layers
   2. Increased layer thickness may be permitted for incohesive material if Contractor demonstrates to Engineer's satisfaction that specified compacted density will be achieved
   3. Use methods and equipment appropriate to the material to be compacted to prevent transmission of damaging shocks to pipe
   4. Thoroughly compact each layer to meet the moisture and compaction specifications herein.

E. Graded gravel
   1. Deposit in uniform layers of 9 inches maximum uncompacted thickness
   2. Compact with suitable vibrating roller or platform vibrator to not less than 70 percent relative density per ASTM D4253/D4254

F. Uncompacted backfill
   1. Compaction of backfill above pipe embedment in locations other than those specified, is required only to prevent future settlement
   2. May be placed by any method acceptable to Engineer which will not impose excessive concentrated or unbalanced loads, shock, or impact on, and will not result in displacement of installed pipe
   3. Until compacted depth over conduit exceeds 3 feet, do not drop fill material over 5 feet. Distance may be increased 2 feet for each additional 1 foot of cover

G. Finish the top portion of backfill with at least 4 inches of topsoil or as specified by landscaping specifications, whichever is greater, corresponding to, or better than, that underlying adjoining turf areas.

H. Trench backfill within the public right-of-way will conform to municipal street and utility standards.

I. Trench backfills through unimproved areas should be restored to previous conditions and left 3" above adjacent grades to allow for settlement. Seed all disturbed areas according to erosion control and landscape specifications.

J. Protection of trench backfill
   1. Where trenches are constructed in ditches or other water courses, protect backfill from erosion
   2. Install ditch checks where the ditch grade exceeds 1 percent
      a. Minimum depth: 2 feet below the original ditch or water course bottom for the full bottom width
      b. Minimum width: 18 inches into the side slopes
      c. Minimum thickness: 12 inches

3.16 DRAINAGE MAINTENANCE

A. Do not backfill trenches across roadways, drives, walks or other trafficways adjacent to drainage ditches or water courses prior to backfilling the trench on the upstream side of the trafficway to prevent impounding water after pipe is laid

B. Backfill so that water does not accumulate in unfilled or partially filled trenches

C. Remove materials deposited in roadway ditches or other water courses crossed by the trench line immediately after backfilling is completed and restore ditches and water courses to original section, grade, and contours

D. Do not obstruct surface drainage any longer than necessary

E. Provide and maintain temporary bridges and other structures across unfilled trenches as required to maintain traffic

F. Provide adequate storm flow conveyance through the site at all times during construction to avoid flooding of any buildings or adjacent property. Provide overland drainage routing when storm sewer inlets are not fully functioning due to erosion and sediment control measures.

3.17 FINAL GRADING

A. After completion of all other outside work and after backfilling is completed and settled, bring to grade at the indicated elevations, slopes and contours, all areas being graded on site

B. Graders and other power equipment may be used for final grading and slope dressing if the result is uniform and equivalent to hand work

C. Grade all surfaces for effective drainage, provide a 2 percent minimum slope except as otherwise shown on the Drawings

D. Provide a smooth transition between adjacent existing grades and new grades

E. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances

F. Slope grades to direct water away from buildings and prevent ponds from forming where not intended

G. Finish subgrades at lawns and unpaved areas to required elevations within a tolerance of plus or minus one (1) inch

H. Finish grades will be no more than 0.1 foot above or below those indicated

I. Finish all ditches, swales and gutters to drain readily

J. Coordinate final subgrade depth with finish landscape treatment and required topsoil depths

K. Topsoil
   1. Clean topsoil, free of plants and seed will be spread to 4-inch minimum depth, or as specified by Drawings, whichever is greater
   2. Reuse grubbings and surface topsoil containing plants and seeds in designated revegetation areas only.

3.18 SLOPE AND CHANNEL STABILIZATION

A. Cover channel banks, slopes, bottom and thalweg (water flowline at lowest point in channel) with erosion control fabric mat where grade is steeper than 4H to 1V and where indicated on the Drawings

B. Lay fabric smoothly on surface, bury top end of each section in 6-inch deep excavated topsoil trench. Provide 6-inch overlap minimum of adjacent rolls. Backfill trench and rake smooth, level with adjacent soil

C. Secure outside edges and overlaps at 48 inch intervals with 4-inch to 6-inch U-shaped type pins or wooden stakes depending on ground condition

D. Lightly dress slopes with topsoil to ensure close contact between fabric and soil

E. At sides of ditches, lay fabric laps in direction of water flow. Lap ends and edges minimum 6 inches

F. Maintain integrity of erosion control fabric

G. Prior to laying fabric, seed disturbed areas under provisions of related seeding

3.19 SETTLEMENT

A. Warranty for settlement of all fills, embankments, and backfills is stipulated in the General Conditions from final completion of Contract under which Work is performed

B. Repair or replace within 30 days after notice by Engineer or Owner

3.20 FIELD QUALITY CONTROL

A. Provide under provisions of General Conditions and Division One Specifications

B. Coordinate testing with Owner. Owner will employ testing agency for field testing to determine compliance of in-place and backfill materials and compaction in accordance with the specifications, and to verify design bearing capacities.

C. It is the Contractor's responsibility to initiate, coordinate and accommodate all required tests and inspections including conformance with requirements of all applicable public agencies and authorities. Contractor will be responsible for coordinating the testing requirement with testing agency and provide the testing agency 48 hours, two business day advance notification to schedule tests.

D. Fills and Embankment Testing
   1. Two moisture-density relationship tests, ASTM D698, on each type of fill material
   2. One in-place compaction test for each 5,000 square feet every 1.5 feet of vertical lift of material placed
   3. Additional in-place compaction tests at the discretion of the Owner

E. Pipe Embedment and Backfill Testing
   1. Two moisture-density relationship tests, ASTM D698, or two relative density tests, ASTM D4253/D4254, as appropriate for each type of embedment on backfill material proposed, except granular embedment material
   2. One in-place compaction test every 200 lineal feet of trench in the compacted embedment zone and at every 1.5 feet of vertical lift of backfill materials, per ASTM D6938
   3. One in-place compaction test near top of trench for trench depth of 2 feet or less, per ASTM D6938
   4. Additional in-place compaction tests at the discretion of the Owner

F. Pavement and Structural Subgrade Testing
   1. At a minimum, two moisture-density relationship tests, ASTM D698, or two relative density tests, ASTM D4253/D4254, as appropriate and adequate for each type backfill material proposed.
   2. Perform tests for each footing, concrete site feature, and drainage structure subgrade. Perform tests at every 100 linear feet of subgrade of foundation walls, retaining walls, and every 150 feet for curbing, pans, drainage features, walks, etc. (or portions thereof). Perform tests every 2,000 square feet required of building slab area, exterior slabs and pavement/flatwork areas (with no less than 3 tests). Test at subgrade and at every vertical lift of backfill materials placed.

3. Additional in-place compaction tests at the discretion of the Owner

G. Inspection and approval
   1. A qualified Geotechnical Engineer will inspect the natural soil at bottom of excavations for structures
   2. Do not prepare subgrade or place concrete until Geotechnical Engineer's inspection has taken place and any resulting recommendations of the Geotechnical Engineer have been fulfilled or until the inspection has been waived by the Geotechnical Engineer
   3. Prior to placement of structural fill, overexcavated foundations subgrades will be observed and tested by a qualified Geotechnical Engineer to ensure suitable bearing materials exist
   4. Geotechnical Engineer will provide a letter to Engineer to confirm the presence of suitable subgrade material and properly placed fill materials by Contractor in accordance with Drawings and geotechnical report.

H. Retesting of failed compaction will be performed by Geotechnical Engineer for Owner, but paid for the Contractor

END OF SECTION

SECTION 02370

EROSION AND SEDIMENTATION CONTROL

PART 1 GENERAL

1.1 SECTION INCLUDES

A. This work consists of temporary measures needed to control erosion and water pollution. These temporary measures will include, but not be limited to, berms, dikes, dams, sediment basins, fiber mats, netting, gravel, mulches, grasses, slope drains, and other erosion control devices or methods. These temporary measures shall be installed at the locations where needed to control erosion and water pollution during the construction of the project and during site restoration, and as directed by ENGINEER, and as shown on the drawings.

B. The Erosion Control Plan presented in the drawings serves as a minimum for the requirements of erosion control during construction. Contractor has the ultimate responsibility for providing adequate erosion control and water quality throughout the duration of the project. Therefore, if the provided plan is not working sufficiently to protect the project areas, then Contractor shall provide additional measures as required to obtain the required protection.

C. Contractor shall include in the bid price for erosion control a minimum of all items shown on the Erosion Control Plan and any additional items that may be needed to control erosion and water pollution.

1.2 RELATED SECTIONS

A. Section 01500 – Construction Facilities and Temporary Controls

B. Section 02220 – Demolition

C. Section 02300 – Earthwork

D. Section 02950 – Seeding

1.3 REFERENCES AND STANDARDS

A. City of Grand Junction

B. CDOT – Colorado Department of Transportation

C. CDPHE – Colorado Department of Public Health and Environment

1.4 SUBMITTALS

A. Submit under provisions of Division One specifications.

B. Submit the following information:
   1. Erosion Control Plan,
   2. Construction schedule for Erosion Control per Article Scheduling,
   3. Sequencing Plan per Article Scheduling,
   4. All applicable permits for Erosion Control.

C. Product data: Submit on all products or materials supplied herein.

1.5 REGULATORY REQUIREMENTS

A. Obtain and comply with all requirements of Owner and CDPHE Stormwater and/or Groundwater Discharge Permits, as required.

B. 401 Construction Dewatering Industrial Wastewater Permit (Construction Dewatering Permit 401):
   1. Contractor shall apply for and obtain a Construction Dewatering Permit 401 from the Colorado Department of Public Health and Environment.
   2. Contractor shall apply for and obtain a Mesa County Construction Stormwater Permit.
   3. All costs for permits shall be the responsibility of Owner.
   4. This permit requires that specific actions be performed at designated times.
   5. Contractor is legally obligated to comply with all terms and conditions of the permit including testing for effluent limitations.
   6. Contractor shall allow the Colorado Department of Public Health and Environment or other representatives to enter the site to test for compliance with the permit.
   7. Non-compliance with the permit can result in stoppage of all work.

C. In the event of conflict between these requirements and erosion and pollution control laws, rules, or regulations of other Federal, State, or local agencies, the more restrictive laws, rules, or regulations shall apply.

1.6 SCHEDULING

A. Sequencing Plan:
   1. Contractor shall submit a sequencing plan for approval for erosion control in conformance with Contractor's overall Construction Plan for approval by Owner.
   2. Changes to the Erosion Control Sequencing Plan may be considered by Owner only if presented in writing by the Contractor.

B. Temporary Erosion Control:
   1. When so indicated in the Contract Documents, or when directed by Owner. Contractor shall prepare construction schedules for accomplishing temporary erosion control work including all maintenance procedures.

2. These schedules shall be applicable to clearing and grubbing, grading, structural work, construction, etc.

C. Contractor shall submit for acceptance the proposed method of erosion control on haul roads and borrow pits and a plan for disposal of waste material.

D. Contractor shall be required to incorporate all permanent erosion control features into the project at the earliest practicable time as outlined in the accepted schedule. Temporary erosion control measures shall then be used to correct conditions that develop during construction.

E. Work shall not be started until the erosion control schedules and methods of operations have been accepted.

PART 2 PRODUCTS

2.1 MATERIALS

A. Comply with all applicable municipal or local Municipal Separate Storm Sewer System (MS4) requirements.

B. All materials shall be submitted for approval prior to installation.

C. Natural or biodegradable materials shall be reasonably clean, free of deleterious materials, and certified weed free. Materials may include, but are not limited to, hay bales, straw, fiber mats, fiber netting, wood cellulose, fiber fabric, gravel.

D. Grass Seed:
1. Temporary grass cover (if required) shall be a quick growing species, suitable to the area, in accordance with local criteria and permit requirements, which will provide temporary cover, and not compete with the grasses sown for permanent cover.
2. All grass seed shall be approved by Engineer and Owner and in accordance with local regulations prior to installation.

E. Fertilizer and soil conditioners shall be approved by Engineer and Owner and in accordance with local regulations prior to installation.

F. Silt Fence Fabric: woven polypropylene
1. Mirafi 100X, "Envirofence"
2. Or accepted substitution

G. Temporary Slope Stabilization Mat (short term): 1.5 pound photodegradable polypropylene top and bottom nets, 100% straw fiber matrix, with a longevity of 12 months.
1. North American Green S150
2. Or accepted substitution

H. Temporary Slope Stabilization Mat (extended term): 3.0 pound UV-stable polypropylene top net, 1.5 pound photodegradable polypropylene bottom net, 70% straw/30% coconut fiber matrix with a longevity of 24 months.
   1. North American Green SC150
   2. Or accepted substitution

I. Biodegradable Slope Stabilization Mat (short term): 9.3 pound leno-woven biodegradable jute top net, 7.7 pound woven biodegradable jute bottom net, 100% straw fiber matrix with a longevity of 12 months.
   1. North American Green S150BN
   2. Or accepted substitution

J. Biodegradable Slope Stabilization Mat (extended term): 9.3 pound leno-woven biodegradable jute top net, 7.7 pound woven biodegradable jute bottom net, 70% straw/30% coconut fiber matrix with a longevity of 18 months.
   1. North American Green SC150BN
   2. Or accepted substitution

K. Permanent Channel Stabilization Mat (flow velocities between 9.5 (unvegetated) and 15 (vegetated) fps): 5.0 pound UV-stable polypropylene top and bottom nets, 24 pound UV-stable polypropylene corrugated center net, 70% straw/30% coconut fiber matrix.
   1. North American Green SC250
   2. Or accepted substitution

L. Permanent Channel Stabilization Mat (flow velocities between 10.5 (unvegetated) and 20 (vegetated) fps): 8.0 pound UV-stable polypropylene top and bottom nets, 24 pound UV-stable polypropylene corrugated center net, 100% coconut fiber matrix.
   1. North American Green SC350
   2. Or accepted substitution

M. Permanent Channel Stabilization Mat (flow velocities between 12.5 (unvegetated) and 25 (vegetated) fps): 24 pound UV-stable polypropylene top and bottom nets, 24 pound UV-stable polypropylene corrugated center net, 100% polypropylene fiber matrix.
   1. North American Green P550
   2. Or accepted substitution

PART 3 EXECUTION

3.1 GENERAL

A. All temporary and permanent erosion and sediment control practices will be maintained and repaired as needed to ensure continued performance of their intended function.

B. Owner will monitor Contractor’s erosion control methods. If the overall function and intent of erosion control is not being met, Owner will require Contractor to provide additional measures as required to obtain the desired results.

C. The erosion control features installed by Contractor shall be adequately maintained by Contractor until the project is accepted.

D. Working In or Crossing Watercourses and Wetlands:
   1. Construction vehicles shall be kept out of watercourses to the extent possible.
   2. Where in-channel work is necessary, precautions shall be taken to stabilize the work area during construction to minimize erosion.
      a. The channel, including bed and banks, shall always be restabilized immediately after in-channel work is completed.
   3. Where a live (wet) watercourse must be crossed by construction vehicles during construction, a Temporary Stream Crossing shall be provided for this purpose.

3.2 PROTECTION OF ADJACENT PROPERITES

A. Properties adjacent to the site of a land disturbance shall be protected from sediment deposition.

B. In addition to the erosion control measures required on the drawings, perimeter controls may be required if damage to adjacent properties is likely, and may include, but is not limited to:
   1. Vegetated buffer strip around the lower perimeter of the land disturbance.
      a. Vegetated buffer strips may be used only where runoff in sheet flow is expected and should be at least twenty (20) feet in width.
   2. Sediment barriers such as straw bales, erosion logs, and silt fences.
   3. Sediment basins and porous landscape detention ponds.
   4. Combination of above measures.

3.3 CONSTRUCTION

A. Stabilization of Disturbed Areas:
   1. Temporary sediment control measures shall be established within five (5) days from time of exposure or disturbance.
   2. Permanent erosion protection measures shall be stablished within five (5) days after final grading of areas.

B. Stabilization of Sediment and Erosion Control Measures:
   1. Sediment barriers, perimeter dikes, and other measures intended to either trap sediment or prevent runoff from flowing over disturbed areas shall be constructed as a first step in grading and be made functional before land disturbance takes place.
   2. Earthen structures such as dams, dikes, and diversions shall be stabilized within five (5) days of installation.
   3. Stormwater outlets shall also be stabilized prior to any upstream land disturbing activities.

C. Stabilization of Waterways and Outlets:

1. All onsite stormwater conveyance channels used by Contractor for temporary erosion control purposes shall be designed and constructed with adequate capacity and protection to prevent erosion during storm and runoff events.
2. Stabilization adequate to prevent erosion shall also be provided at the outlets of all pipes and channels.

D. Storm Sewer Inlet Protection: All storm sewer inlets which are made operable during construction or which drain stormwater runoff from a construction site shall be protected from sediment deposition by the use of filters.

E. Construction Access Routes:
1. Wherever construction vehicles enter or leave a construction site, a Stabilized Construction Entrance is required.
2. Where sediment is transported onto a public road surface, the roads shall be cleaned thoroughly at the end of each day.
3. Sediment shall be removed from roads by shoveling or sweeping and be transported to a sediment controlled disposal area.
4. Street washing shall be allowed only after sediment is removed in the manner described above.

3.4 DISPOSITION OF TEMPORARY MEASURES

A. All temporary erosion and sediment control measures shall be disposed of within thirty (30) days after final site stabilization is achieved or after the temporary measures are no longer needed as determined by Owner.

B. Trapped sediment and other disturbed soil areas resulting from the disposition of temporary measures shall be permanently stabilized to prevent further erosion.

C. Substantial Completion of Erosion Control Measures:
1. At the time specified in the Contract Documents, and subject to compliance with specified materials and installation requirements, Contractor shall receive a Substantial Completion Certificate for temporary erosion control measures.
2. Maintenance of Erosion Control Measures after Substantial Completion: Contractor shall be responsible for maintaining temporary erosion control measures as specified in the drawings and Contract Documents until such time as work has been accepted by Owner and as specified in Division 1 for Closeout Procedures.

PART 4 MEASUREMENT FOR PAYMENT [SEE NOTES IN PARAGRAPH 1.1C]

4.1 LUMP SUM

A. Contractor shall include in the bid price for erosion and sedimentation control work a minimum of all items shown on the Erosion Control Plan, as required by Owner and any additional items that may be needed to control erosion and water pollution throughout all phases of the project.

END OF SECTION

SECTION 02510

WATER DISTRIBUTION SYSTEM

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Buried pipe, fittings, hydrants, valves, appurtenances, and associated accessories for raw water distribution and transmission lines

B. Precast vaults

1.2 RELATED SECTIONS

A. Section 02300 – Earthwork

B. Section 02676 – Disinfection of Water Systems

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM)
   1. A36 – Standard Specification for Carbon Structural Steel
   2. A48 – Standard Specification for Gray Iron Castings
   3. A53 – Standard Specification for Pipe, Steel, Black and Hot Dipped, Zinc Coated, Welded and Seamless
   4. A126 – Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings
   5. A185 – Standard Specification for Welded Steel Wire Fabric for Concrete Reinforcement
   6. A242 – Standard Specification for High-Strength Low-Allow Structural Steel
   7. A276 – Standard Specification for Stainless Steel Bars and Shapes
   8. A307 – Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 PSI Tensile Strength
   9. A449 – Standard Specification for Hex Cap Screws, Bolts and Studs, Steel, Heat Treated, 120/105/90 ksi Minimum Tensile Strength, General Use
   10. A536 – Standard Specification for Ductile Iron Castings
   11. A674 – Standard Practice for Polyethylene Encasement for Ductile Iron Pipe for Water or Other Liquids
   12. A615 – Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
   13. A1011 – Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength
   14. B62 – Standard Specification for Composition Bronze or Ounce Metal Castings
   15. B88 – Standard Specification for Seamless Copper Water Tube

16. B96 – Standard Specification for Copper-Silicon Alloy Plate, Sheet, Strip, and Rolled Bar for General Purposes and Pressure Vessels
17. B763 – Standard Specification for Copper Alloy Sand Castings for Valve Applications
18. B843 – Magnesium Alloy Anodes for Cathodic Protection
19. C33 – Standard Specification for Concrete Aggregates
20. C136 – Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
21. C150 – Standard Specification for Portland Cement
22. C913 – Standard Specification for Precast Concrete Water and Wastewater Structures
23. C1227 – Standard Specification for Precast Concrete Septic Tanks
24. D429 – Standard Test Methods for Rubber Property-Adhesion to Rigid Substrates
25. D698 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kn-m/m3))
26. D1241 – Standard Specification for Materials for Soil-Aggregate Subbase, Base, and Surface Courses
27. D1248 – Standard Specification for Polyethylene Plastics Extrusion Materials for Wire and Cable
28. D1330 – Standard Specification for Rubber Sheet Gaskets
29. D1351 – Standard Specification for Thermoplastic Polyethylene Insulation for Electrical Wire and Cable
30. D1784 – Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
31. D1785 – Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
32. D2000 – Standard Classification System for Rubber Products in Automotive Applications
33. D2239 – Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter
34. D2241 – Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
35. D2467 – Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
36. D2454 – Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems
37. D2737 – Standard Specification for Polyethylene (PE) Plastic Tubing
38. D2774 – Standard Practice for Underground Installation of Thermoplastic Pressure Piping
39. D2837 – Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials or Pressure Design Basis for Thermoplastic Pipe Products
40. D3035 – Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter
41. D3139 – Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
42. D3212 – Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals

43. D3261 – Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing
44. D3350 – Standard Specification for Polyethylene Plastics Pipe and Fittings Materials
45. D3139 – Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
46. D3950 – Standard Specification for Strapping, Nonmetallic (and Joining Methods)
47. D4253 – Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table
48. D4254 – Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density
49. D6938 – Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
50. E8 – Standard Test Methods for Tension Testing of Metallic Materials
51. F412 – Standard Terminology Relating to Plastic Piping Systems
52. F477 – Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
53. F714 – Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Outside Diameter
54. G97 – Standard Test Method for Laboratory Evaluation of Magnesium Sacrificial Anode Test Specimens for Underground Applications

B. American Water Works Association (AWWA)
1. B300 – Standard for Hypochlorites
2. B301 – Standard for Liquid Chlorine
3. B302 – Standard for Ammonium Sulfate
4. B303 – Standard for Sodium Chlorite
5. C104 – Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings
6. C105 – Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems
7. C110 – Standard for Ductile-Iron and Gray-Iron Fittings
8. C111 – Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
9. C115 – Flanged Ductile-Iron Pipe with Ductile-Iron or Grey-Iron Threaded Flanges
10. C116 – Standard for Protective Fusion-Bonded Epoxy Coatings for Interior and Exterior Surfaces of Ductile-Iron and Gray-Iron Fittings
11. C150 – Standard for Thickness Design of Ductile-Iron Pipe
12. C151 – Standard for Ductile-Iron Pipe, Centrifugally Cast
13. C153 – Standard for Ductile-Iron Compact Fittings
14. C200 – Standard for Steel Water Pipe 6 In. (150 mm) and Larger
15. C203 – Standard for Coal-Tar Protective Coatings & Linings for Steel Water Pipes
16. C206 – Standard for Field Welding of Steel Water Pipe
17. C207 – Standard for Steel Pipe Flanges for Waterworks Service, Sizes 4 In. Through 144 In. (100 mm Through 3,600 mm)
18. C213 – Standard for Fusion-Bonded Epoxy Coatings and Linings for Steel Water Pipe and Fittings
19. C214 – Standard for Tape Coatings for Steel Water Pipelines
20. C219 – Standard for Bolted, Sleeve-Type Couplings for Plain-End Pipe
21. C500 – Standard for Metal-Seated Gate Valves for Water Supply Service
22. C502 – Standard for Dry-Barrel Fire Hydrants

23. C504 – Standard for Rubber-Seated Butterfly Valves
24. C509 – Standard for Resilient-Seated Gate Valves for Water Supply Service
25. C515 – Standard for Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service
26. C550 – Standard for Protective Epoxy Interior Coatings for Valves and Hydrants
27. C600 – Standard for Installation of Ductile Iron Mains and Their Appurtenances
28. C604 – Standard for Installation of Buried Steel Water Pipe – 4 In. (100 mm) and Larger
29. C605 – Standard for Underground Installation of Polyvinyl Chloride (PVC) and Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe and Fittings
30. C651 – Disinfecting Water Mains
31. C700 – Standard for Cold-Water Meters – Displacement Type, Metal Alloy Main Case
32. C800 – Standard for Underground Service Line Valves and Fittings
33. C900 – Standard for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 60 In. (100 mm Through 1,500 mm) for Water Transmission and Distribution
34. C901 – Standard for Polyethylene (PE) Pressure Pipe and Tubing 1/2 In. (13 mm) Through 3 In. (76 mm) for Water Service
35. C906 – Polyethylene (PE) Pressure Pipe and Fittings 4 in. (100 mm) Through 63 In. (1,600 mm) for Water Distribution and Transmission
36. M11 – Steel Pipe: A Guide for Design and Installation
37. M17 – Standard for Installation, Field Testing, and Maintenance of Fire Hydrants
38. M23 – Standard for PVC Pipe Design and Installation
39. M41 – Standard for Ductile-Iron Pipe and Fittings

C. Colorado Department of Transportation (CDOT)

D. National Fire Protection Agency (NFPA)

E. Occupational Safety and Health Administration (OSHA)

F. NSF International:
   1. Standard 60 – Drinking Water Treatment Chemicals – Health Effects
   2. Standard 61 – Drinking Water System Components – Health Effects

G. Surface Preparation Standards (SSPC)

H. American Welding Society (AWS):
   1. D1.1 – Structural Welding Code – Steel

I. National Association of Corrosion Engineers (NACE):
   1. SP0169 – Control of External Corrosion on Underground or Submerged Metallic Piping Systems
   2. SP0286 – Electrical Isolation of Cathodically Protected Pipelines

J. Uni-Bell PVC Pipe Association:
   1. Uni-Pub-8: Tapping Guide for PVC Pressure Pipe

K. Plastics Pipe Institute (PPI):
   1. TR-4 – HDB / HDS / SDB / PDB / MRS Ratings for Thermoplastic Piping Materials or Pipe
   2. TR-33 – Generic Butt Fusion Joining Procedure for Field Joining of Polyethylene Pipe
   3. Handbook of Polyethylene Pipe
   4. Material Handling Guide

L. Ductile Iron Pipe Research Association (DIPRA):
   1. Thrust Restraint Design for Ductile Iron Pipe

M. American Railway Engineering and Maintenance-Of-Way Association (AREMA)

N. International Plumbing Code (IPC)

O. International Code Council (ICC)

P. Underwriters' Laboratories (UL)

1.4 SUBMITTALS

A. Submit under provisions of Division 1 Specifications

B. Shop Drawings: Provide piping layout and assembly drawings with fitting dimensions. Provide sufficient information to verify compliance with specifications

C. Shop Drawings: Provide sufficient data to verify compliance with the specifications and to illustrate construction and assembly of precast vault

D. Product Data: Provide manufacturer's catalog information with dimensions, material and assembled weight. Indicate pressure ratings for pipe, fittings, valves
   1. Pipe materials
   2. Special, fitting, and coupling details
   3. Joint restraint system
   4. Valves
   5. Laying and installation schedule
   6. Specifications and data sheets
   7. Affidavits of compliance for protective shop coatings and linings

E. Product Data: Provide manufacturer catalog information on castings, grating, and accessories to indicate compliance with specifications of precast vault

F. Design Data: Include calculations prepared by precast manufacturer indicating design loads and material requirements for reinforcement

G. Manufacturer's Certificate: Certify that products meet or exceed specified requirements and applicable standards. Provide prior to shipment.

H. Test Reports: Submit reports of field pressure and disinfection tests under provisions of Section 01340

I. Test Reports: Indicate disinfection results comparative to specified requirements

1.5 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Division 1 Specifications

B. Accurately record actual locations of piping mains, valves, connections, top of pipe elevations, and any mapped or unmapped utilities

C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities

1.6 QUALITY ASSURANCE

A. Manufacturers shall be experienced in the design and manufacturing of materials specified herein for a minimum period of 5 years

B. All PVC pipe, regardless of diameter, shall be supplied by a single manufacturer

C. Perform Work in accordance with AWWA C651, and the Colorado Department of Public Health and Environment (CDPHE), Mesa County, and City of Grand Junction.

D. Contractor shall conduct visual inspection before installation

E. Provide manufacturer's name and pressure rating marked on piping and valves

F. Provide piping complete with all fittings, jointing materials, supports, joint restraint system, and necessary appurtenances for watertight, fully operational water lines

1.7 REGULATORY REQUIREMENTS

A. Conform to all municipal codes and ordinances, laws and regulations of Mesa County, City of Grand Junction, CDPHE, the notes and details on the drawings and as specified herein, and CDPHE Stormwater Management and/or Construction Dewatering Permit

B. Conform to AWWA C651, as appropriate, and CDPHE Design Criteria for Potable Water Systems for performing the work of this Section

C. In case of apparent conflict, CDPHE requirements govern over these specifications

D. In absence of State and local regulations, International Plumbing Code applies

E. NFPA Compliance: Install fire water systems in accordance with NFPA 24 “Standard for the Installation of Private Fire Service Mains and Their Appurtenances”

F. UL Compliance: Provide fire hydrants that comply with UL 246 “Hydrants for Fire-Protection Service,” and are listed by UL.

G. Contractor, not Owner, shall prepare, submit, pay, and otherwise obtain all necessary permits from all appropriate entities

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Division 1 specifications

B. Delivery
   1. Ship rubber gaskets in cartons and store in a clean area away from grease, oil, ozone producing electric motors, heat and the direct sunlight

C. Storage
   1. Store pipe, fittings and gaskets in clean locations protected from environmental conditions such as: direct sunlight, mud, etc.
   2. Do not use pipe and fittings stored in direct sunlight for periods in excess of 18 months
   3. Store pipe on a flat surface which provides even support for the barrel with bell ends overhanging
      a. Do not stack pipe higher than 5 feet

D. Storage: Use the following precautions for valves, during storage:
   1. Do not remove end protectors unless necessary for inspection; then reinstall for storage
      a. Protect valves from weather by storing indoors or support valves off ground or pavement in watertight enclosures when outdoor storage is necessary

E. Handling
   1. Handle so as to insure installation in sound undamaged condition
   2. Use equipment, tools and methods for unloading, reloading, hauling and laying that do not damage pipe or cause an impact. Damaged pipe will be cause for rejection.
   3. Use hooks or straps with broad, well-padded contact surfaces for lifting sections of pipe

F. Preparation for Transport: Prepare valves, for shipping as follows: Ensure that valves are dry and internally protected against rust and corrosion. Protect valves against damage to threaded ends, flange faces, and weld ends. Set valves in best position for handling. Set valves closed to prevent rattling

G. Deliver and store valves and accessories in shipping containers with labeling in place in accordance with AWWA C500

H. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation

I. Seal valve ends to prevent entry of foreign materials into valve body

J. During loading, transporting and unloading, exercise care to prevent damage to material
   1. Use nylon slings only
   2. Do not drop pipe or fittings
   3. Do not roll or skid against pipe already on ground
   4. Repair any damage done to coating or lining
   5. Handle per manufacturer's recommendations
   6. Store rubber gaskets in cool dark location
   7. Store all material on wood pallets or timbers

K. Adequately tag or otherwise mark all piping, fittings, and valves as to size per AWWA C509 and C900

L. Shop coated materials shall be handled, transported, stored and shipped in a manner that will prevent damage to the coating and lining. Coating or lining damaged in handling or other operations shall be repaired to the approval of and at no additional cost to the Owner

M. Any damage to the pipe or the protective coating from any cause during the installation of the pipeline and before final acceptance by the Engineer shall be repaired in accordance with these Specifications and at no additional cost to the Owner

N. Precast Concrete Structures
   1. Transport and handle precast concrete units with equipment to protect from dirt and damage
   2. Do not place precast concrete units in position which will cause damage
   3. Handle precast concrete structures by means of lifting inserts. Do not move from manufacturer’s yard until curing is complete.

1.9 JOB CONDITIONS

A. All work which requires the interruption of active water service lines must be completed as quickly as possible in order to minimize inconvenience to customers and risk to the City and coordinated as specified in Division 1

B. Underground Obstructions
   1. Underground Obstructions known to Engineer are shown on Drawings
      a. Locations shown may prove inaccurate and other obstructions not known to Engineer may be encountered
      b. Contractor shall field locate and verify all obstructions where or not shown on the Drawings
   2. Notify each utility owner and request utility be field located by surface reference at least 48 hours prior to trenching or excavation
   3. Expose and verify size, location and elevation of underground utilities and other obstructions where conflicts might exist sufficiently in advance to permit changes in the event of a conflict
      a. Notify Engineer and Owner in case of a conflict

b. In case of a conflict, the proposed work may be changed by Engineer
4. Maintain, protect, and support by shoring, bracing or other means existing utilities and appurtenances

C. Verify existing system operation, pressures, and valve settings (open or closed) prior to construction

PART 2 PRODUCTS

2.1 PVC PIPE - 4" TO 12" DIAMETER

A. Manufacturers:
1. JM Eagle
2. Georg Fischer Piping Systems
3. North American Pipe Corporation
4. Diamond Plastics Corporation
5. Vinyltech Corporation
6. Or accepted substitution

B. The following piping shall be small diameter PVC pipe as indicated on Drawings and as specified herein:
1. Raw Water mains: 6" diameter

C. Pipe: AWWA C900, DR 18 except as otherwise specified or indicated on the Drawings

D. Marking: Identification markings on pipe shall conform to AWWA C900

E. Fittings: Ductile iron fittings, ANSI A 21.53/AWWA C153
1. Working pressure rating: 350 psi rating
2. Joint: mechanical joints with restraints
3. Coating:
a. Exterior: AWWA C111
b. Interior: AWWA C104 and C111, lined with double thickness cement seal coated
c. Or interior and exterior: AWWA C116, fusion bonded epoxy coating

F. Joints: ASTM D3139, integral bell or mechanical joint
1. Push-on joints: pipe to pipe joints, except as otherwise specified or indicated on Drawings. Push on joints are not permitted on fittings or valves
a. Integral bell type with elastomeric gaskets, ASTM F477 factory installed
b. Suitable for buried service
c. Gaskets:
i) Material: Virgin SBR rubber suitable for potable water conforming to AWWA C111
ii) Lubricant shall be suitable for potable water contact
2. Bells shall be oriented downhill for all slopes steeper than 15%
3. Restraint device for PVC push on joint
a. Restraint material: ASTM A536, ductile iron

b. Provide joint restraints on slopes greater than 33%.
c. A backup ring shall be used behind the PVC bell. A restraint ring, incorporating a plurality of individually-actuating gripping surfaces, shall be used to grip the pipe, and a sufficient number of bolts shall be used to connect the bell ring and the gripping ring
d. Pressure rating consistent with pipe pressure rating
e. Restraint coatings shall be consistent with manufacturer's standard
f. Manufacturers:
    i) "Certa-Lok"
    ii) Or accepted substitution

4. Mechanical joint restraint
    a. Provide mechanical joint restraint for all ductile iron fittings connecting to PVC pipe
    b. Provide mechanical joint restraints on slopes greater than 33%.
    c. Restraint devices for shall consist of multiple gripping wedges incorporated into a follower gland meeting the applicable requirements of ANSI/AWWA A21.10/ C110
    d. Pressure rating consistent with pipe pressure rating
    e. Restraint coatings shall be consistent with manufacturer's standard
    f. Manufacturer:
        i) EBAA Iron "MEGALUG 2000 PV"
        ii) Or accepted substitution

G. Couplings
1. Mechanical couplings:
    a. Dresser Style 38
    b. Rockwell 411
    c. Or accepted substitution
2. Insulated Mechanical Couplings:
    a. Dresser Style 39
    b. Or accepted substitution
3. Transition Couplings:
    a. Rockwell 415
    b. Dresser Style 39
    c. Or accepted substitution
4. Glands color coded: Black

2.2 PVC PIPE – 14" TO 48" DIAMETER

A. Manufacturers
1. JM Eagle
2. North American Pipe Corporation
3. Diamond Plastic Industries
4. Vinyltech Corporation
5. Or accepted substitution

B. The following piping shall be large diameter PVC pipe as indicated on Drawings and as specified herein:
   1. Raw Water Main: 20” diameter
   2. Diameters: Cast iron pipe equivalent outside diameters

C. Pipe: AWWA C900, DR 18 except as otherwise specified or indicated on the Drawings

D. Marking: Identification markings on pipe shall conform to AWWA C900

E. Fittings: Ductile iron fittings, ANSI A 21.53/AWWA C153
   1. Working pressure rating: 350 psi rating
   2. Joint: mechanical joints with restraints
   3. Coating:
      a. Exterior: AWWA C111
      b. Interior: AWWA C104 and C111, lined with double thickness cement seal coated
      c. Or interior and exterior: AWWA C116, fusion bonded epoxy coating

F. Joints: ASTM D3139, integral bell or mechanical joint
   1. Push-on joints: pipe to pipe joints, except as otherwise specified or indicated on Drawings. Push on joints are not permitted on fittings or valves
      a. Integral bell type with elastomeric gaskets, ASTM F477 factory installed
      b. Suitable for buried service
      c. Gaskets:
         i) Material: Virgin SBR rubber suitable for potable water conforming to AWWA C111
         ii) Lubricant shall be suitable for potable water contact
   2. Bells shall be oriented downhill for all slopes steeper than 15%
   3. Restraint device for PVC push on joint
      a. Restraint material: ASTM A536, ductile iron
      b. A backup ring shall be used behind the PVC bell. A restraint ring, incorporating a plurality of individually-actuating gripping surfaces, shall be used to grip the pipe, and a sufficient number of bolts shall be used to connect the bell ring and the gripping ring
      c. Pressure rating consistent with pipe pressure rating
      d. Restraint coatings shall be consistent with manufacturer's standard
      e. Manufacturers:
         i) “Certa-Lok”
         ii) Or accepted substitution
   4. Mechanical joint restraint
      a. Provide mechanical joint restraint for all ductile iron fittings connecting to PVC pipe
      b. Provide mechanical joint restraints on slopes greater than 33%.
      c. Restraint devices for shall consist of multiple gripping wedges incorporated into a follower gland meeting the applicable requirements of ANSI/AWWA A21.10/ C110
      d. Pressure rating consistent with pipe pressure rating
      e. Restraint coatings shall be consistent with manufacturer's standard

f. Manufacturer:
   i) EBAA Iron "MEGALUG 2000 PV"
   ii) Or accepted substitution

G. Couplings
1. Mechanical couplings:
   a. Dresser Style 38
   b. Rockwell 411
   c. Or accepted substitution
2. Insulated Mechanical Couplings:
   a. Dresser Style 39
   b. Or accepted substitution
3. Transition Couplings:
   a. Rockwell 415
   b. Dresser Style 39
   c. Or accepted substitution
4. Glands color coded: Black

2.3 PIPE, FITTINGS, AND ACCESSORIES

A. Comply with the most current City of Grand Junction standards and specifications for the public water system products and accessories.

2.4 PVC SADDLE TAP

A. Provide saddle tap for connection to air release/vacuum breaker combination valves as shown on the Drawings

B. Use tapping saddle manufactured specifically for C900 PVC pipe with stainless steel wide band straps, nuts and washers

C. Manufacturer:
1. Mueller
2. Or accepted substitution

2.5 PIPE ACCESSORIES

A. Identification Marker Tape: Provide metallic core tape, blue with black letters "CAUTION – WATER LINE BELOW" continuously printed plastic tape with metallic core, intended for direct-burial service; not less than 6-inch wide x 4 mils thick. Provide identification markers of one of the following:
1. Allen Systems, Inc.
2. Emed Co., Inc.
3. Seton Name Plate Corp.
4. Or accepted substitution

B. Tracer Wire
1. Provide tracer wire for all PVC pipe

2. All tracer wire shall be 10 AWG solid copper wire coated with 45 mil Type HMW - PE blue insulation compliant with ASTM D1351 specifically designed for direct burial in corrosive soil or water
3. UL listed

C. Tracer Wire Test Stations
1. 4-inch with locking lid
2. Manufacturers:
   a. CP Test Services
   b. Glenn Series "Glenn-4"
   c. Or accepted substitution

D. Corrosion Control
1. Rust inhibitive primer:
   a. Tnemec "Series 77H Chem-Prime"
   b. Or accepted substitution
2. Rust preventative compound:
   a. Houghton "Rust Veto 344"
   b. Rust-Oleum "R-9"
   c. Or accepted substitution

E. Pipe Spacers
1. Pipe bands shall be fabricated of a minimum of 14 gauge 304 stainless steel
   a. Steel strapping shall be in accordance with ASTM A36
2. Hardware:
   a. Bolts: 5/16-inch stainless-steel flange bolts

F. Insulators
1. Polyethylene casing insulator band and skids with stainless-steel bolts

G. End Seals
1. Fabricated of EPDM or neoprene
2. Durometer hardness: 60
3. Minimum thickness: 1/8 inch
4. Hardware: 304 stainless steel with worm screws
5. Manufacturers
   a. Advance Products & Systems, Inc.
   b. Pipeline Seal & Insulator, Inc.
   c. Or accepted substitution

2.6 BUTTERFLY VALVES – 16" TO 36" (DIRECT BURY) AND ACCESSORIES

A. Manufacturers:
1. Pratt
2. Milliken
3. Or accepted substitution.

B. AWWA C504 Class 150B for direct bury service

1. Valve body shall be constructed of cast iron ASTM A126 Class B and conform to AWWA C504 in terms of laying lengths and minimum body shell thickness
2. Mechanical joint ends following AWWA C111
3. Valve disc shall be cast iron or ductile iron furnished with Type 316 stainless steel seating edge to mate with rubber seat on body
    a. Valve disc shall seat in position at 90 degrees to pipe axis and shall rotate 90 degrees between full-open and tight-closed position. Install valves with valve shafts horizontal and convex side of disc facing anticipated direction of flow
    b. Disc shall not creep or flutter under service conditions
4. Seat: Buna-N-Rubber
    a. 16-inch to 18-inch: Bonded seats that meet ASTM D429 Method B
    b. 24-inch and larger: Seats retained in the valve body by mechanical means without metal retainers or other devices located in the flow stream
    c. Retaining hardware for seats: type 304 or 316 stainless steel. Nuts and screws used with clamps and discs for rubber seats shall be held securely with locktight, or other approved method, to prevent loosening by vibration or cavitation effects
5. Valve Shaft: type 304 SS, ASTM A276
    a. Shaft bearings: stainless steel in accordance with AWWA C504. Design valve shaft to withstand 3 times amount of torque necessary to open valve
    b. Packing: Standard self adjusting and wear compensating, split-V type, and replaceable without removing actuator assembly
6. Actuators:
    a. Provide manual actuators for single project, from same manufacturer
    b. Shaft connecting actuator to valve body must be fully enclosed. Bonnet and extension to be fully enclosed and water tight
    c. Provide bonnet extensions, as required, between valve body and actuator. Space between actuator housing and valve body shall be completely enclosed so that no moving parts are exposed to soil or elements
    d. Provide actuators for valves with size based on line velocity of 12 feet per second and unidirectional service.
        i) Equip with gear manual actuator
        ii) Fully enclosed, traveling-nut type. Traveling nut shall engage alignment grooves in the housing
        iii) Traveling nut actuator shall be self-locking and designed to transmit twice the required actuator torque without damages to faces of gear teeth or contact faces of nut
    e. Oil-tight and watertight actuator housing for valves, specifically designed for buried service and factory packed with suitable grease
    f. Equipped with 2-inch actuator nut
    g. Rotation: Counterclockwise to open with the word "OPEN" and an arrow indicating the direction to open cast on valve body or operating nut
    h. Valve operating key: Provide one (1) for project, 7-foot length with tee handle
7. Coating
    a. Follow AWWA C550 and NSF 61

b. Coat interior and exterior ferrous surfaces of valve with epoxy suitable for potable water conditions: in accordance with AWWA C550 and coating manufacturer's recommendations
c. Provide three coats of two component, high-build epoxy with minimum dry film thickness of 12 mils

C. Extension stems
1. Provide as specified for buried valves with operating nuts more than 4.5 feet below grade
2. Non-rising stems
a. Solid steel shafting with O.D. not less than O.D. of valve stem or galvanized steel pipe with I.D. not less than O.D. of valve stem
b. Connected to the valve by a flexible socket coupling
c. All other connections pinned
d. Extend stem to within 6-inch of grade
e. Provide spacers to center stem in valve box
f. Provide wrench nut

D. Valve boxes, depth as required for valve
1. Three-piece cast iron (complying with ASTM A48, Class 20A) adjustable screw type, 5.25-inch diameter, minimum thickness of 3/16 inch
2. Box, cover, and base coated by dipping in asphalt varnish.
3. Cover marked with word, “WATER.”
4. Provide extension piece to permit 6-inch adjustment above finish grade
5. Manufacturers:
a. Tyler Pipe Company "Series 6860 with #160 oval base"
b. East Jordan Iron Works "8560 Series"
c. Tyler Union "6860 Series"
d. Or accepted substitution

2.7 VALVE INSERTION

A. Manufacturers:
1. Romac
2. Or accepted substitution

B. Resilient wedge designed for use in potable water systems

C. The design shall allow the valve to be installed into an existing pressurized pipeline while maintaining constant pressure and service as usual. The valve shall be equipped with a standard handwheel operator.

D. Valve Construction:
1. The ductile iron body, bonnet, and wedge shall provide a strength and pressure rating that meets or exceeds the requirements of AWWA C515
2. Valve shall be ductile iron construction and meet ASTM A536 Grade 65-45-12

3. Chemical and modularity tests shall be performed as recommended by the Ductile Iron Society, on a per ladle basis. Testing for tensile, yield and elongation shall be done in accordance with ASTM E8
4. Sizes 12" and smaller must be capable of working on Cast/Grey Iron or Ductile Iron Class A, B, C and D without changing either top or bottom portion of split valve body
5. 250 psi maximum working pressure. The pressure rating markings must be cast into the body of the insert valve.
6. After the installation of the insert valve body on to the existing pipe, a pressure test of 1.1 times that of the contents shall be sustained for 15 minutes. Once the pressure test is affectively achieved, the insert valve body must not be moved in accordance with AWWA Standards. If the insert valve is moved the pressure test must be completed again. The insert valve must not be moved or re-positioned once the pressure test is achieved.

E. Resilient Wedge Gate Assembly:
1. The construction of the resilient wedge shall comply with AWWA C509 requirements
2. The ductile iron wedge shall be fully encapsulated with EPDM rubber by a high pressure and high temperature compression or injection mold process
3. The resilient wedge shall seat on the valve body and not the pipe to obtain the optimum seating and flow control results. The resilient wedge shall be totally independent of the carrier pipe.
4. The resilient wedge shall not come into contact with the carrier pipe or depend on the carrier pipe to create a seal
5. Pressure equalization on the down or upstream side of the closed wedge shall not be necessary to open the valve
6. The wedge shall be symmetrical and seal equally well with flow in either direction
7. The resilient wedge must ride inside the body channels to maintain wedge alignment throughout its travel to achieve maximum fluid control regardless of high or low flow pressure or velocity
8. The resilient wedge must have more support than the operating stem as the resilient wedge enters and exits the water (fluid) way

F. Fusion-Bonded Epoxy:
1. The insert valve is fully epoxy coated on the interior and the exterior. The fusion-bonded coating is applied prior to assembly so that even the bolt holes and body-to-bonnet flange surfaces are fully epoxy coated
2. Valve shall be coated with a minimum of 8 mils epoxy in compliance with AWWA C550 and certified to ANSI/NSF-61

G. Gaskets and Triple O-Ring Stem Seals:
1. This insert valve features triple O-Ring stem seals. One O-Ring is located above, and two O-Rings are located below the thrust collar.
2. The lower two O-Rings provide a permanently sealed lubrication chamber that will make the valve easier to operate over a longer period of time. The upper O-Ring ensures that sand, dirt or grit cannot enter the valve to cause damage to the lower O-Rings. This is especially important for buried and sewage service applications.

3. Side flange seals shall be of the O-Ring type of either round, oval, or rectangular cross- sectional shape

H. Valve Stem & Thrust Washers:
   1. The gate valve stem and wedge nut shall be copper alloy in accordance with AWWA C515
   2. The NRS stem must have an integral thrust collar in accordance with AWWA C515. Two-piece stem collars are not acceptable. The wedge nut shall be independent of the wedge and held in place on three sides by the wedge to prevent possible misalignment.
   3. Two thrust washers are used. One is located above, and one is located below the stem thrust collar. Two thrust washers ensure easy operation at all times.
   4. NRS with AWWA standard turns.
   5. Operated by 2" square wrench nut according to ASTM A126 CL.B – open counter-clockwise.

I. Hardware:
   1. Bolting materials shall develop the physical strength requirements of ASTM A307 with dimensions conforming to ANSI B18.2.1.

J. Extended Life Value:
   1. The stuffing box, operating stem and resilient wedge (complete bonnet and all moving parts) shall be removable, repairable and or replaceable under pressure. In other words, even while the valve is fully pressurized in the system all moving components can be removed under pressure. In the event the valve stem is broken or damaged the bonnet can be removed under pressure.
   2. Internal pressure equalization system assures the safe entry and removal of the valve bonnet during initial installation as well as future maintenance

K. Split Restraint Devices:
   1. Shall consist of multiple gripping wedges incorporated into a follower gland meeting the applicable requirements of ANSI/AWWA C110/A21.10
   2. The devices shall have a working pressure rating of 350 psi for 4-12 inch. Ratings are for water pressure and must include a minimum safety factor of 2 to 1 in all sizes
   3. Chemical and modularity tests shall be performed as recommended by the Ductile iron Society, on a per ladle basis. Three test bars shall be incrementally poured per production shift as per U.L. specifications and ASTM A536. Testing for tensile, yield and elongation shall be done in accordance with ASTM E8.
   4. Gland body wedges and wedge actuating components shall be cast from grade 65-45-12 ductile iron material in accordance with ASTM A536
   5. Mechanical joint restraint shall require conventional tools and installation procedures per AWWA C600, while retaining full mechanical joint deflection during assembly as well as allowing joint deflection after assembly.
   6. Proper actuation of the gripping wedges shall be ensured with torque limiting twist off nuts. Set screw pressure point type hardware shall not be used.
   7. Restraint devices shall be listed by Underwriters Laboratories and Approved by Factory Mutual (3" through 12" inch size)

2.8 AIR RELEASE AND VACUUM BREAKER COMBINATION VALVES

A. Manufacturers:
   1. Vent-o-mat "RBX"
   2. GA "Figure CAV"
   3. Val-Matic "200C Series"
   4. APCO "140C Series"
   5. Or accepted substitution

B. Provide combination air release and vacuum breaker valves as indicated on Drawings
   1. Provide integral type that functions as both an air release and a vacuum breaker valve
   2. Provide a shutoff valve
      a. 2" and smaller valve size: ball valve
      b. Larger than 2" valve size: gate valve

2.9 BLOW-OFF DRAIN

A. Provide blow-off drains where indicated on the Drawings as shown on Details

2.10 CORROSION CONTROL

A. Shop paint all ferrous metal surfaces of valves and accessories, both interior and exterior for corrosion protection, epoxy interior coating for potable water contact.

B. Manufacturer's standard paint will be acceptable if it is functionally equivalent and compatible with specified field coatings

C. Exterior bituminous coating or asphalt varnish: Manufacturer's Standard epoxy coal tar

D. Ductile-iron Pipe and Fittings Shop lining: Cement-lined, AWWA C104/C205

E. Rust inhibitive primer: Tnemec "Series 77H Chem-Prime" or accepted substitution

F. Rust preventative compound: Houghton "Rust Veto 344", Rust-Oleum "R-9", or accepted substitution

2.11 BEDDING

A. Bedding: As specified in Section 02300

2.12 ACCESSORIES – MISCELLANEOUS

A. Extension stems
   1. For valve installations with operating nuts over 5 five below grade, extend stem to 4.5 feet of final grade. Provide spacers to center stem in valve box.

B. Valve boxes for all buried valves, depth as required for valve
   1. Three-piece cast iron (complying with ASTM A48, Class 20A) adjustable screw type, 5.25-inch diameter, minimum thickness of 3/16 inch.
   2. Box, cover, and base coated by dipping in asphalt varnish.
   3. Cover marked with word, "WATER."
   4. Provide threaded top section to permit 6-inch adjustment above finish grade.
   5. Series 6860 with #160 oval base as manufactured by Tyler Pipe Company or accepted substitution.

C. Concrete for Thrust Blocks: constructed of "Class B" Concrete as defined by CDOT Construction Specifications with maximum water to cement ratio of 0.63 by weight and 28-day compressive strength of 3,000 psi

D. Anchorages: Provide anchorages for tees, wyes, crosses, plugs, caps, bends, valves and hydrants. After installation, apply full coat of asphalt or other acceptable corrosion-retarding material to surfaces of ferrous anchorages.
   1. Clamps, straps and washers: Steel, ASTM A506
   2. Rods: Steel, ASTM A575
   3. Rod Couplings: Malleable-iron, ASTM A197
   4. Bolts: Steel, ASTM A307
   5. Cast-Iron Washers: Gray-iron, ASTM A126

2.13 DISINFECTION CHEMICALS

A. Calcium and sodium hypochlorite shall conform to AWWA B300 and B301

B. Store hypochlorite in a cool, dark place away from flammable materials
   1.

2.14 PRECAST CONCRETE VAULT

A. Manufacturers:
   1. Oldcastle Precast
   2. Front Range Precast Concrete
   3. Or accepted substitution

B. Materials
   1. Reinforcement
      a. Reinforcing Steel: ASTM A615 Grade 60
      b. Welded Wire Fabric: ASTM A185
   2. Concrete:
      a. Cement: ASTM C150, Portland Cement, Type II
      b. Aggregates: ASTM C33, free of deleterious substances
      c. Minimum compressive strength: ASTM C39, 4500 psi minimum at 28 days
   3. Precast Sectionss
      a. Specification: ASTM C1227
      b. Minimum wall thickness: 6 inch
      c. Grade rings as required

4. Gaskets: ASTM C923
    a. Mastic: FS SS-S-210A, "RAM-NEK" or accepted substitution
    b. Rubber: Neoprene, 40± 5 hardness when measured by ASTM D2240, Type A durometer
5. Castings: ASTM A48 with asphalt varnish coating hot dip applied at foundry, 6 mils thick
6. Manhole Steps: Steel bar, 1/2 inch Grade 60, drop-front type, with polypropylene coating applied by manufacturer, Type MA Industries, Inc. "PS2-PF" or accepted substitution
7. Inlet Gratings and Manhole Ring and Cover
    a. Cast iron, heavy duty traffic type, ASTM A48, Class 30B. Grind bearing surfaces to ensure flat, true surfaces
    b. Covers to seat at all points on ring
8. Pipe Penetrations:
    a. Cast-a-Seal gasket
    b. Link-Seal
    c. Or accepted substitution
9. Manhole Height Adjustment: Use precast concrete grade rings
10. Rock Subbase: 1-1/2 inch minus, well-graded gravel over compacted subgrade
11. Water: Clean and free of deleterious substances

C. Fabrication
1. Vault Section
    a. Precast concrete dimensions as shown on plans
    b. Precast lid: Same or greater reinforcement and wall thickness with capability for H20 loading
    c. Joints: Shiplap or tongue and groove with double mastic gaskets, each joint to set equally and tightly
    d. Access opening: Minimum 24 clear
    e. Pipe connection: As indicated on Drawings
    f. Pipe knockout: As indicated on Drawings
2. Grating and Metal Frame: As specified on Drawings

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions under provisions of Division 1 Specifications

B. Verify locations and inverts or tops of pipe for connections to existing system as well as crossings with other utilities as indicated on the drawings. Report any discrepancies to Engineer

C. Carefully examine pipe and fittings for cracks, damage to linings, and other defects prior to installation

D. Remove all defective piping from site and replace

E. Examine areas for weak or structural defects or deviations beyond allowable tolerances for piping clearances that adversely affect excavation and quality of Work

F. Start installation only when conditions are satisfactory

G. Verify items provided by other sections of Work are properly sized and located

H. Verify that built-in items are in proper location, ready for roughing into Work

I. Verify excavation for vault is correct

3.2 PERFORMANCE - GENERAL

A. Perform work in a safe and proper manner with appropriate precautions against hazard

B. Provide adequate working space and clearances for work performed within excavations and for installation and removal of utilities

C. Contain all construction activity on the designated site and within the limits of work. Cost of restoration of site will be the responsibility of the Contractor

D. Contractor to verify quantities to perform all earthwork required according to Drawings, including but not limited to, additional import or export required to handle compaction, pavement subgrade preparation, and pipe bedding

E. Contractor shall take precautions to limit the removal of or damage to existing pavements, multi-use paths sidewalks, curbs, lawns, shrubbery, trees, hedges, walls, fences, buildings, or other existing improvements to the least practicable amounts and shall replace or restore such improvements to their original location and condition after the excavation has been backfilled and compacted

3.3 PROTECTION OF EXISTING UTILITIES AND STRUCTURES

A. Excavation and backfill operations shall be performed in such a manner to prevent cave-ins of excavations or the undermining, damage or disturbing of existing utilities and structures or of new work

B. Backfill shall be placed and compacted so as to prevent future settlement or damage to existing utilities and structures and new work

C. Any excavations improperly backfilled or where settlement occurs shall be reopened to the depth required then refilled with approved materials and compacted, and the surface restored to the required grade and condition, at no additional costs to the Owner

D. Any damage due to excavation, backfilling, or settlement of the backfill, or injury to persons or damage to property occurring as a result of such damage shall be the responsibility of the Contractor. All costs to repair such damage, in a manner satisfactory to the Engineer, shall be borne by the Contractor at no additional expense to the Owner

3.4 SITE PREPARATION

A. Clear all site areas within the limits of work of grasses, roots, brush, and other objectionable material and debris

B. Remove all waste materials from site and dispose. Stockpile all acceptable grubbings for reuse in revegetation areas.

C. Remove debris including all demolished trees, underbrush, stumps, roots and other combustible materials from site and dispose of off-site; on-site burning is not permitted

3.5 DEWATERING

A. Comply with CDPHE Dewatering Requirements

B. Dewatering discharge to surface waterways requires CDPHE dewatering permit. Contractor must obtain dewatering permit and comply with discharge requirements therein, if necessary

3.6 PIPE PREPARATION

A. Ream pipe and tube ends and remove burrs

B. Remove scale and dirt, on inside and outside, before assembly

C. Cut ends of metallic pipe, recoat with coating approved for potable water service and compatible with manufacturer's coatings.

3.7 PRECAST CONCRETE VAULT PREPARATION

A. Verify items provided by other section of Work are properly sized and located

B. Verify that built-in items are in proper location, ready for roughing into Work

C. Verify excavation for manholes is correct

D. Excavation, Backfill, Subgrade Compaction: Refer to Section 02300 for requirements

E. Rock Subbase
   1. Remove water and place 6-inch minimum depth
   2. Vibrate for compaction
   3. Level top to accept precast sections with uniform bearing all around
   4. If material below vault is unsuitable, excavate as directed by the Engineer and backfill to grade with 1-1/2 inch minus rock and compact

3.8 PLACING PRECAST SECTIONS

A. Thoroughly clean joints of sections to place gasket material

B. Place gasket material on base or lower section to ensure watertight fit between lower precast section and upper precast section

C. Fill inside and outside of joint completely with non-shrink grout and trowel smooth

D. Cure non-shrink grout using approved methods as recommended by manufacturer

3.9 PREFORMED GASKETS

A. Remove and replace vault sections which have chipped or cracked joints

B. Thoroughly clean section joints

C. Install gasket in conformance with manufacturer's recommendations

D. Only use primer furnished by gasket manufacturer

3.10 BEDDING

A. Comply with City standards and specifications

B. Excavate pipe trench in accordance with Section 02300 for work of this Section. Do not disturb trench bottom during excavation. Hand trim excavation for accurate placement of pipe to elevations indicated.

C. Place bedding material in accordance with Section 02300 at trench bottom, level fill materials in one continuous layer not exceeding 6 inches compacted depth, compact to 95 percent. Protect from lateral displacement by placing embedment evenly on both sides of pipe

D. Provide dewatering and backfill trench in accordance with Section 02300

3.11 PIPE INSTALLATION

A. Comply with City standards and specifications. Use the manufacturer’s recommendations if the City standards do not specifically apply.

B. Install PVC Pipe in accordance with AWWA M23 and AWWA C605

C. Install Ductile Iron Pipe in accordance with AWWA C600

D. Install Ductile Iron Fittings in accordance with AWWA M41

E. Route pipe as indicated on the Drawings

F. The inside of all pipe, valves, and fittings shall be smooth, clean, and free from blisters, loose mill scale, sand, and dirt when connected

G. Install as specified or in accordance with the manufacturer's recommendations

H. Cutting Pipe
   1. Cut pipe to measurement taken at the site, not from the drawings
   2. Cut pipe neatly without damage to pipe
   3. Cut smooth, straight, and at right angles to pipe axis
   4. Dress and bevel end of cut pipe to remove roughness and sharp corners
   5. Cut pipe with saw or abrasive wheel
   6. Follow state and federal safety regulations pertaining to cutting asbestos concrete pipe as necessary

I. Provide an isolation or shutoff valve and union at the water connections to each fixture and unit of equipment, whether shown on the drawings or not

J. Install pipe to indicated elevations. Maintain minimum 3.0 feet depth of ground cover and maintain minimum grade for drainage. Establish elevations of buried piping to ensure minimum cover is achieved. Maximum depth of 7.0 feet is allowed to avoid a local high point unless shown otherwise on the plans. Add additional soil in areas of future fill to provide minimal cover at all times. Report any variations from plan to Owner and Engineer
   1. Provide air release valve at all high points and blow-offs or hydrant at all low points. Coordinate locations and details with Engineer.
   2. Where minimum depth cannot be maintained, provide a minimum of 2 inch of specified insulation board per 1 foot of cover not provided. Contractor must have Owner and Engineer approval prior to installation.
      a. Place insulation board over bedding material for the width of the trench

K. Install pipe to allow for expansion and contraction without stressing pipe or joints

L. Protect from lateral displacement by placing embedment evenly on both sides of pipe

M. Do not lay pipe in water. Maintain groundwater level a minimum of 12 inches below pipe to be installed. Do not lay pipe under unsuitable weather or trench conditions

N. Make changes in horizontal, vertical, and curved alignment shown on drawings by using joint deflections in the amount permissible by manufacturer and shown on drawings

O. Do not bend pipe

P. Deflect pipe at joints

Q. Do not deflect PVC pipe at connection to ductile iron fittings

R. Form and place concrete for thrust blocks at each elbow or change of direction of pipe main as indicated on Drawings

S. Utility crossings
   1. Whenever possible, lay water mains over sanitary and storm sewers to provide vertical separation of at least 18-inch between invert of water main and crown of sewer

2. If standard crossing detail is not available and above separation cannot be met, provide one continuous length of watertight sewer pipe 20' long centered on water main with joints between different pipes encased in 6-inch minimum of concrete and extending 6-inch either side of joint or encase sewer pipe in 6-inch of concrete completely around pipe, for not less than 10' either side of water main
3. Water Mains Passing Under Sanitary Sewers: If vertical separation is less than 18-inch, provide structural support for sewer. Provide concrete encasement where water lines pass under sanitary sewer line. Reference detail shown on Drawings

T. Maintain a minimum 10 feet of horizontal separation and 18 inches of vertical separation between water main and storm or sanitary sewer lines in accordance with the CDPHE
1. Provide concrete encasement if these clearances cannot be achieved and when water line is below sanitary sewer line

U. Tracer wire and marker tape
1. Install tracer wire continuous over top of pipe
2. Install tracer wire test stations at maximum 500 LF of water line per City requirements. Locate test station at fire hydrants, gate valves, or special test station locations in a valve box
3. Terminate tracer wire following drawing details
4. Tape tracer wire to top of pipe using PVC tape every 4 feet along the pipe, and on each side of fitting
   a. Tape: minimum 2 inches wide and wrapping full circumference of pipe
5. Install identification /warning marker tape in fill area of trench above all water lines

V. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system

W. Install access fittings to permit disinfection of water system, subject to approval by Engineer

X. Backfill trench in accordance to specifications herein

Y. Protect pipe from floatation or movement until completely backfilled and put into service

3.12 WATER MAIN CONNECTIONS

A. Comply with City standards and specifications. Coordinate with City and fire department representatives for any impacts to the existing water system and provide advanced notice to impacted properties if applicable.

B. Connect to water main per plans and referenced standards or details.

3.13 JOINTS

A. Make pipe joints carefully and neatly

B. Connect piping in accordance with manufacturer's recommendations

C. Push-on joints
   1. Lay pipe with bell ends facing the direction of laying except when Engineer authorizes reverse laying
   2. Assembly of PVC plain end into bell: follow PVC pipe manufacturer's recommendation
   3. For PVC pipe, Contractor to ensure that pipe is not inserted into the bell ends beyond the push line
      a. Utilize EBAA Mega-Stop bell protection, or approved substitution, if necessary, to ensure previously laid pipe joints are not impacted by ongoing installation
   4. Lubricate joint surfaces immediately before completing the joint
   5. Bevel spigot ends of field cut piping
   6. Groove spigot ends of field cut restrained joint piping if required by joint system
   7. Install restrained joints following manufacturer's recommendations

D. Mechanical joints
   1. Before assembling joint, clean both bell and plain end of rust and foreign matter
   2. Assemble joint following AWWA C111, C600, C605 and as specified
   3. Lubricate gasket and install in accordance with manufacturer's instructions
   4. If an effective seal is not obtained, disassemble joint, clean thoroughly, and reassemble
   5. Do not over tighten bolts to compensate for poor installation
   6. Carefully align holes in mechanical joints with restraint device to permit installation of the harness bolts
   7. Install mechanical joint pieces so the mechanical joint holes straddle the top centerline for horizontal piping, or the side centerline for vertical piping

3.14 PROTECTIVE COATING

A. Provide polyethylene tube encasement on all buried ductile iron fittings and valves
   1. Encase ductile iron fittings and valves in polyethylene per AWWA C105, Method A, secured with polyethylene compatible adhesive tape. Overlap polyethylene onto PVC pipe a minimum of 6 inches
   2. Before backfilling, inspect polyethylene for rips, punctures and other damage and repair following AWWA C105

B. Coat exposed ferrous metal surfaces of joints, couplings, and uncoated steel with primer and tape coating system after installation. Do not coat stainless steel or high strength low alloy steel nuts and bolts
   1. Surface Preparation: Clean surfaces of rust, scale, soil, mud, oil, grease, and other contaminants by hand or power tool following SSPC-SP2 or SP3 and other appropriate means as recommended by coating manufacturer Remove excess moisture and provide surface dryness as recommended by coating manufacturer
   2. Application: Apply primer in uniform manner to clean and dry surfaces following coating manufacturer's recommendations
      a. Fill complex and irregular surfaces with appropriate mastic or filler tape to eliminate bridging; then apply tape/wrap to primed and filled surfaces following coating manufacturer's recommendations.

b. When coating restraining rods or strapping, apply tape wrap longitudinally
c. Where metal being coated enters concrete, overlap coating onto concrete by minimum of 2 inches after placement of concrete

3. Inspection: After field coating of specified items, conduct visual inspection to verify complete coverage has been accomplished.
   a. Repair damaged or incompletely coated surfaces following coating manufacturer's recommendations

C. Metal Surfaces not Protected by Poly Wrap
1. Coat all steel clamp rods, bolts, and other metal accessories used in tapping saddles, anchorages, cut ends of pipe, follower rings and bolts or joint harnesses subject to submergence or contract with the earth and not concrete encased, but including pipe fittings and bolts in polyethylene tube protection
2. Apply 2 coats of coal tar paint to clean, dry metal surfaces, allow first coat to dry before applying second coat

D. Metal Harness Rods
1. Provide field applied primer and Polyken tape wrap

3.15 CONCRETE ENCASEMENT

A. Provide where indicated on the Drawings

B. Comply with City standards and specifications.

C. Suitably support and block pipe and anchor against flotation

3.16 VALVE INSTALLATION

A. Comply with City standards and specifications

B. Carefully inspect valve before installation. Clean interior. Operate valve to determine parts in proper working order, with valves seating and drain valve operating properly. Set plumb and center stem in valve box and securely brace into place. Comply with AWWA C600 and referenced standards.

C. Provide concrete collar for installations within landscaped areas

D. Protect valve box and cover during paving operations and clean any excess concrete, or asphalt, or road base from valve box and cover to ensure visibility and proper operation

3.17 INSERTION VALVE INSTALLATION

A. Install according to Manufacturer’s suggested procedures
1. Clean the area of the pipeline that is to receive the insert valve
2. Prepare the insert valve for assembly onto the pipeline per Manufacturer’s recommendations

3. Install the two insert valve body halves on the pipeline
4. Bolt two body halves of insert valve together. Tighten bolts per Manufacturer's recommendations.
5. After body bolts have been tightened, confirm that the insert valve is level
6. Install mechanical joint gaskets to insert valve and complete assembly using split mechanical joint restraints
7. Attach temporary insertion valve. A test port shall be attached and the assembly should be pressure tested.
8. Prepare tapping machine for mounting to temporary valve.
9. Tapping machine shall be mounted to the temporary isolation valve with chip flushing valve attached.
10. After completing the tap, close temporary isolation valve.
11. Remove tapping machine and cut out pipeline section.
12. Prepare insertion valve bonnet for live line insertion and attach to valve insertion tool per Manufacturer's recommendations
13. Position and attach valve insertion tool to temporary insertion valve. Confirm proper orientation of valve bonnet.
14. Open temporary isolation valve and advance travel of the bonnet to the body of the insert valve
15. Install six set pins to secure bonnet to insert valve body
16. Once set pins are in place, release the bonnet from the insertion tool
17. Use insertion tool blow off valve to release water with insertion tool housing and remove insertion tool from temporary insolation valve
18. Remove temporary isolation valve
19. Install O-Ring between valve body and bonnet to seal connection

3.18 TAPPING

A. Tapping shall be performed using standard tapping saddles designed for use on PVC piping in accordance with AWWA C605. Tapping shall be performed only with use of tap saddles or sleeves. NO DIRECT TAPPING WILL BE PERMITTED. Tapping shall be performed in accordance with the applicable sections for saddle tapping as per "Uni-Pub-8: Tapping Guide for PVC Pressure Pipe by Uni-Bell PVC Pipe Association"

B. All connections requiring a larger diameter than that recommended by the pipe supplier, should be made with a pipe connection as specified and indicated on the drawings.

C. Equipment used for tapping shall be made specifically for tapping PVC pipe:
   1. Tapping bits shall be slotted "shell" style cutters, specifically made for PVC pipe. 'Hole saws' made for cutting wood, steel, ductile iron, or other materials are strictly prohibited

3.19 THRUST BLOCKS

A. Installation:
   1. Thrust blocks shall be constructed at bends and fittings that require support due to unbalanced line thrust. Care shall be taken to ensure that outlets, cover bolts, nuts,

clamps, and other fittings are accessible. A bond breaker shall be placed between the pipe and the thrust block to aid in future removal. If a large thrust block is to be placed, it shall be separated into sections by a suitable material. Bearing surface areas are minimum areas to bear against the undisturbed trench wall and are provided in the City of Grand Junction Standards Table for Concrete Thrust Blocking Standard Waterline Detail W-08. If the soil bearing capacity is insufficient to provide adequate support based on minimum bearing areas established by Drawing Details, then the minimum bearing area shall be increased to a size that shall ensure support restraint. In every instance, the thrust block shall bear against undisturbed earth

2. Before placing concrete, equipment used in the mixing and transport shall be cleaned. Debris, water, or ice shall be removed from the area to be occupied by concrete. Concrete shall not be placed on frozen subgrade. Concrete shall be placed only in the presence of the Owner or Engineer unless inspection is waived prior to the placement

B. Formwork for Thrust blocks:
   1. Forming for concrete thrust blocks and anchors shall be done by bulkheading around the shape of the thrust block or anchor with wood, burlap sacks, or reinforced paper sacks that are filled with sand or earth. Sacks shall be constructed of a size easily handled when full and left in place in the trench. Wood forms shall be removed before backfilling.
   2. Horizontal struts or braces required for trench shoring shall not remain in concrete thrust blocks. Prior to placing concrete, the forms and ditch bank will be inspected and approved by Owner or Engineer
   3. When concrete is deposited against the ground without the use of forms, the ground shall be thoroughly moistened or other provisions made to prevent the ground from drawing water in from the concrete

C. Thrust block Curing Time:
   1. Newly placed concrete shall be allowed to set undisturbed for a minimum of 24 hours

D. Compaction of Fill Over Thrust blocks
   1. Backfill may be placed over thrust blocks once the surface has set sufficiently and they are able to resist the weight of the backfill. However, tamping or compacting shall not be allowed above the thrust block for a minimum of 24 hours after placement

E. Hydrostatic testing shall not be conducted until thrust blocks have fully cured, a minimum of 7 days

3.20 ABANDONMENT

A. Cap ends of main as shown. Place required concrete blocking as shown on drawing details

B. Where mains are to be abandoned and removed to a fitting or valve, cut and plug main at fitting or valve

1. When shown on drawings, remove fire hydrants and valves, including lead joint tees when encountered; salvage and deliver removed fire hydrants and valves to the City
2. Pipe, fittings, and other appurtenances that are removed, but are not required to be salvaged become property of Contractor
    a. Remove and dispose of offsite

3.21 ERECTION TOLERANCES

A. Establish invert elevations as shown on the drawings

B. Construct pipe within manufacturer's tolerances of horizontal and vertical deflection. Refer to City for allowable deflections at joints and fittings.

3.22 FIELD QUALITY CONTROL

A. Comply with City standards and specifications. Test each line at the Contractor's expense in the presence and to the satisfaction of City inspectors.

B. Field inspection and testing will be performed under provisions set forth by the referenced standards

C. Test each line at the Contractor's expense in the presence and to the satisfaction of Owner or Engineer at a maximum of 1,000-foot intervals

D. Water Line Disinfection
    1. Comply with AWWA C651 and provide Engineer and Owner with results.
    2. Flush water lines prior to disinfection, except when tablet method is used. Acceptable chlorine disinfectants are calcium hypochlorite granules, sodium hypochlorite solutions, and calcium hypochlorite solutions, and calcium hypochlorite tablets.
    3. After the pipe is filled with water and chlorine, the chlorinated water shall be held in contact with the pipe for 24 hours. At the end of the 24-hour period, the water in the pipeline shall be tested by the local health authority having jurisdiction, or their designated representative, to ensure a residual chlorine content in compliance with City requirements. The pipeline shall then be thoroughly flushed to remove the heavily chlorinated water. This activity requires a permit from the CDPHE WQCD prior to flushing. Comply with all provisions of the permit. Care shall be taken in flushing the pipeline to prevent property damage and danger to the public. Discharges of water from blowoff assemblies or other appurtenances shall be contained or discharged in a manner approved by the City and CDPHE.
    4. For fire lines, flush piping complying with NFPA 24
    5. If water in pipe does not meet the governing agency requirements, repeat disinfection procedure until acceptable. Furnish copies of acceptance forms from governing agency to Owner and Engineer.

E. Valve Testing
    1. Conduct pressure and leakage tests on all newly installed valves

2. Furnish all necessary equipment and material and make all connections to the pipe, as required. The Engineer shall monitor the tests.

F. Hydrostatic Pressure Tests
   1. Provide all necessary pumping equipment, piping connections, pressure gauges with maximum of 5 psi increments, and other required equipment, facilities, and materials
   2. Raw water may be used for flush and pressure testing. If potable water is used it must be delivered in acceptable containers
   3. Immediately locate and replace all pipe fittings, valves, pipe joints, and other materials found to be defective with new and acceptable material
   4. If tests indicate work does not meet specified requirements, remove work, replace, and retest at no cost to Owner
   5. Procedure
      a. Disconnect all fixture devices and other accessories which may be damaged by the specified test pressure
      b. Plug or cap ends as required
      c. Bleed system to eliminate all air from system
      d. No pressure testing shall be permitted until all concrete thrust blocks have adequate curing time to reach design strength, 7 day minimum
      e. Notify Owner and Engineer 48 hours prior to testing
      f. Test for 2 hours with no more than 5 psi pressure loss
      g. Leakage is the quantity of water added to a test section to maintain test pressure ±5 psi:

$$L = \frac{S \times D \times (P)^{0.5}}{133{,}200}$$

Where:
L = allowable leakage in gallons per hour
S = length of pipe tested, in feet
D = nominal diameter of pipe, in inches
P = average test pressure during test, psig

   6. Hydrostatic Test Conditions: At lowest point in the line or section under test pressure or operating pressure, whichever is greater, as scheduled below

Pipe	Test Pressure	Operating Pressure	Test Medium	System
20-inch PVC	150 psi	100 psi	Water	Distribution

   7. While the test pressure is maintained, an examination shall be made of the pipeline and any leaks located and repaired. Pipe or fittings found to be faulty shall be removed and replaced. Leakage is not allowed through the bonnet of the line valve. A valve leaking through the bonnet may be repaired in place or removed and replaced. Cutting and replacement of pavement as well as excavation and backfilling may be necessary when locating and repairing leaks discovered during pressure testing.
   8. After visible leaks are stopped, repeat procedure beginning at 3.13.D.5 of this section

G. PVC Water Pipe Continuity Testing

1. Test tracer wire for continuity, in the presence of Owner and Engineer, after backfill is complete and before Substantial Completion
2. Notify Owner and Engineer five working days in advance to schedule testing
3. Continuity test to consist of locating the PVC water pipe with an electronic-type pipe locator
4. If test is negative for continuity, repair or replace as necessary to achieve continuity

3.23 CLEANING

A. See Section 02676 Disinfection of Water Systems

3.24 DISINFECTION

A. See Section 02676 Disinfection of Water Systems

3.25 FINAL FLUSHING

A. See Section 02676 Disinfection of Water Systems

3.26 DISINFECTION FIELD QUALITY CONTROL

A. See Section 02676 Disinfection of Water Systems

3.27 DISINFECTION TESTING AND ACCEPTANCE

A. See Section 02676 Disinfection of Water Systems

3.28 FINAL ACCEPTANCE

A. Comply with City standards and specifications for placing water line in service

B. The inside of all pipe, valves, and fittings shall be smooth, clean, and free from blisters, loose mill scale, sand, and dirt when connected.
   1. Wire brush, if necessary, wipe clean and keep joint contact surfaces clean until connection is complete

C. Drain all test water from the new pipe system prior to placing in service

D. Provide water tap locations (x, y, z) on the Drawings

E. Provide operation and maintenance manuals for air and line valves

F. Provide final reports to Engineer for:
   1. Bac-T results
   2. Residual chlorine tests
   3. Hydrostatic tests for each section or pipe
   4. Cathodic protection system test(s)
   5. Tracer wire continuity test

END OF SECTION

SECTION 02630

STORM DRAINAGE SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Piping and concrete structures for storm sewer system, roof drainage, and culverts

B. Riprap for channel lining, outlet protection and rock check dams

1.2 RELATED SECTIONS

A. Section 02300 – Earthwork

B. Section 03300 – Concrete

C. Section 03600 – Grout

D. Section 09900 – Coatings

1.3 REFERENCES

A. ACPA - American Concrete Pipe Association

B. ASTM C76 - Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe

C. ASTM C150 - Portland Cement

D. ASTM C443 - Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets

E. ASTM C478 – Precast Concrete Structures

F. ASTM C497 - Testing Concrete Pipe, Manhole Sections, or Tile

G. ASTM A48 - Gray Iron Castings

H. ASTM A185 - Steel Welded Wire Fabric, Plain, for Concrete Reinforcement

I. ASTM A615 - Deformed and Plain Billet-Steel Bars for Concrete Reinforcement

J. ASTM C33 - Concrete Aggregates

K. ASTM C478 - Precast Reinforced Concrete Manhole Sections

L. ASTM C990 – Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants

M. Urban Storm Drainage Criteria Manual, Urban Drainage and Flood Control District (UDFCD)

N. Colorado Department of Transportation (CDOT) Standard Specifications for Road and Bridge Construction

1.4 DESIGN REQUIREMENTS

A. Comply with applicable requirements of ASTM C76

B. Comply with City of Grand Junction, Mesa County, and CDPHE Stormwater and/or Groundwater Discharge Permit and related storm design criteria. If standards conflict, the more stringent criteria shall govern.

1.5 SUBMITTALS

A. Submit under provisions of Division One Specifications

B. Shop Drawings: Provide drawings with pipe and structure details, design standards, reinforcement, dimensions, etc. Provide additional detailed information (including elevations, fittings, specialty materials or fabrications, etc.) for special or custom features, structures, junctions and/or pipes. Provide pipe-laying schedule.

C. Product Data: Provide sufficient data on features, pipe, joints, gasket material, lubricant and accessories to verify compliance with specifications.

D. Manufacturers Certificate: Certify that pipe, meets or exceeds specified requirements. Confirm all materials comply with applicable standards.

E. Test Reports: Submit all shop and field test reports in accordance with Division One Specifications Product Data:

F. Provide sufficient data to verify compliance with these specifications.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Delivery
   1. Ship rubber gaskets in cartons and store in a clean area away from grease, oil, ozone producing electric motors, heat and the direct rays of the sun

B. Storage
   1. Store pipe, fittings and gaskets in clean locations protected from environmental conditions such as: (direct sunlight, mud.. etc)
   2. Do not use pipe and fittings stored in direct sunlight for periods in excess of 18 months
   3. Store pipe on a flat surface which provides even support for the barrel with bell ends overhanging
      a. Do not stack pipe higher than 5 feet

C. Handling
    1. Handle so as to insure installation in sound undamaged condition.
    2. Use equipment, tools and methods for unloading, reloading, hauling and laying that do not damage pipe or cause an impact. Damaged pipe will be cause for rejection
    3. Use hooks or straps with broad, well padded contact surfaces for lifting sections of pipe

1.7 ENVIRONMENTAL REQUIREMENTS

A. Weather limitations: Do not install piping over frozen surfaces or in standing water.

PART 2 GENERAL PRODUCTS

2.1 PIPE AND FITTINGS MATERIALS

A. Comply with City of Grand Junction standards and specifications for public storm sewer products.

B. General: Provide pipes of one of the following materials, of weight/class indicated. Provide pipe fittings and accessories of same material and weight/class as pipes, with joining method as indicated

C. Fittings: Furnish bends, ells, tees, wyes, couplings and other fittings of the same type and class of material having equal or superior physical and chemical properties as acceptable to the Engineer

D. Reinforced Concrete Pipe: ASTM C76,
    1. 12-inch RCP Class V, with modified tongue-and-groove compression gasket joints complying with ASTM C443.
    2. 15-inch RCP Class IV (Class V when specified on plans), with modified tongue-and-groove compression gasket joints complying with ASTM C443.
    3. 18-inch thru 24-inch RCP Class III (Class IV or V when specified on plans), with modified tongue-and-groove compression gasket joints complying with ASTM C443.
    4. 24-inch thru 36-inch RCP Class II (Class III, IV or V when specified on plans), with modified tongue-and-groove compression gasket joints complying with ASTM C443.

E. PVC Sewer Pipe: ASTM D3034, Type PSM, SDR 35 with PVC, elastomeric joints complying with ASTM D3212 using elastomeric seals complying with ASTM F477.

2.2 MATERIALS

A. Comply with City of Grand Junction standards and specifications for public storm sewer products.

B. Plugs and Caps: Use pipe plugs or caps provided by the pipe manufacturer and approved by the Engineer for pipe stubouts.

C. Cleanouts: Provide as indicated, pipe extension to grade with ferrule and countersink cleanout plug. Provide round cast-iron access frame over cleanout, with heavy duty secured scoriated cover with lifting device cast with the word “STORM”.

D. Reinforcement
   1. Reinforcing Steel: ASTM A615 Grade 60
   2. Welded Wire Fabric: ASTM A185

E. Concrete:
   1. Minimum compressive strength: ASTM C39, 4500 psi at 28 days
   2. Cement: ASTM C150, Portland Cement, Type II
   3. Aggregates: ASTM C33, free of deleterious substances

F. Gaskets:
   1. ASTM C990 for preformed flexible joint sealants
   2. FS SS-S-210A, "RAM-NEK" or accepted substitution
   3. Rubber: 40$\pm$ 5 hardness when measured by ASTM D2240, Type A durometer

G. Inlet Gratings and Manhole Rings and Covers
   1. Cast iron, heavy duty traffic type, ASTM A48, Class 35B. Grind bearing surfaces to ensure flat, true surfaces
   2. Provide bike/pedestrian-safe grates where such traffic is anticipated
   3. Set grate on frame such that openings maximize inlet intake
   4. Covers to seat at all points on ring
   5. Covers to be cast with "STORM" in 2-inch tall flush letters
   6. Manhole covers to receive asphalt varnish coating hot dip applied at foundry, 6 mils thick

H. Manhole Height Adjustment: Use precast concrete grade rings

I. Rock Subbase: 1-1/2 inch minus, well-graded gravel over compacted subgrade

J. Water: Clean and free of deleterious substances

K. Grout:
   1. Non-Shrink, Non-Metallic Grout: Factory premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents, capable of developing minimum compressive strength of 4000 psi in one day and 8000 psi in 7 days
   2. Epoxy Grout: Three Component Epoxy Resin System
      i) Two liquid epoxy components
      ii) One inert aggregate filtered component
      iii) Each component furnished in separate package for mixing at job site

2.3 CONCRETE CATCH BASINS AND MANHOLES

A. Comply with City of Grand Junction standards and specifications for public storm sewer products.

B. Precast Concrete Units:
   1. Manufacturers: Carder Concrete Products, Amcor Precast, or accepted equal
   2. Specification: ASTM C478 and C789
   3. Minimum wall thickness: greater of 6 inches or 1/12 of internal diameter
   4. Reinforced
   5. Grade rings as required
   6. Cast steps into units.

C. Precast Units or Cast-in-place as shown. Use concrete that will attain a 28-day compressive strength of not less than 4500 psi with a cement content of not less than 6 sacks per cu. yd. Openings to be precast per plan or sawcut in field.

D. Cast-in-place Concrete Units: As shown on the drawings complying with the City of Grand Junction and Colorado Department of Transportation drainage and design standards.

E. Manholes shall be coated in accordance with City engineering standards and in accordance with Section 09900.

2.4 PVC PLASTIC INLINE DRAINS AND DRAIN BASINS

A. Manufacturer: Nyloplast America Inc. or accepted substitution.

B. Inline drains and drain basins shall be manufactured from PVC pipe stock, utilizing a thermo molding process to reform the pipe stock to the furnished configuration. The drainage pipe connection stubs shall be manufactured from PVC pipe stock and formed to provide a watertight connection with the specified pipe system. The joint tightness shall conform to ASTM D3212.

C. Surface drainage products shall meet the mechanical property requirements for fabricated fittings as described in ASTM F794, F949 and F1336.

D. Inline drain and drain basin adapters and accessories
   1. Adaptable to SDR-35 PVC piping.
   2. Watertight adaptors.

E. Cast iron or ductile iron frames and grates:
   1. Light –traffic rated
   2. Pedestrian rated
   3. Hinged and locking
   4. Made specifically for use with the specified inline drains and drain basins
   5. Painted black
   6. ASTM A-48-83 Class 30B or A536 grade 70-50-05 grade iron
   7. Size indicated on the drawings

2.5 CONCRETE FABRICATION

A. Comply with City of Grand Junction standards and specifications for public storm sewer products.

B. Vault/Manhole Sections
   1. Precast concrete dimensions as shown on plans
   2. Minimum manhole inside diameter: 48 inch
   3. Precast lid and Cones: Same or greater reinforcement and wall thickness as vault or manhole section with capability for H20 loading
   4. Vault Joints: Shiplap or tongue and groove with double mastic gaskets, each joint to set equally and tightly
   5. Manhole Joints: Keylock type with double mastic gaskets, each joint to set equally and tightly
   6. Access opening: Minimum 24 clear or as indicated
   7. Pipe connection: As indicated on Drawings
   8. Pipe knockout: As indicated on Drawings
   9. Precast concrete, monolithic base or cast-in-place base
   10. Manhole steps: 12 inch on center, vertical alignment above largest bench or open area

C. Grating and Metal Frame: As specified on drawings

2.6 SOIL MATERIALS

A. Comply with City of Grand Junction standards and specifications for public storm sewer products.

B. Furnish pipe bedding and cover as specified in Section 02300 – Earthwork.

C. Riprap Materials:
   1. Hard, dense, durable stone, angular in shape and resistant to weathering
   2. Minimum specific gravity of 2.5
   3. Material may be approved by Engineer, if by visual inspection, the rock is determined to be sound and durable
   4. Engineer may require Contractor to furnish laboratory test results if the material appears to be marginal or unacceptable
   5. Tested material shall meet the following requirements for abrasion resistance or compressive strength:

Test	Test Method	Requirement
Abrasion Resistance by Los Angeles Machine	ASTM C 535	50% loss, max
Unconfined Compressive Strength of Drilled Core Specimen	AASHTO T 24	2500, min

6. Contractor shall provide a five ton sample of riprap indicating the compliance to required material soundness and gradation specifications if requested by the Engineer.
7. Gradation:

Riprap Designation	% Smaller Than Given Size By Weight	Intermediate Rock Dimension (Inches)	Mean Particle Size, d_{50} (Inches)
Type L	70-100 50-70 35-50 2-10	15 12 9 3	9
Type M	70-100 50-70 35-50 2-10	21 18 12 4	12
Type H	70-100 50-70 35-50 2-10	30 24 18 18 6	18

8. Granular Riprap Bedding:
   a. 3/4" – 1" Crushed rock – AASHTO 57/67

Sieve Size (Inch)	Percent Passing by Weight
1	100
3/4"	90-100
1/2"	25-60
3/8"	20-55
NO. 4	0-10
NO. 8	0-5
NO. 200	0-2

D. Pipe Bedding:
   1. Refer to Section 02300 – Earthwork
   2. Minimum 6 inch deep, unless specified otherwise

E. Drainage Fabric: Nonwoven geotextile, specifically manufactured as a drainage geotextile; made from polyolefins, polyesters, or polyamides; and with the following minimum properties determined according to ASTM D 4759 and referenced standard test methods:
   1. Grab Tensile Strength: 110 lbf (490 N); ASTM D 4632.
   2. Tear Strength: 40 lbf (178 N); ASTM D 4533.
   3. Puncture Resistance: 50 lbf (222 N); ASTM D 4833.
   4. Water Flow Rate: 150 gpm per sq. ft. (100 L/s per sq. m); ASTM D 4491.
   5. Apparent Opening Size: No. 50 (0.3 mm); ASTM D 4751.

PART 3 EXECUTION

3.1 REGULATORY REQUIREMENTS

A. Comply with City of Grand Junction standards and specifications for public storm sewer installation.

3.2 PIPE PREPARATION

A. Shape trench and place bedding as specified in Section 02300 and as shown on the drawings.
   1. Dig bell or coupling holes
   2. Do not support pipe on blocks or mounds of earth.
   3. Provide uniform and continuous bearing and support for full length of pipe between bell holes
   4. Minor disturbance over a maximum length of 18 inches near the middle of each length of pipe will be permissible by the withdrawal of pipe slings or other lifting tackle

B. Alignment and Grade
   1. Except as indicated on the Drawings, lay all pipe straight and at a uniform grade.
   2. Use batter boards to determine and check pipe subgrades.
   3. Other methods of maintaining alignment and grade may be acceptable if approved by the Engineer.

3.3 PIPE INSTALLATION

A. Inspect pipe and accessories for defects before lowering into trench.

B. Replace any defective, damaged or unsound pipe.

C. Carefully lower pipe, fittings, and accessories into the trench with derricks, ropes, and other suitable equipment to prevent damage. Do not dump or drop pipe or accessories into trench.

D. Pipe embedment shall be as specified in Section 02300 for pipe.

E. Protect from lateral displacement by placing the specified pipe embedment material.

F. Do not lay pipe in water, under unsuitable weather conditions or under unsuitable trench conditions

G. Joint to form true and smooth line.

H. Remove any pipe not making a good fit.

I. Begin pipe laying at the lowest point unless reverse laying is accepted by Engineer.

J. Utilize implements, tools and facilities as recommended by the manufacturer and/or catch basins if required to remove debris.

K. Keep pipe clean during and after laying.

L. During construction, close all open ends with watertight expandable type plugs.
   1. At the end of each day's operations.
   2. Whenever pipe ends are left unattended.
   3. Deposit adequate backfill on pipe to prevent flotation.
   4. Do not use wood, burlap or other similar temporary plugs.

M. Remove and re-lay any pipe which has floated.

3.4 PRECAST STRUCTURE PREPARATION

A. Verify items provided by other section of Work are properly sized and located

B. Verify that built-in items are in proper location, ready for roughing into Work

C. Verify excavation for manholes is correct

D. Excavation and Backfill: Refer to Section 02300 - Earthwork for requirements

E. Coordinate placement of inlet and outlet pipe or duct sleeves required by other sections

F. Rock Subbase: Remove water, excavate, and place 1-1/2 inch washed rock 6-inch minimum depth, vibrate for compaction

3.5 CATCH BASINS

A. Construct catch basins to the sizes and shapes indicated, and to conform to requirements of authorities having jurisdiction.
   1. Rock Subbase: Remove water, excavate, and place 1-1/2 inch washed rock 6-inch minimum depth, vibrate for compaction
   2. For precast units, set in place to accurate elevations on firm, solid bed, plumb and level.
   3. Pipe openings, elevations and alignment per plans
   4. Seal and grout all pipe penetrations
   5. Set cast iron frames and gratings to the elevations indicated.

3.6 PLACING MANHOLE SECTION OR CAST-IN PLACE BASE

A. Rock Subbase: Remove water, excavate, and place 1-1/2 inch washed rock 6-inch minimum depth, vibrate for compaction

B. Place base pad, trowel top surface level to accept manhole section with uniform bearing all around

C. Place sufficient non-shrink grout on base to ensure watertight fit between first manhole section and base or place first manhole section directly in wet concrete

D. Place manhole sections plumb and level, trim to correct elevations

E. Clean ends of sections and place double mastic gasket

F. Fill inside and outside of joint completely with non-shrink grout and trowel smooth

G. Cure non-shrink grout using approved methods

H. Set cover rings and covers level without tipping, to correct elevations or set cover rings and covers with slight tip to match cross slope of finished surface where directed by Engineer

I. Completed manholes shall be rigid and watertight

J. Coordinate with other sections of work to provide correct size, shape, and location

3.7 PREFORMED GASKETS

A. Remove and replace manhole sections which have chipped or cracked joints

B. Thoroughly clean section joints

C. Install gasket in conformance with manufacturer's recommendations

D. Only use primer furnished by gasket manufacturer

3.8 MANHOLE INVERT

A. Place concrete in bottom of manhole and form smooth transition. Trowel smooth and brush for non-skid finish. Slope bench 1 inch per foot for drainage to invert.

B. Invert shape to conform to radius of pipe it connects

C. Remove all rough sections or sharp edges which tend to obstruct flow or cause material to snag. Remove all grout droplets from invert

D. Construct in conformance with standard drawings

3.9 MANHOLE RINGS AND COVERS

A. Place rings in bed of non-shrink grout on top of manholes

B. Ensure no infiltration will enter manhole at this location

C. Carry non-shrink grout over flange of ring

D. Set top of ring flush with all surfaces subject to foot and vehicular traffic

E. Set top of ring 6 inches above surfaces in open, unraveled, non-pedestrian areas

F. Use precast grade rings for height adjustment

3.10 CONNECTION TO EXISTING MANHOLES

A. Maintain flow at all times

B. Prior approval of proposed method for maintaining flow must be obtained from Engineer

C. Cover area around new pipe with non-shrink grout and or waterstop gasket to ensure a watertight structure

D. Make connection during low flow periods

3.11 GROUT

A. PREPARATION
   1. Non-Shrink, Non-Metallic Grout, General Use
      a. Clean concrete surface to receive grout
      b. Saturate concrete with water for 24 hrs prior to grouting and remove excess water just prior to placing grout
      c. Cold weather conditions
         i) Warm concrete, substrate and base plate to 40 deg F, or above; store grout in warm area
         ii) Follow manufacturer's recommendations for cold weather application
      d. Hot weather conditions
         i) Use cold mixing water and cool base plate if possible; store grout in cool area
         ii) Follow manufacturer's recommendations for hot weather application
      e. Apply to clean, sound surface
      f. Apply latex bonding agent to hardened concrete, mix-in-grout, or as directed by Engineer
   2. Epoxy Grout: Apply only to clean, dry, sound surface
      a. Patching cavities in concrete including, but not limited to, tie holes, and structural and equipment support

B. APPLICATION
   1. Non-Shrink, Non-Metallic Grout
      a. Mix in a mechanical mixer
      b. Use no more water than necessary to produce flowable grout
      c. Provide air vents where necessary to eliminate air pockets
      d. Place in accordance with manufacturer's instructions
      e. Where exposed to view finish grout edges smooth
      f. Protect against rapid moisture loss by immediately covering with wet rags and polyethylene sheets or curing compound
      g. Wet cure grout for 7 days, minimum

h. Maintain the temperature at a minimum of 40 deg F until grout reaches 3000 psi
i. After placement of grout, eliminate excessive external vibration

2. Epoxy Grout
   a. Mix and place in accordance with manufacturer's instructions
   b. Completely fill all cavities and spaces around dowels and anchors without voids
   c. Obtain manufacturer's technical assistance as required to insure proper placement

3.12 RIPRAP

A. Do not place riprap over frozen or spongy subgrade surfaces.

B. Place riprap at pipe outlets and in channels as indicated on plans. Top of riprap to match invert of outlet pie and channels.

C. Excavate and prepare subgrade.

D. Place geotextile fabric per plans under all bedding. Place bedding and place riprap on bedding per plans.

E. Material may be machine placed and then arranged as necessary by use of a Gradall with multi-prong grapple device or by hand to minimize voids. Dumping alone is not sufficient to achieve properly placed riprap.

3.13 FIELD QUALITY CONTROL

A. Field inspection and testing including a lamp test will be performed for every section of pipe after backfill has occurred
   1. Contractor shall furnish suitable assistance to the Engineer
   2. A minimum of 75% of a true circle will be required to indicate a properly constructed line
   3. Contractor will repair any section not passing the lamp test.

B. Request inspection immediately after placing cover over pipe.

C. Backfilling and testing as required per Section 02300 - Earthwork.

END OF SECTION

SECTION 02920

SEEDING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Soil preparation

B. Fertilization

C. Seeding methods

D. Areas to be reseeded

E. Seed Mix

F. Maintenance

G. Seed protection and slope stabilization

1.2 RELATED SECTIONS

A. Section 01500 – Construction Facilities and Temporary Controls

B. Section 02300 – Earthwork

C. Section 02370 – Erosion and Sedimentation Control

1.3 REFERENCES

A. Federal Specification (FS) O-F-241 - Fertilizers, Mixed, Commercial

B. American Association of Nurserymen - Standardized Plant Names

C. Association of Official Seed Analysts (AOSA)

D. Colorado Department of Agriculture (CDA) Seed Act

E. Colorado Department of Transportation (CDOT) Construction Specifications

1.4 SUBMITTALS

A. Submit under Division One Specifications for products related to seeding work including but not limited to seed mixes, mulches, composts, tackifiers, fertilizers and herbicides.

B. Product Data:

1. Certified Live Seed analyses not more than 6 months old by a recognized laboratory of seed testing for grass mixtures including percent of live seed (PLS), germination, all crop seeds in excess of 1 percent, inerts and weeds
2. Manufactures guaranteed chemical analysis, name, trade name, trademark and conformance to state and local laws of all fertilizers and herbicides

1.5 QUALITY ASSURANCE

A. Provide seed mixture in containers showing percentage of seed mix, year of production, net weight, date of packaging, and location of packaging

B. Provide a certificate of the PLS test of the grass seed intended for the project, certifying that the seed furnished is from a lot that has been tested by a recognized laboratory within the last 6 months

C. All brands furnished shall be free from such noxious seeds as Russian or Canadian Thistle, Coarse Fescue, European Birdweed, Johnson Grass, Leafy Spurge, field bindweed, kochia, or any state-listed, CDOT-listed , municipality-listed, or Mesa County-listed noxious weed species

D. Any materials that have become wet, moldy or otherwise damaged in transit or in storage will not be used

1.6 QUALIFICATIONS

A. Applicator: Company specializing in performing work of this section with landscaping license from State of Colorado
   1. Experienced with type, elevation, topography and scale of work specified
   2. Adequate equipment and personnel to perform work

1.7 REGULATORY REQUIREMENTS

A. Comply with codes and ordinances of local regulatory agencies for fertilizer and herbicide composition and regulations of Mesa county and the State of Colorado.

B. of compliance from authority having jurisdiction indicating approval of seed mixture

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Division One specifications

B. All materials and products will remain in original manufacturers shipping bags or containers until they are used. All material or products will be stored in a manner to prevent them from coming into contact with water or other contaminating substance and in a manner that product effectiveness will not be impaired

C. Deliver grass seed mixture in sealed containers. Seed in damaged packaging is not acceptable

D. Commercial fertilizer or commercial herbicide: mixed in original bags or containers of the manufacturer, showing weight, chemical analysis and manufacturer name. Store in such a manner such that product effectiveness will not be impaired

1.9 ENVIRONMENTAL REQUIREMENTS

A. Do not prepare or seed frozen soils

B. Perform seeding and planting only after preceding work establishing final ground surface is completed

C. Conduct minimum of two (2) soil tests to confirm fertilizer type and application rates

1.10 MAINTENANCE SERVICE

A. Maintain seeded areas immediately after placement until grass is well established and exhibits vigorous growing condition

1.11 WARRANTY

A. All plant material and work accomplished under this section shall be guaranteed to provide a uniform stand of grass acceptable to the Owner at the end of a one (1) year time period from the completion of the Seeding and Erosion Control work

PART 2 PRODUCTS

2.1 SEED

A. In conformance with State and Federal regulations and subject to the testing provisions of the Associate of Official Seed Analysts (AOSA)

B. Seed Suppliers: Licensed Seed Dealer with Colorado Department of Agriculture

C. Provide the latest crop available in accordance with Colorado Department of Agriculture Seed Laws, Chapter 35, Article 27

D. Compensate for percentage of purity and germination by furnishing sufficient additional seed to equal the specified pure live seed product. The formula for determining the quantity of pure live seed (PLS) is as follows:

Pounds of Seed (Bulk) x Purity x Germination = Pounds of Pure Live Seed (PLS)

2.2 SEED MIX

A. Dryland seed mix shall be as follows unless otherwise approved by the City's Foresty Supervisor:

B.

Description	PLS rates per acre (100%)	% of Mix	Growth Form
Crested Wheatgrass, Ephraim	6	20%	1.25
Western Wheatgrass, Arriba	16	20%	3.25
Smooth Brome, Lincoln	12	15%	2.0
Alkali Sacaton	0.5	10%	0.25
Viva Galleta Grass	12	10%	1.25
Orchard grass, Paiute	4	10%	0.5
Perennial Ryegrass, Tetraploid	8	15%	1.25
Oats or Winter Wheat	Add in	Add in	3.0
Total		100	12.75
Drill rate @ 12.75 lbs/acre			
Broadcast rate @ 25.5 lbs/acre			

[1]PLS = Pure Live Seed – If broadcast seeding, double the rate

2.3 GRASS SEED MIX

A. PBSI Dry Native Mountain Mix - 50 LBS PLS/Acre. For use on south facing slopes with little or no shade
   1. Mountain Bromegrass Bromus marginatus 20%
   2. Slender Wheatgrass Elymus trachycaulus 10%
   3. Streambank Wheatgrass Elymus lanceolatus 15%
   4. Rocky Mountain Fescue Festuca saximontana 10%
   5. Prairie Junegrass Koeleria cristata 5%
   6. Thickspike Wheatgrass Elymus macrourus 15%
   7. Bluebunch Wheatgrass Pseudoroegneria spicata 10%
   8. Bottlebrush Squirreltail Elymus elymoides 5%
   9. Sandberg Bluegrass Poa secunda 10%

2.4 SOIL MATERIALS

A. Select onsite topsoil: Earth material of loose friable clay loam reasonably free of admixtures of subsoil, refuse stumps, roots, rocks, brush, weeds or other material which can be detrimental to the proper development of site revegetation

2.5 ACCESSORIES

A. Soil Additives (Fertilizer)
   1. Dry fertilizers: Primary element composition by weight of 6-10-5

a. Nitrogen (N) six (6%) percent of which fifty (50%) per-cent inorganic, phosphoric acid (P_2O_5) ten (10%) percent, and potash (K_2O) five (5%) percent

2. Commercial fertilizer: Primary element composition by weight of 18-46-0
   a. Nitrogen, eighteen (18%) percent, of which fifty (50%) percent is organic, and phosphoric acid (P_20_5), forty-six (46%) percent
   b. These elements may be organic, inorganic, or a combination and shall be available according to the methods adopted by the Association of Official Chemists
3. Dry, pelletized or granular, uniform in composition and a free flowing product. Do not use material which has caked, segregated, exceeded the expiration date of application, or be otherwise damaged
4. Thoroughly mixed by the manufacturer. Clearly identify the contents of each container. Do not use materials and containers previously opened, exceeding the expiration date for application or otherwise damaged

B. Water: Clean, fresh and free of substances or matter which could inhibit vigorous growth of grass

C. Mulching Material: Straw or onsite grasses from grubbing operation, dry, free from foreign matter detrimental to plant life

PART 3 EXECUTION

3.1 GENERAL

A. Seed all areas disturbed by construction, including all areas along the roadside ditches

B. Pattern for seeding and fertilization as required by field conditions. In no case shall revegetation occur within 30 days of the application of any chemical weed control substance

C. Engineer to review grading prior to seeding

3.2 SOIL PREPARATION

A. Uniformly place and spread topsoil removed during grubbing and stored on site. Provide minimum thickness of 4 inches to meet finished grade. Key topsoil to the underlying and surrounding material by the use of harrows, rollers or other equipment suitable for the purpose

B. Apply water to the topsoil for compaction purposes in a fine spray by nozzles in such a manner that it will not wash or erode the newly placed soil

C. Exercise care during soil preparation on all embankments so as not to disturb established ground cover. Areas disturbed during the soil preparation will be fertilized and seeded at the discretion of the Engineer in accordance with these documents

3.3 FERTILIZATION

A. Do not proceed with fertilization in adverse weather and unsuitable ground conditions. Examples of these respective conditions may be wind, precipitation, frozen and untillable ground or conditions detrimental to the effectiveness of the application

B. Apply fertilizer in a manner to assure uniform distribution, light watering is acceptable for dispersion

C. In cases where work progress is stopped due to the above conditions, fertilization will begin again, when appropriate conditions exist. The application will begin again with a reasonable overlapping of the previously applied area

D. The application rate for fertilizer shall be 200 lbs/acre for all seeding and sod installation unless otherwise approved by the Engineer

3.4 SEEDING METHODS

A. All seeding shall be installed either by hydroseeding or drilling method. Small areas of restoration may be broadcast seeded if directed by Engineer. Do not proceed with seeding in adverse weather and unsuitable ground conditions. Examples of these respective conditions may be wind, precipitation, frozen or untillable ground or conditions detrimental to the effectiveness of the application. All seeding shall be performed between either March 1st to May 30th of the calendar year of construction unless indicated otherwise by Engineer

B. Hydroseeding:
   1. Apply seeded slurry with hydraulic seed at a rate of //160 lbs// live seed per 1,000 square feet, evenly in two intersecting directions
   2. Do not hydroseed areas in excess of that which can be mulched on same day
   3. Immediately following seeding apply mulch to a thickness of 1/8 inch
   4. Apply water with a fine sprat immediately after each area has been mulched. Saturate to four (4) inches of soil

C. Drilling:
   1. Accomplish seeding by means of an approved power drawn drill, followed by drag chains. The grass drill should be equipped with a satisfactory feeding mechanism, agitation, and double disk furrow openers. Equip drills with depth bands set to maintain a planting depth of approximately 3 to 2 inch and shall be set to space rows not more than 7 inches apart
   2. If inspections indicate that strips wider than the specified space between the rows planted have been left or other areas skipped, the Engineer will require immediate resowing of seed in such areas at the Contractor's expense. The seeding mixture shown in the Materials Section applies at a pure live seed rate per acre
   3. Immediately following seeding apply straw mulch at a rate of one (1) ton per acre
   4. Apply water with a fine spray immediately after each area has been mulched. Saturate to four (4) inches of soil depth
   5. Provide additional watering weekly until revegitation seed has germinated

3.5 AREAS TO BE RESEEDED

A. Seed all disturbed areas that are damaged or disturbed by the Contractor's activities during the entire project scope

B. Additional areas as requested by the Owner and approved by the Engineer

3.6 MAINTENANCE

A. Fertilize the seeded areas once a uniform stand of grass has been established

B. Maintain seeded areas until there is an acceptable uniform plant growth. Reseed areas that are not producing a uniform plant growth within five (5) weeks following seeding. Acceptable uniform plant growth shall be defined as that time when the scattered bare spots, not greater than 1 square foot in area, do not exceed three percent (3%) of the seeded area

C. Maintenance period - 1 year

D. Areas that are seeded late in the fall planting season which are not producing acceptable uniform plant growth, as described above, shall be reseeded during the following spring planting season. If such a condition exists, and the Contractor has diligently, in the opinion of the Engineer, pursued the performance of his work, the Owner at his option, may extend the contract completion date and reduce contract retainage. Retainage may be reduced to less than five percent (5%) of the total contract amount, but shall be at least two (2) times the estimated cost of obtaining the required growth in the indicated areas, plus areas which are susceptible to damage by winter kill, washout or other causes

E. Contractor shall control perennial weeds, thistle, spotted and napweed, spurge and other weeds during the maintenance period

3.7 SEED PROTECTION AND SLOPE STABILIZATION

A. Cover seeded slopes with erosion control fabric where grade is 4 to 1 or greater and where indicated on the Drawings and/or Section 02300 and Section 02730. Cover seed with mulch in all other areas

B. Lay fabric smoothly on surface, bury top end of each section in 6-inch deep excavated topsoil trench. Provide 6-inch overlap minimum of adjacent rolls. Backfill trench and rake smooth, level with adjacent soil

C. Secure outside edges and overlaps at 48 inch intervals with 4-inch to 6-inch U-shaped type pins or wooden stakes depending on ground condition

D. Lightly dress slopes with topsoil to ensure close contact between fabric and soil

E. At sides of ditches, lay fabric laps in direction of water flow. Lap ends and edges minimum 6 inches

F. Maintain integrity of erosion control fabric until seed germination. If seed is washed out before germination, fertilize, reseed and restore affected areas

END OF SECTION

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Cast-in-place concrete

B. Reinforcing steel

C. Forms

D. Concrete accessories

1.2 RELATED SECTIONS

A. 03600 - Grout

1.3 REFERENCE STANDARDS AND GUIDES

A. Comply with the following except as modified by supplementary requirements of this Project Specification.

B. American Concrete Institute – ACI:
1. 117 – Standard Specifications for Tolerances for Concrete Construction and Materials
2. 214 – Recommended Practice for Evaluating Compression Test Results of Field Concrete
3. 301 – Specifications for Structural Concrete
4. 304 – Guide for Measuring, Mixing, Transporting and Placing Concrete
5. 305 – Hot Weather Concreting
6. 306 – Cold Weather Concreting
7. 308.1 – Guide to Curing Concrete
8. 309 – Guide for Consolidation of Concrete
9. 315 – Details and Detailing of Concrete Reinforcement
10. 318 – Building Code Requirements for Structural Concrete
11. 347 – Guide to Formwork for Concrete
12. 350 – Code Requirements for Environmental Engineering Concrete Structures and Commentary

C. American Standards and Testing Materials (ASTM)
1. A615 – Deformed and Plain Carbon Steel Bars for Concrete Reinforcement
2. C31 – Practice for Making and Curing Concrete Test Specimens in the Field
3. C33 – Concrete Aggregates
4. C39 – Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
5. C94 – Specification for Ready-Mixed Concrete

6. C143 – Standard Test Method for Slump of Hydraulic-Cement Concrete
7. C150 – Specification for Portland Cement
8. C173 or C231 – Test Methods for Air Content of Freshly Mixed Concrete
9. C260 – Air Entraining Admixtures for Concrete
10. C309 – Liquid Membrane-Forming Compounds for Curing Concrete
11. C452 – Standard Test Method for Potential Expansion of Portland-Cement Mortars Exposed to Sulfate
12. C494 – Chemical Admixtures for Concrete
13. C618 – Fly Ash and Raw or Calcinated Natural Pozzolan for Use as a Mineral admixture in Portland Cement Concrete
14. D1751 – Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types)

D. Concrete Reinforcing Steel Institute (CRSI)
1. DA4 – Manual of Standard Practice
2. P1 – Placing Reinforcing Bars

E. National Institute of Standards and Technology (NIST)
1. PS 1 – Structural Plywood

1.4 PERFORMANCE TOLERANCES

A. Confirm to ACI 117, ACI 301, and ACI 347 as modified herein. In case of conflict, ACI 117 governs.

1.5 SUBMITTALS

A. Submit under provisions of Division 1 specifications

B. Shop Drawings: Reinforcing bar lists, fabrication and placement drawings
1. Indicated bar sizes, spacing, locations, and quantities of reinforcing steel. Bending and cutting schedules shall be included in all shop drawings.
2. Indicate pertinent dimensions, materials, bracing, arrangement of joints and ties, and exact location of openings, framing, and special conditions affecting work
3. All shop drawings shall be original drawings produced by the supplier and shall not be reproductions of the Contract Documents

C. Product Data: Provide sufficient information on products specified to verify compliance with specifications. Provide data on
1. Attachment accessories
2. Admixtures and mixes
3. Curing Compounds

D. Test Reports
1. Submit reports of tentative concrete mix designs and testing prior to placing any concrete, including
   a. Slump range on which the design is based
   b. Total gal of water per cu yd

c. Brand, type, composition, and quantity of cement with manufacturer and plant location identified
d. Brand, type, composition and quantity of fly ash
e. Specific gravity and gradation of each aggregate
f. Ratio of fine to total aggregates
g. Surface-dry weight of each aggregate per cu yd
h. Brand, type ASTM designation, active chemical ingredients and quantity of each admixture
i. Air content and tolerance
j. Water/cementitious material ratio and tolerance
k. Compressive strength based at 7- and 28-day compression tests
l. Submit reports of field quality control testing
m. Time of initial set

2. Submit suppliers certified fly ash test reports for each shipment delivered to concrete supplier
   a. Physical and chemical characteristics
   b. Certification of compliance with the specifications
   c. Signed by Contractor and concrete supplier
3. Existing data on proposed design mixes are acceptable if certified and complete

1.6 QUALITY ASSURANCE

A. Perform work in accordance with ACI 301. Maintain one copy of each document on site.

B. Follow recommendations of ACI 305 when concreting in hot weather.

C. Follow recommendations of ACI 306 when concreting in cold weather.

D. Acquire cement and aggregate from same source for all work

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle materials under provisions of Division 1 Specifications

B. Cement and fly ash: Store in moisture proof enclosures, do not use if caked or lumpy

C. Aggregate: Store to prevent segregation and inclusion of foreign materials, do not use the bottom 6-inch of piles in contact with the ground

D. Reinforcing steel
   1. Store on supports 6” minimum off of ground, which will keep it from contact with ground and protected from oil or other materials detrimental to steel or bonding capability. Cover to prevent unacceptable surface corrosion and contamination.
   2. Tag bundles of reinforcing bars and wire spirals with metal tag showing specification, grade, size, quantity and suitable identification to permit checking, sorting and placing.

E. Rubber and plastic materials: Store in a cool place, do not expose to direct sunlight

F. Prepare a delivery ticket for each load of ready-mixed concrete

G. Truck operator shall hand ticket to Geotechnical Engineer or Third Party Inspector at the time of delivery with ticket to show:
   1. Quantity delivered
   2. Actual quantity of each material in batch
   3. Outdoor temp in the shade
   4. Time at which cement was added
   5. Numerical sequence of the delivery
   6. Quantity of water that can be added in the field based on mix design
   7. Free moisture in fine and coarse aggregate in percent by weight
   8. Temperature of batch

PART 2 PRODUCTS

2.1 FORMS

A. Prefabricated: Symons "Steel-Ply" or accepted substitution

B. Plywood: PS 1, waterproof resin-bonded, exterior type Douglas Fir; face adjacent to concrete Grade B or better

C. Lumber: Straight, uniform width and thickness; free from knots, offsets, holes, dents, and other surface defects

D. Chamfer strips: Clear, white pine, surface against concrete planed

E. Form coating: Colorless biodegradable oil or water based release agent that will not stain concrete and is VOC compliant. Acceptable products: Nox-Crete "Nox-Crete Form Coating", L & M "Debond", or accepted substitution

F. Form Coating where exposed to potable water: Meets NSF Standard 61, Dayton Superior “Clean Strip J1EF”, Hill and Griffith Company “Grifcote LV-50-Plus”

G. Form ties: Removable end, permanently embedded body types with waterstops not requiring auxiliary spreaders, with cones on both ends, embedded portion 1-inch minimum back from concrete face. If not provided with threaded ends, constructed for breaking off ends without damage to concrete.

2.2 REINFORCING STEEL

A. Bars: ASTM A615, Grade 60

B. Bar supports: CRSI Class 1, fabricated from galvanized wire having PVC coated legs

C. Tie wire: 16 ½ gage or heavier, black annealed wire

D. Form and fabricate reinforcing steel in accordance with ACI 315 and 318 and CRSI DA4 except as specified or indicated on Drawings, free from rust, scale and contaminants which will reduce bond.

E. Dowel Adhesive: Hilti “HIT-RE 500 V3”, Powers “PE 1000+”, Simpson “SET-XP”, or accepted substitution.

2.3 CONCRETE

A. Cement: ASTM C150, Type I/II modified cement tested to meet type V for sulfate resistance per ASTM C150 Table 4 and ASTM C452. Cement should have a tricalcium aluminate content of not more than 8 percent.

B. Fly ash: ASTM C618, Class F

C. Fine aggregate: Clean, natural sand, ASTM C33; no manufactured or artificial sand

D. Coarse aggregate: Crushed rock, natural gravel, or other inert granular material, ASTM C33 except clay and shale particles no more than 1%.
   1. Alkali Silica Reactivity: Aggregate shall be considered non-reactive with a documented satisfactory service record for a minimum ten year period used in concrete with similar cementitious material or with an alkali (Na_2O eq.) content in concrete equal or higher than that in the proposed mixture. In the absence of service record the aggregate shall be tested and will be considered non-reactive if it complies with a) or b)
      a. ASTM C1260 14-day expansion less than or equal to 0.1%, or
      b. ASTM C1293 1-year expansion less than or equal to 0.040%

E. Water: Clean and free from injurious amounts of oils, acids, alkalis, salts, organic materials, or other substances that may be deleterious to concrete or steel.

F. Admixtures
   1. Air entraining agent: ASTM C260; Grace "Darex AEA", Master Builders "MB-VR", Sika Chemical "AEA", or accepted substitution
   2. Chemical Admixtures: ASTM C494, non-corrosive and chloride free.

2.4 ACCESSORIES

A. Membrane Forming Curing Compound: ASTM C309, L&M Construction Materials “Dress & Seal WB30”, BASF "MasterKure CC 200WB”, Euclid “Super Diamond Clear VOX”, Dayton Superior “Cure & Seal 1315 EF”, or accepted substitution.

B. Curing Compound for surfaces in contact with potable water: Meets NSF Standard 61, Dayton Superior “Clear Cure VOC J7WB”, Atlas Tech Products “Atlas Quantum-Cure NSF”, W.R. Meadows “VOCOMP-25”.

C. Epoxy Bonding Agent: ASTM C881, Sika “Sikadur 32 Hi-Mod”, Dayton Superior “Sure Bond J58”, L&M Construction Materials “Epobond”, Dayton Superior “Sure Bond J58”, or accepted substitution. Use when joining new to existing concrete.

D. Non-Epoxy Bonding Agent: ASTM C1059 Type II, Larson Products "Weld-Crete", BASF "MasterEmaco A 660", L&M Construction Materials "Everbond", Dayton Superior "Acrylic Bonding Agent J40", or accepted substitution. Use when joining new to existing concrete when bonding agent cannot be placed immediately prior to placement of new concrete.

E. Patching Mortar: Sika "Sikatop", L&M Construction Materials "Durapatch VOH", or accepted substitution.

2.5 CONCRETE MIX DESIGN

A. Concrete Mix: Measure and combine cement, aggregate, water, and admixtures in accordance with ASTM C94 and ACI 211.1.
   1. Cement: When used in exposed concrete shall be one brand from one source. Do not mix different cements in same element of Work.
   2. Water-Cement Ratio (if fly ash used, water-cement plus fly ash ratio): 0.45 maximum for 4000 psi or 4500 psi concrete, 0.52 maximum for 3000 psi concrete.
   3. Air-Entrainment: Air-entrain concrete exposed to exterior or exposed to liquids. See Table below for requirements.
   4. Chemical Admixtures: Use is optional to aid concrete properties and allow for efficient placement. Manner of use and amount shall be in accordance with manufacturer's written recommendations and as approved by Engineer. Do not use admixtures that increase early shrinkage or negatively affect finishing.
   5. Fly Ash: Use is optional unless otherwise noted. Combine fly ash with cement at a rate of 1 pound fly ash for each pound reduction of cement. Amount of fly ash shall not be less than 15% or more than 25% of weight of cement plus fly ash. When fly ash used, minimum amount of cement designated may be proportionately reduced.
   6. Use no admixtures other than specified, unless approved by Engineer.

B. Class of Concrete:
   1. Furnish in accordance with table. Cement contents listed are minimum values and shall be increased as required to attain other specified characteristics.
   2. Slumps listed are maximum, except when high range water reducer is used. Maximum slump when high-range water reducer is used, 10 inches.
   3. Chloride ion content shall not exceed values listed in ACI 318, Table 19.3.2.1.

Use	28-Day Compressive Strength (psi)	Coarse Aggregate (size no.)	Minimum Cement Content (bags/cu yd)	Air Content (%)
Exposed Concrete or concrete with less than 3'-0" cover	4500	67	6.5	6±1.5

2.6 FABRICATION

A. Reinforcing Steel: Accurately formed, fabricated in accordance with ACI 315 and 318 and CRSI DA4 except as specified or indicated on drawings, free from rust, scale and contaminants which will reduce bond

2.7 SOURCE QUALITY CONTROL

A. Test the proposed concrete mix for each size and gradation of aggregates and each consistency intended for use in the project

B. Aggregates
   1. Sample and test according to ASTM C33
   2. Determine bulk specific gravity in accordance with ASTM C127 and C128

C. Fly Ash: Supplier's chemical composition and physical analysis test

D. Initial set test
   1. In accordance with ASTM C403
   2. Test at 70 degrees F and 90 degrees ambient
   3. Test at 70 degrees F on mix including specific plasticizing and entraining admixtures
   4. Test at 90 degrees F on mix including specified retarding and air entraining admixtures
   5. Fly ash: Supplier's chemical composition and physical analysis test

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify site conditions in field or under provisions of Division 1 Specifications

B. Verify requirements for concrete cover over reinforcement

C. Verify that anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not cause hardship in placing concrete

3.2 PREPARATION

A. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent in accordance with manufacturer's instructions

B. Subgrade and bedding shall be compacted and free of frost. If placement occurs at temperatures below freezing, provide temporary heat and protection to remove frost. Do not place concrete on frozen material.

C. Remove standing water, ice, mud, and foreign matter before placing concrete

D. In locations where new concrete is dowelled to existing work, drill holes in existing concrete, insert steel dowels with dowel adhesive system.

3.3 FORMS

A. Formwork design, detailing, and installation shall be Contractor's responsibility and shall conform to ACI 347R.

B. Type of forms used is Contractor's option, except as otherwise indicated or shown. Plywood and other wood forms shall have smooth level surfaces treated with form oil or sealer to produce clean release of concrete from forms.
   1. Where wall remain exposed use plywood, prefabricated metal or wood forms; do not use boards. Lay forms out in a uniform pattern with the long dimension of the form placed vertically and joints aligned.
   2. Form ties shall be plastic cone snap ties. Cone shall be min ¾ inch diameter by 1 inch deep. Taper tie through-bolt form ties may be used as an alternate to plastic cone snap ties; conform to details shown. Do not use wire ties on exposed concrete.
   3. Provide ¾ inch chamfer on external corners of exposed concrete.

C. Coat plywood and wood forms with non-staining form release agent. Apply release agent before reinforcement is placed.

D. Clean, patch, and repair form material before reuse.

E. Formwork shall prevent leakage of mortar, shall not deflect under weight of concrete and workmen, and shall withstand fluid pressure of concrete. Maximum deviation from a true plane: 1/8 inch within 6 feet

F. Brace or tie forms to maintain desired position, shape, and alignment during and after concrete placement

G. Design to produce hardened concrete to the shape, lines, and dimensions indicated on the drawings

H. Plywood or lined forms are not required for surface normally submerged or not normally exposed to view

I. Other type of forms may be used for surfaces not restricted to plywood or lined forms as backing for form lining

J. Flat segmental forms, 2 foot maximum width, may be used for curved surfaces 25 feet minimum diameter

K. Provide polyethylene film to protect concrete from water loss when placing concrete against gravel or crushed rock not containing 25 percent minimum material passing a No. 4 sieve, lap joint 4 inches

L. When placing concrete against rock, remove all loose pieces of rock and clean exposed surface with high pressure hose

M. Size and space wailers, studs, internal ties and other form supports so proper working stresses are not exceeded

N. Locations to be finished to a specified elevation, slope, or contour, bring form to true line and grade and provide a wooden guide strip at the proper location in the forms for finishing the top surface with a screed or template

O. Provide temporary opening at the bottom of columns and wall forms and wherever necessary for cleaning and inspection

P. Install form ties on exposed surfaces in uniformly spaced vertical and horizontal rows

Q. Do not remove or disturb until concrete has attained sufficient strength to safely support all dead and live loads

R. Maintain forms in place for a minimum of 40 hours for length of curing time in accordance with ACI 306/306R when temperature is 45 deg F and below

S. Remove forms carefully to prevent surface gouging, corner or edge breakage and other damage

3.4 REINFORCING STEEL

A. Accurately position reinforcing steel on supports, spacers, hangers, or other reinforcing steel at maximum intervals of 4 feet on center

B. Secure with wire ties or suitable clips. Tie 50 percent of all reinforcement and reinforcement at intersections for wall and floor construction

C. Except at contact splices, minimum clear distances between bars, the greater of
   1. Nominal diameter of bars
   2. 1.5 times max size of coarse aggregate

D. Splices
   1. As specified or indicated on the drawings
   2. Splices at other locations will be acceptable, if approved by the Engineer
   3. Do not weld or tack weld reinforcing steel
   4. Remove and replace steel upon which any unauthorized welding has been performed

3.5 EMBEDMENTS

A. Accurately position and securely anchor in forms, anchor bolts, steel shapes, conduit, sleeves, masonry anchorages, and other materials to be embedded in concrete

B. Cast pipe and other embedded items into concrete as placement progresses. Do not provide blockouts.

C. Place items constructed of dissimilar metals to avoid physical contact with reinforcing. Secure item and reinforcing to ensure they will not shift and come into contact during

concrete placement. Contact between reinforcing steel and other metal, other than bare, coated, or plated carbon steel not permitted.

D. The following restrictions shall be adhered to, unless otherwise noted
   1. No duct, conduit, pipe, or fitting placed vertically shall be larger in cross-sectional area than 4% oc column into which it is placed.
   2. Duct, conduit, pipe, and fittings, when placed within slabs or walls
      a. Shall not be larger than 1/3 thickness of slab or wall
      b. Shall be placed within the middle 1/3 of slab or wall where possible
      c. Shall not be placed closer than 3 outside diameters clear from each other when parallel
      d. Shall cross each other at right angles
      e. Shall be secured to prevent shifting of "floating" during concrete placement
      f. Multiple conduits shall not cross each other at the same location
      g. Except for conduits that must run up a column, keep conduits a minimum of 2 to 3 feet away from columns
      h. Where conditions require conduit to be tied to the inside face of the reinforcing mat, the conduit shall be galvanized steel or PVC, shall be placed 3 outside diameter clear away from the parallel reinforcement bar.
   3. Reinforcing steel shall be in place before embedded items placed and reinforcing cut or removed shall be replaced with additional reinforcing as indicated.
   4. Do not pass sleeves through columns or beams without Engineer's approval.

E. Anchor bolts
   1. Unless installed in pipe sleeves, provide sufficient threads on anchor bolts to permit a nut on the concrete side of the form or template
   2. Install a second nut on the other side of the form or template
   3. Adjust the nuts to hold the bolt rigidly in the proper position

F. Clean embedments before installation

3.6 TRANSPORTING MIXED CONCRETE

A. Transporting of mixed concrete shall conform to ACI 304R.

B. Maximum delivery time from batch plant is 90 minutes

C. Do not exceed manufacturer's guaranteed capacity of truck agitators. Maintain the mixed concrete in a thoroughly mixed and uniform mass during hauling.

D. Do not incorporate additional mixing water into the concrete during hauling or after arrival at the delivery point, unless ordered by the Engineer. If additional water is to be incorporated into the concrete, revolve the drum not less than 30 revolutions at mixing speed after the water is added and before placing concrete.

E. Notify Special Inspector of any water added to the concrete mixture

F. Furnish a water measuring device in good working condition, mounted on each transit mix truck, for measuring the water added to the mix on the site by the Engineer

G. Provide delivery ticket to Special Inspector or Owner and comply with delivery requirements of this section

3.7 PLACING CONCRETE

A. Place concrete in accordance with ACI 304, ACI 301, and ACI 318

B. Schedule and attend pre-pour meeting with Owner at least 7 days before first pour to review requirements of this specification

C. Notify Engineer and Owner not less than 48 hours in advance of the times and places at which contractor intends to place concrete

D. Predetermine limits at each pour and place all concrete within limits of pour in one continuous operation

E. Rigidly secure forms, reinforcing steel, embedment, and anchor bolts in proper position

F. Remove all mud, water, ice, snow, frozen material, and debris from space to be occupied by concrete

G. Clean surfaces encrusted with dried concrete from previous concrete operations

H. Convey to the point of final deposit by methods which will prevent separation or loss of ingredients

I. Place concrete in final position without being moved laterally more than 5 feet

J. Place concrete in horizontal layers not more than 2 feet of depth to allow for proper consolidation

K. Place subsequent layer while the preceding layer is still plastic

L. Top finish concrete when thoroughly settled

M. Remove all laitance, debris, and surplus water from the tops of the forms by screeding, scraping or other effective means

N. Overfill the forms for walls whose tops will be exposed to the weather and screed off the excess after the concrete has settled

O. Allow concrete in walls and columns to settle at least 2 hours before concrete is placed in structural systems to be supported by the walls and columns

P. Clean concrete spatter and other foreign substances from surfaces not in contact with concrete.

3.8 BONDING TO HARDENED CONCRETE

A. Place new concrete on rough, clean, damp faces of existing concrete

B. Roughen concrete to be bonded to future concrete to 1/4 inch amplitude

C. Remove surface mortar of smooth surfaces to expose aggregate

D. Clean hardened concrete of all foreign substances, including curing compound, washed with clean water, and keep saturated for 24 hrs preceding placement of fresh concrete

E. Apply epoxy bonding agent for bonding to hardened concrete

3.9 CONSOLIDATION

A. Thoroughly consolidate concrete during and immediately after placement

B. Work concrete around all reinforcements and embedments and into the corners of the forms

C. Use mechanical vibrators which will maintain 9,000 cycles per minutes when immersed in the concrete, 1 ½ hp motor minimum

3.10 COLD WEATHER CONCRETING

A. Conform to ACI 306, except as modified herein

B. Minimum concrete temp at the time of mixing

Outdoor Temp at Placement (in shade)	Concrete Temp at Mixing
Below 30°F	70°F
Between 30°F & 45°F	60°F
Above 45°F	45°F

C. Do not place heated concrete which is warmer than 80 degrees F

D. If freezing temp are expected during curing, maintain the concrete temp at or above 50 deg F for 5 days or 70 deg F for 3 days with forms in place

E. Do not allow concrete to cool suddenly

3.11 HOT WEATHER CONCRETING

A. Conform to ACI 305, except as modified herein

B. At air temp of 90 degrees F and above keep concrete as cool as possible during placement and curing

C. Do not allow concrete temperature to exceed 80 deg F at placement

D. Prevent plastic shrinkage cracking due to rapid evaporation of moisture

E. Do not place concrete when the actual or anticipated evaporation rate equals or exceeds 0.2 lbs per sq ft per hr as determined from ACI 305, Fig 2.1.5

3.12 CONSTRUCTION JOINTS

A. Unless otherwise noted, construction joints shown are optional. Joints not shown on Drawings shall be approved by Engineer. Locate to miss splices in reinforcement.

B. Limit size on concrete pours. Maximum length of wall and slab pours shall not exceed 60 feet.

C. Before concrete placed, construction joints shall be cleaned, laitance removed, and surface wetted. Remove standing water.

D. Construction joints shall have keys or roughened surfaces. Where roughened surfaces are used, surface shall have amplitude of ¼ inch minimum.

E. Install construction joints in slabs perpendicular to the planes of their surfaces

3.13 FINISHING SLABS AND FLATWORK

A. Slab Finishes:

Description	Concrete Finish
Surfaces to Receive Grout or Topping	Float
Submerged and Buried Slabs	Float
Exterior Exposed Slabs	Float and Broom Finish
Exterior Stairs and Walks	Float and Broom Finish

B. After placement, screed concrete with straightedges, power strike-offs or vibrating screeds.

C. After screeding, bull float or darby surfaces to eliminate ridges and to fill in voids left by screeding.

D. Float:
1. Use magnesium or aluminum hand floats or power floats with slip on float shoes.
2. Float finish shall result in uniform smooth granular texture.

E. Broom Finish: Use fine, soft-bristled broom and broom at right angles to direction of traffic to give nonskid finish approved by Engineer.

3.14 FINISHING FORMED SURFACES

A. Remove fins and other surface projections from all formed surfaces except exterior surfaces that will be in contact with earth backfill and are not specified to be dampproofed

B. Use a power grinder, if necessary, to remove projections and provide a flush surface

C. Remove fins and fill all tie holes on surfaces exposed to view
   1. Clean, dry and fill plastic cone snap tie holes with Patching Mortar. Fill taper tie through-bolt form tie holes with Non-Shrink Grout.
   2. Finish flush to match the texture of adjacent concrete

3.15 CURING AND PROTECTION

A. Protect concrete from frost and keep moist for min curing period of 7 days after placement in accordance with ACI 308.
   1. Formed Surfaces:
      a. Wet cure by spraying surfaces as frequently as drying conditions may require to keep concrete surfaces moist.
      b. Surfaces may be cured by leaving forms in-place. For vertical surfaces, apply water to run down inside of forms, if necessary, to keep concrete moist.
      c. After forms are removed, wet cure for remainder of curing period or apply curing compound.
      d. Do not use curing compound where mortar, grout, concrete, or other coatings or adhesives will be applied.

B. Flatwork:
   1. Cure using curing compound or wet cure.

C. Curing Compound:
   1. Apply curing compound at uniform rate sufficient to comply with requirements for water retention as specified and as measured in accordance with ASTM C156.
   2. Cover areas subjected to direct sunlight with ambient temperature expected to exceed 80°F with white pigmented compound, other surfaces may be covered with fugitive dye compound.

D. Water curing
   1. Begin water saturation as quickly as possible after initial set
   2. Regulate water application to provide complete surface coverage with minimum runoff
   3. Interrupt the application of water to walls for grout cleaning only over the area being cleaned at the time and do not permit the surface to become dry during such an interruption

E. Protect from damaging mechanical disturbances, load stresses, heavy shock, and excessive vibration.

F. Protect finished concrete surfaces from damage caused by construction equipment, materials, and methods, and from rain or running water.

3.16 REMOVAL OF FORMING AND SHORING

A. Do not remove forming or shoring until member supported has acquired sufficient strength to safely support own weight and any imposed loads. Forming shall remain in place for at least min time recommended by ACI 347R. In addition, forming for

horizontal members shall remain in place minimum 7 days. In no case shall forming for horizontal members be removed before concrete has reached 70% of specified design strength.

B. Reshore areas as required to carry additional imposed loads.

3.17 DEFECTIVE CONCRETE

A. Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances or specified requirements.

B. General:
1. Prior to starting repair work, obtain Engineer's approval of proposed repair techniques and materials.
2. Method of repair shall not adversely affect the appearance of the finished structure.
3. Develop repair techniques on portion of as-cast surface selected by Engineer. Surface of repair remaining exposed to view shall match color and texture of adjacent surfaces.
4. Prepare surfaces, apply and install materials, and cure as recommended by material manufacturers.

C. Defective Areas:
1. Remove honeycombing, stone packets, spalls, and other defective concrete down to sound concrete. If chipping required, make edges perpendicular to surface. Do not feather edges.
2. Fill defective area with patching mortar

3.18 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed in accordance with ACI 301 under provisions of Section 01400

B. Owner's geotechnical consultant provide field and compressive strength tests to determine compliance of concrete materials in accordance with the specifications except as indicated otherwise under provisions of Section 01400

C. The Owner shall pay for compressive strength tests to determine compliance of concrete material in accordance with the specifications

D. Concrete Field Tests
1. Tests by ACI certified technician
2. Concrete Test Samples: Samples for acceptance tests on concrete shall be obtained in accordance with ASTM C172 at the point of placement or discharge.
3. Provide all equipment, supplies, and the services of one or more employees, as required
4. The test frequencies specified are minimum. Additional tests may be performed as required by the job conditions

E. Slump: Provide a sample from each truck load in accordance with ASTM C143 if requested by Engineer and when making test cylinders

F. Air Content: Provide a sample from each truck load if requested by Engineer and when making test cylinders

G. Compression Tests
   1. Provide one set of 6 cylinders each day when up to 50 cu yds have been placed
   2. Make one additional set of 6 cylinders for each additional 50 cu yds or each major pour placed in one day
   3. Test two cylinders in each set at 7 days
   4. Test two cylinders in each set at 28 days
   5. The other two cylinders to be used as directed by Engineer at any time
   6. Engineer will evaluate in accordance with ACI 214 and 318
   7. Make, cure, store, and deliver cylinders in accordance with ASTM C31
   8. Test in accordance with ASTM C39
   9. Mark or tag each set of test cylinders with the date and time of day the cylinders were made, the location in the work where the concrete represented by the cylinders was placed, the delivery truck or batch number, the air content, and the slump

H. Storage Facilities for Concrete Test Cylinders
   1. Including water necessary, a specially prepared box with high-low thermometer and thermostatically controlled heating devices in accordance with ASTM C31

I. Failure of Test Cylinder Results: Evaluation of concrete structures where laboratory-cured cylinders fail to meet 28-day concrete strength requirements of the contract documents will be subject to, but not limited to, the following measures.
   1. Upon failure of 28-day test cylinder results, the Engineer may require the Contractor, at his expense, to obtain and test at least three 4-inch diameter cored samples from area in question
   2. Concrete will be considered adequate if average of three core tests is at least 85 percent of, and if no single core is less than 75 percent of, the specified 28-day strength. Where concrete durability is a concern due to freeze thaw or sulfate exposure the Engineer may reject concrete that passes ACI 318 core testing criteria for strength, but fails to meet acceptance criteria for cylinder testing.
   3. In the event an area is found to be structurally unsound, the Engineer may order removal and replacement of concrete as required. The cost of the core tests and removal and replacement of defective concrete shall be borne by the Contractor
   4. Fill all core holes as specified for repairing defective concrete

END OF SECTION

SECTION 03600

GROUT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Patching cavities in concrete

B. Other grouting specified or indicated on Drawings

1.2 RELATED SECTIONS

A. Section 03300 – Concrete

1.3 REFERENCES

A. ASTM C109 – Test Method for Compressive Strength of Hydraulic Cement Mortar

B. ASTM C157 – Test Method for Length Change of Hardened Hydraulic Cement Mortar and Concrete

C. ASTM C191 – Time of Setting of Hydraulic Cement by Vicat Needle

1.4 SUBMITTALS

A. Submit under provisions of Section 01340

B. Product Data: Provide manufacturer's catalog sheet for material indicating test data and physical properties

1.5 QUALITY ASSURANCE

A. Conform to applicable industry standard, Corps of Engineers, Specification CRD-C 621 - Specification for non-shrink grout

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Non-Shrink, Non-Metallic Grout
   1. Master Builders - Masterflow 928
   2. M.R. Meadows - Sealtight 588
   3. Sonneborn - Sonogrout 10K
   4. Euclid - Tammsgrout Supreme
   5. Sika - SikaGrout 212
   6. Or accepted substitution

B. Epoxy Grout
   1. L&M Inc. - Epogrout
   2. Sika - Sikadur 42, Grout Pack
   3. Or accepted substitution

2.2 MATERIALS

A. Non-Shrink, Non-Metallic Grout: Factory premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents, capable of developing minimum compressive strength of 4000 psi in one day and 8000 psi in 7 days

B. Epoxy Grout: Three Component Epoxy Resin System
   1. Two liquid epoxy components
   2. One inert aggregate filtered component
   3. Each component furnished in separate package for mixing at job site

C. Water: Clean and free from deleterious substances

PART 3 EXECUTION

3.1 PREPARATION

A. Non-Shrink, Non-Metallic Grout
   1. Clean concrete surface to receive grout
   2. Saturate concrete with water for 24 hrs prior to grouting and remove excess water just prior to placing grout
   3. Cold weather conditions
      a. Warm concrete, substrate and base plate to 40 deg F, or above; store grout in warm area
      b. Follow manufacturer's recommendations for cold weather application
   4. Hot weather conditions
      a. Use cold mixing water and cool base plate if possible; store grout in cool area
      b. Follow manufacturer's recommendations for hot weather application
   5. Apply to clean, sound surface
   6. Apply latex bonding agent to hardened concrete, mix-in-grout, or as directed by Engineer

B. Epoxy Grout: Apply only to clean, dry, sound surface

3.2 APPLICATION

A. Non-Shrink, Non-Metallic Grout
   1. Mix in a mechanical mixer
   2. Use no more water than necessary to produce flowable grout
   3. Provide air vents where necessary to eliminate air pockets
   4. Place in accordance with manufacturer's instructions
   5. Where exposed to view finish grout edges smooth

6. Protect against rapid moisture loss by immediately covering with wet rags and polyethylene sheets or curing compound
7. Wet cure grout for 7 days, minimum
8. Maintain the temperature at a minimum of 40 deg F until grout reaches 3000 psi
9. After placement of grout, eliminate excessive external vibration

B. Epoxy Grout
1. Mix and place in accordance with manufacturer's instructions
2. Completely fill all cavities and spaces around dowels and anchors without voids
3. Obtain manufacturer's technical assistance as required to insure proper placement

3.3 SCHEDULE

A. Non-Shrink, Non-Metallic Grout: General Use
1. Grouting of manhole covers, pipe inlets, and precast manholes and vaults

B. Epoxy Grout
1. Patching cavities in concrete including, but not limited to, tie holes, and structural and equipment support

END OF SECTION

SECTION 09900

COATINGS

PART 1 GENERAL

1.1 SUMMARY

A. Coating of surfaces as noted on the Drawings and as specified herein, including:
   1. Interior surfaces of the riser, cone and other exposed concrete surfaces of manholes.

1.2 REFERENCES

A. MSDS: Material Safety Data Sheets

B. ASTM: American Society for Testing and Materials

C. SSPC: The Society for Protective Coatings

D. OSHA: Occupational Safety and Health Administration

E. NSF: National Sanitation Foundation

1.3 SUBMITTALS

A. Product Data:
   1. Manufacturer's literature including application recommendations and generic makeup for each coating scheduled.
   2. Factory or shop-applied primer manufacturer's literature including application recommendations and generic makeup shall be submitted with all material and equipment submittals. All primers shall conform to the requirements of this Section.

B. Samples:
   1. Actual color samples available for each coating scheduled.

C. Miscellaneous:
   1. Schedules:
      a. Schedule of proposed coating systems within 60 days after Notice to Proceed.
      b. Schedule of proposed coating systems shall contain all information as indicated in Coating Schedule included herein.
   2. Submit one copy of manufacturer's MSDS, for each type of coating, to Engineer's field office for information. Contractor shall post copy of MSDS on Site at all times coating is in progress.

D. Submit in accordance with Section 01340.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. All coatings shall conform to OSHA requirements for allowable exposure to lead and other hazardous substances.

B. Applicator Qualifications:
   1. Engage an experienced field applicator with a minimum of 5 yrs successful experience and who has successfully completed coating system applications similar in material and extent to those indicated.

C. Single-Scource Responsibility:
   1. Provide coating material produced by same manufacturer for each system.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Materials shall be delivered to site in original containers with labels intact and seals unbroken.

B. Protect and heat or cool material storage location to maintain temperature ranges recommended by coating manufacturers, but not less than 55° F.

C. Avoid danger of fire. Oily rags and waste must be removed from buildings each night or kept in appropriate metal containers. Provide fire extinguishers of type recommended by coating manufacturer's in areas of storage and where finishing is occurring. Allow no smoking or open containers of solvent.

D. Empty containers shall have labels canceled and clearly marked as to use.

1.6 PROJECT / SITE CONDITIONS

A. Environmental Requirements:
   1. Dry-heat and ventilate areas to obtain conditions recommended by coating manufacturer.
   2. Relative humidity conditions as specified by coating manufacturer shall be adhered to.
   3. No unprotected, unheated exterior coating shall be undertaken when cold, damp, foggy, or rainy weather appears probable, nor when the temperature of the substrate is below 55° F, unless approved in writing by coating manufacturer.
   4. Maintain manufacturer's environmental requirements until coating is fully cured.
   5. Apply no coating in areas where dust is being generated.
   6. Testing and disposal of any waste and coating shall be the responsibility of the Contactor.

B. Upon Substantial Completion, remaining unused material will become property of Owner. Seal material as required for storage, mark contents with color, type, location, and shelf life, and store on Site where required by Owner. Provide minimum of two gallons of each system component and color used.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Sherwin Williams.

2.2 MATERIALS

A. All drop manholes (manholes with fall greater than 0.40’ fall through the manhole), force main outlet manholes, and lift station wet wells shall be coated on the interior surfaces of the riser, cone and other exposed concrete surfaces with a minimum 30 mil dry thickness of Sherwin Williams COR-COTE SC Sewer Cote, haze grey color, (Part A B62-450, Part B B62V450); Tnemec Perma-Glaze Series 435, or an approved equal.

2.3 THINNING, MIXING, AND TINTING

A. Where thinning is necessary, only the products of the manufacturer furnishing the coating will be allowed. All such thinning shall be done in strict accordance with coating manufacturer’s recommendations.

B. Mixing shall be accomplished using a low speed drill with a jiffy mixer or paddle. Epoxy shall be mixed in a clean dry container free of foreign matter or debris. Mixing rates shall be as recommended by the manufacturer.

C. Each coat shall be slightly darker than preceding coat, unless otherwise noted. Tint undercoats similar to finish coat.

PART 3 PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine the areas and conditions under which Work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Materials removed and replaced to correct defects due to Work placed on unsuitable surfaces shall be at Contractor’s expense.

3.2 SURFACE PREPARATION

A. All surfaces to be coated shall be prepared as specified herein and in accordance with coating manufacturer’s recommendations. The object shall be to obtain a uniform, clean, and dry surface.

B. The surface of the concrete to be coated shall be free of bug holes or other imperfections that may allow for porosity in the coating.

C. Quality of surface preparation described herein is considered a minimum. If coating manufacturer requires a higher degree of preparation, comply with coating manufacturer's recommendations.

D. Where surface dryness is questioned, test with dampness indicating instrument. Do not apply coatings over surfaces where moisture content exceeds that permitted by coating manufacturer.

E. Shop primed surfaces shall be scarified before applying top coats. Conform to top coat manufacturers recommendations.

F. If recoat time between application of primer and second coat or between top coats is exceeded, scarify surface before applying coatings. Conform to top coat manufacturers recommendations.

G. Concrete:
   1. Concrete shall pass the overnight visqueen test for dryness before applying coating. Test for moisture in accordance with ASTM D4263.
   2. Repair surface defects/voids as recommended by coating manufacturer.
   3. The surface of the concrete to be coated shall be free of bug holes or other imperfections that may allow for porosity in the coating.
   4. After cleaning, surfaces shall be washed and all dust, sand, and loose particles removed by vacuuming. If Contactor elects to blow off the surfaces with air, it shall be oil-free air and the method shall conform to OSHA requirements.
   5. Verify that pH of cleaned concrete surfaces to be coated is within range of 9 to 11. Application of coating materials outside this range will not be permitted without written approval from Engineer.

3.3 APPLICATION

A. Surfaces shall be dry at time of application.

B. Air surface temperature during application and curing shall be 50 Degrees F or above.

C. The minimum surface temperature shall be 55°F and rising. Some coatings are modified so that they may be applied at lower temperatures, conform to manufacturer's recommendations.

D. Apply in strict accordance with manufacturer's recommendations by brush, roller, spray, or other application method. The number of coats and thickness required is the same regardless of application method.

E. Each coat shall be allowed to dry in accordance with manufacturer's requirements. Drying time shall be construed to mean "under normal conditions". Where conditions other than normal exist, because of weather or because of confined space, longer times will be necessary. Units shall not be put in service until coatings are thoroughly dry and cured.

F. Surfaces to be coated that will be inaccessible in the completed work shall receive the final coat before enclosure.

G. Coatings shall be applied to provide an opaque, smooth surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, or other surface imperfections will not be acceptable. Areas cut-in by brush prior to rolling shall have uniform appearance in comparison with adjoining surfaces.

H. Make edges of coating adjoining other materials or colors sharp and clean without overlapping.

I. Crevices and other hard-to-apply areas shall be back-rolled/back-brushed in conjunction with application of field applied prime coat or intermediate coat. This includes, but is not limited to: between pipe flanges, pipe flange/barrel joints, equipment fittings, and other narrow openings.

J. Manufacturer-Applied Coatings:
   1. Repair abraded areas on factory-finished items in accordance with equipment manufacturer's recommendations.
   2. Blend repaired areas into original finish.

3.4 FIELD QUALITY CONTROL

A. For manholes, after the structure is installed and backfilled, all surfaces covered with an epoxy coating shall be tested with an electric Holiday detector. The voltage and specific methods of testing shall be as recommended by the manufacturer of the coating material.

B. Examination of Work on Site by coating manufacturer's representative shall be performed when requested by Engineer.

C. Sampling of Materials:
   1. Engineer reserves the right to select unopened containers of materials furnished for the Project and have the materials tested at an independent laboratory. Owner will pay for first tests.
   2. Retests of rejected materials and tests of replacement materials shall be paid for by Contractor.
   3. Remainder of contents of containers not required for testing will be returned to Contractor.

D. Coverage:
   1. 2. If coverage is not acceptable to Engineer, Engineer reserves the right to require additional application of coating at no extra cost to Owner.

END OF SECTION