SET NO. _____

PROJECT MANUAL

BID SET

CITY OF GRAND JUNCTION

UPPER KANNAH CREEK WATERLINE REPLACEMENT

3/3/2023

PROJECT MANUAL

BID SET

CITY OF GRAND JUNCTION

UPPER KANNAH CREEK WATERLINE REPLACEMENT

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

JVA Job No. 1071.16e

1/4/2023

PROJECT MANUAL

TABLE OF CONTENTS

CITY OF GRAND JUNCTION
UPPER KANNAH CREEK WATERLINE REPLACEMENT

SECTION 01010

SUMMARY OF WORK

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Work covered by contract documents

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 construction of approximately 11,000 LF of 20” C900 PVC water main with valves, bends, couplings, tees, crosses blowoff assemblies, and air vacs. The work also includes shoring and bypass pumping across Kannah Creek, and abandonment (or demolition) and capping of the existing water system at the connection locations.

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.

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 of Grand Junction and Engineer upon 48 hours written notice and approval.

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

1.6 WORK SEQUENCE AND WORK RESTRICTIONS

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

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

C. Construct work in stages to minimize water service outages. Coordinate construction schedule and water main shutdowns with Engineer and Owner. Contractor must notify

affected homeowners and/or businesses of planned service outages a minimum of two (2) days prior.

D. Contractor must provide temporary water service if service outage exceeds two (2) hours, unless approved by the Owner or Engineer

E. Power outages of up to 2 hours duration, and water service interruptions of up to 4 hours duration will be permitted
   1. Schedule each outage with Engineer and Owner at least (48) hours in advance. Provide (7) days notice for water outage so City can provide door hangers.
      a. Number of outages to be kept to a minimum

F. 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 will be performed in the dedicated street Right-of-Way, utility easement, and on City of Grand Junction's property

B. 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

C. Construction Area Limits
   1. Confine construction operations to the immediate vicinity of the location indicated on Drawings and in accordance with the Owner. Lay-down, stockpiling and work should remain in the ROW. Contractor is responsible to repair any property damage.
   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

D. 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

E. 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 of Grand Junction 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
      a. Submit traffic control plans for work within right-of-ways for approval by City of Grand Junction prior to pre-construction meeting.
   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 of Grand Junction 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. Visual Observations were conducted at the site, the results of which are to be found in the report issued by RockSol Consulting Group, Inc., “Slope Assessment, Kannah Creek Flow Line, Grand Junction, Colorado” dated March 16, 2021. A geotechnical report evaluating the existing soils along the proposed waterline alignment was than produced by RockSol Consulting Group, Inc. on December 20, 2022 titled “Geotechnical Investigation Report Kannah Creek Flowline Upper 3 Miles”.

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

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

1.4 INTERPRETATION

A. Soil inspection 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

Geotechnical Investigation Report
Kannah Creek Flowline Upper 3 Miles
Mesa County, Colorado
RockSol Project No. 599.62

Prepared for:

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

Attention: Mr. John Eklund, PE, CFM

December 20, 2022

Prepared by:

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

Geotechnical Investigation Report
Kannah Creek Flowline Upper 3 Miles
Mesa County, Colorado
RockSol Project No. 599.62

Prepared for:

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

Attention: Mr. John Eklund, PE, CFM

December 20, 2022

Prepared by:

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

Ryan Lepro	Audrey Kachin	Donald G. Hunt, PE
Engineering Geologist	Civil Materials Technician	Senior Geotechnical Engineer

Table of Contents

ATTACHMENTS

1.0 PROJECT PURPOSE AND DESCRIPTION

This report documents the geotechnical investigation performed by RockSol Consulting Group, Inc. (RockSol) to assist the City of Grand Junction (City) with the design, excavation, and installation of a new Kannah Creek Raw Waterline. The new waterline will replace the existing waterline that extends west from Kannah Creek to Juniata Reservoir, referred to as the Kannah Creek-Flow Line Upper 3 Miles alignment. The new water transmission line will be 20 inches in diameter with a minimum depth of cover of three feet below surface grade.

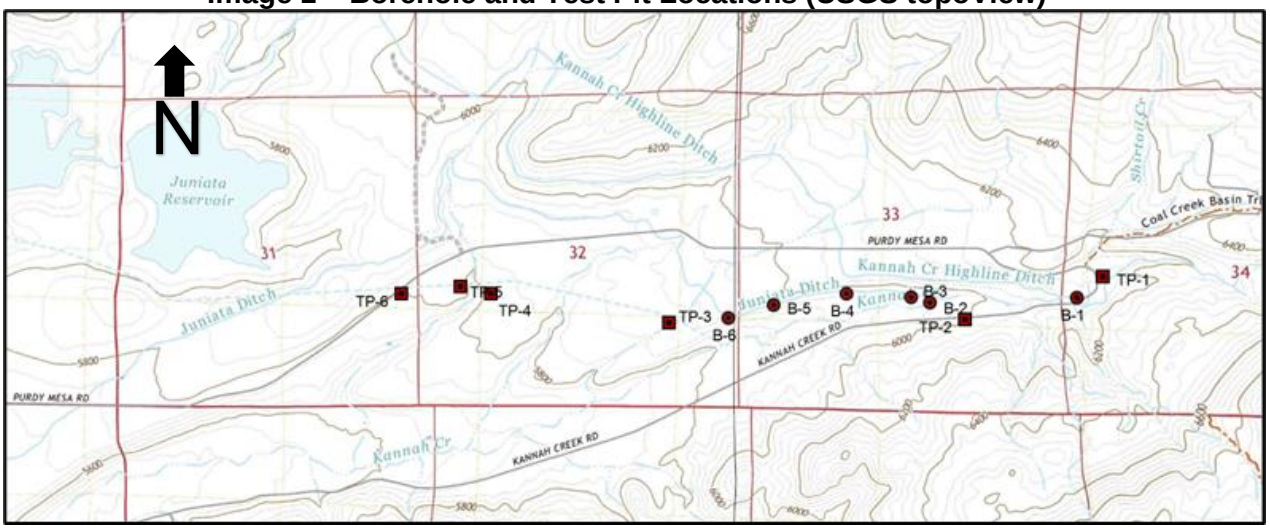
In locations that the alignment follows the existing line, the new line will be 10 feet to15 feet offset of the existing line. Current plans have identified a "new proposed" waterline alignment from approximate Station 62+50 – Station 108+00, as shown in the attached reference document (See Appendix A) "Kannah Creek Raw Water Line Alternatives Analysis", completed by design consultant JVA. Additional documents provided by the City of Grand Junction used in our geotechnical evaluation and analysis included:

- Preliminary Site Location for the proposed water line, and preliminary plans from JVA for a portion of the new alignment. (See Appendix A).
- Previous Geotech Report from Huddleston Berry with test pit (Test Pit #1) excavation information at approximate Sta. 138+25 (See Appendix A).

The scope of work for this geotechnical investigation included:

- Performing a subsurface investigation by the method of drilling at six borehole locations and excavating at five test pit locations (See Image 1) to obtain information on the subsurface soil, groundwater if encountered, and bedrock conditions for the proposed waterline installation and observe and categorize the ease of excavation at five locations near the proposed alignment. Two of the boreholes were drilled to evaluate subsurface conditions where the flowline is proposed to cross under Kannah Creek.
- Obtaining soil samples for soil classification and geotechnical analysis from the boreholes and test pits.
- Preparing a geotechnical report presenting the field and laboratory data obtained, geological conditions, and geotechnical recommendations for the proposed waterline creek crossings, excavation, and backfill.

Image 1 – Borehole and Test Pit Locations (USGS topoView)



2.0 PROJECT SITE CONDITIONS

The project site is in Sections 31 through 34, Township 12 South, Range 97 West of the 6th Principal Meridian in Mesa County, Colorado. The project site is located along Kannah Creek on the eastern portion and between Purdy Mesa Road and Kannah Creek Road (see Images 2 and 3). The new alignment will cross Kannah Creek near borehole locations B-1 and B-2 (See Image 3) and then follow the existing access road along the south side of Juniata Ditch (also known as Juniata Enlarged Ditch) for approximately 3,000 feet. The Juniata access road appears to have been constructed as a cut and fill operation along a natural slope cut down by Kannah Creek, forming a valley. The Juniata Ditch appears to have been constructed as a cut operation within the native slope soil and bedrock materials along the project alignment. Kannah Creek flows to the west with an approximate elevation relief of 400 feet within the project vicinity. Kannah Creek was flowing water at the time of our geotechnical field operations. Water was not noted in Juniata Ditch at the time of our field exploration.

At approximate Station No. 70+00, Juniata Ditch bends to the north and the new waterline alignment continues west approximately 800 feet across undeveloped private property before connecting up to the existing Kannah Creek-Flow Line easement, as shown below in Image 2. Topography along the existing Kannah Creek – Flow Line easement are relatively flat with the exception of minor tributary gully crossings with moderate to steep slopes. Topographic relief slopes to the southwest towards Kannah Creek.

Image 2 – Site Vicinity Map (USGS topoView)

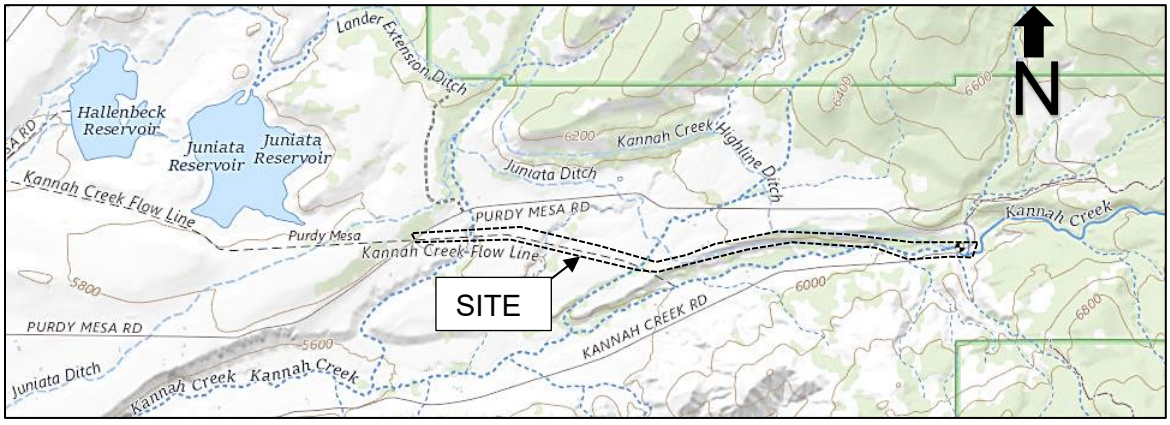
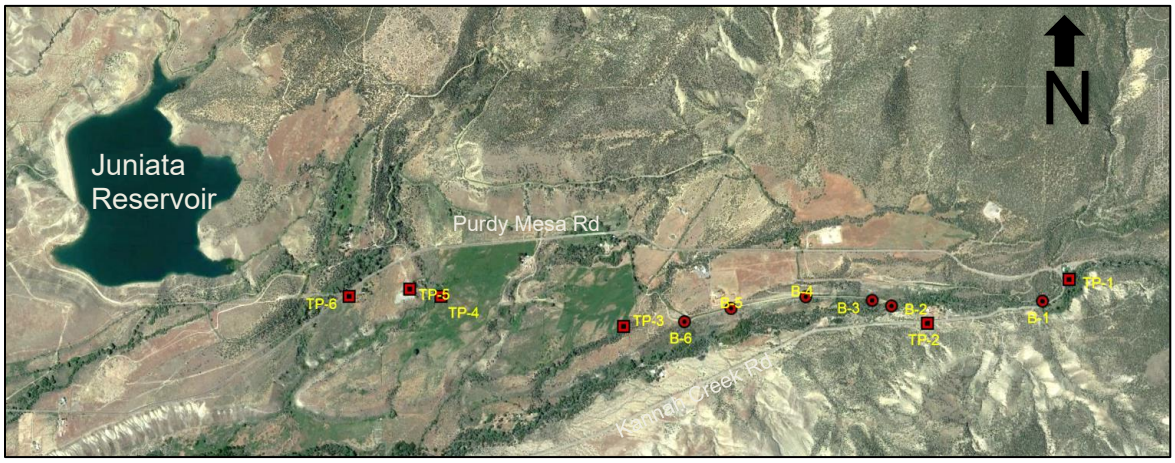


Image 3 – Aerial Image of Borehole and Test Pit Locations (Google Earth)

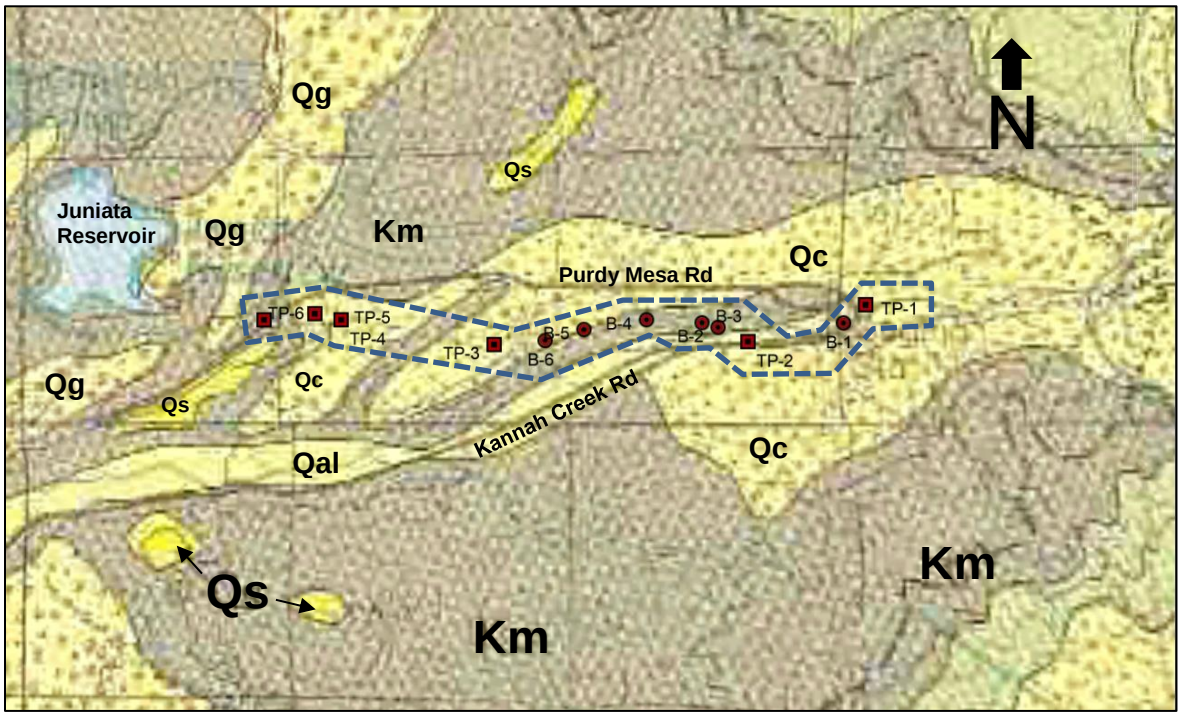


3.0 GEOLOGICAL SETTING

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 4, Site Geology Map below).

Based on the USGS map, the site is underlain by Mancos Shale (Km) bedrock formation which consists mostly of gray shale, claystone, and minor sandstone, alluvial deposits (Qal) of well-rounded boulder to clay-size debris, and colluvium (Qc) deposits consisting of boulder to clay size debris in talus deposits and in deposits formed by landslide, slump, earthflow, mudflow, soil creep, and solifluction. Undifferentiated surficial deposits (Qs) and terrace and pediment gravel (Qg) consisting of gravel, sand, and silt are mapped adjacent to the project site limits.

Image 4 – Site Geology Map (USGS Map C-124)



4.0 SUBSURFACE EXPLORATION

For this investigation, RockSol completed six boreholes identified as B-1 through B-6 (See Images 1 and 3 above and Appendix A) and five test pits/excavations identified as TP-2 through TP-6. The boreholes were drilled October 18, 2022, and the test pits were excavated October 28, 2022. The boreholes and test pit locations were determined by the City and surveyed after drilling operations were completed by the City. The survey information (surface elevations, northing, easting) was provided to RockSol for inclusion on the borehole and test pit logs. The boreholes were located in the field by RockSol ahead of drilling operations for utility clearance purposes using a GPS satellite receiver and antenna. The unit displays the strength of the satellite signals received and the GPS accuracy. Generally, the horizontal accuracy ranges from 3 to 5 meters, or 10 to 16 feet.

Boreholes B-1 and B-2 extended to an approximate depth of 20 feet below existing grades for characterization of subsurface conditions, including groundwater depths/elevations, to assist with the new waterline crossings of Kannah Creek. Boreholes B-3 through B-6 extended to an approximate depth of 15 feet below existing grades for characterization of subsurface conditions, including groundwater depths/elevations to assist with trench excavation considerations along the Juniata Ditch access road.

Boreholes were advanced with a Simco 2800 truck mounted drill rig using 4.25-inch outside diameter solid stem auger. The boreholes were logged in the field by a representative of RockSol with the depth to groundwater, if encountered, noted at the time of drilling. The boreholes were backfilled at the completion of drilling.

Subsurface materials were sampled and resistance of the soil to penetration of the sampler was performed using modified California barrel and standard split spoon samplers. Penetration Tests were performed using an automatic lift system and a hammer weighing 140 pounds falling 30 inches. The modified California barrel sampler has an outside diameter of approximately 2.5 inches and an inside diameter of 2 inches. The standard split spoon sampler used had an outside diameter of 2 inches and an inside diameter of 1⅜-inches. Brass tube liners were used with the modified California barrel sampler. Brass tube liners are not used with the standard split spoon sampler. The standard split spoon sampling method is the Standard Penetration Test (SPT) described by ASTM Method D-1586.

The modified California Barrel sampling method is similar to the SPT test with the difference being the sampler dimensions and the number of 6-inch intervals driven with the hammer per ASTM D3550. It is RockSol's experience that blow counts obtained with the modified California sampler tend to be slightly greater than a standard split spoon sampler. Penetration resistance values (blow counts) were recorded for each sampling event. Blow counts, when properly evaluated, indicate the relative density or consistency of the soils. Depths at which the samples were taken, the type of sampler used, and the blow counts that were obtained are shown on the Borehole Logs (See Appendix B).

A Yanmar V1055 Mini-Excavator, owned by the City, was used to excavate Test Pits TP-2 through TP-6. The bucket on the excavator was equipped with rock chisel/rock penetration type teeth. Test pits were excavated to an approximate depth of 6 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 Test Pit Logs for each test pit. Individual RockSol Test Pit Soil Logs are included in Appendix C.

As previously mentioned, the City provided RockSol with a geotechnical investigation report performed by Huddleston-Berry (Geotechnical Investigation, Kannah Creek Intake, Whitewater, Colorado, Project #00208-0079, dated May 4, 2018). Subsurface information from Test Pit location TP-1 was used for this evaluation. The geotechnical report includes a test pit log for TP-1 and location plan (See Appendix A).

5.0 LABORATORY TESTING SUMMARY

Soil samples retrieved from the borehole and 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) and American Association of State Highway and Transportation Officials (AASHTO). The following laboratory tests were performed in accordance with the American Society for Testing and Materials (ASTM), AASHTO, and current local practices:

- Natural Moisture Content (ASTM D-2216)
- Percent Passing No. 200 Sieve (ASTM D-1140)
- Liquid and Plastic Limits (ASTM D-4318)
- Dry Density (ASTM D-2937)
- Gradation (ASTM D-6913)
- Water-Soluble Sulfates (CDOT CP-L 2103)
- Soil Classification (ASTM D-2487, ASTM D-2488, and AASHTO M145)
- Standard Test Method for pH of Soils (ASTM D4972-01 and AASHTO T289)
- Swell Test (Denver Swell Test, modified from ASTM D-4546)
- Moisture/Density Relationship (Proctor) (AASHTO T99 Method A)

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 Borehole and Test Pit Soil Logs presented in Appendix C. Please note that soil gradation curves are approximate and do not reflect all oversized (>4-inches in diameter) material excavated and present in the site soil stratigraphy.

6.0 SITE SOIL AND BEDROCK CHARACTERIZATION

6.1 Surficial Materials

Surficial soils at the borehole and test pit locations generally consist of a relatively thin cover of silty sand topsoil, approximately 3 to 6 inches in thickness and supporting a sparse cover of vegetation.

6.2 Subsurface Materials

Descriptions of the surface and subsurface conditions encountered in the boreholes and test pits are provided below and the test pits are also summarized in Table 1 – Test Pit Summary and also summarized on the Borehole and Test Pit Logs presented in Appendix C.

Boreholes B-1 and B-2 – Kannah Creek Crossings

Fill material consisting of dense to very dense slightly silty to silty sand, gravelly sand, and clayey sand with gravel and boulder size material was noted to an approximate depth of 8 feet below existing grade at Borehole B-1 and 5 feet below existing grade at Borehole B-2.

At Borehole B-1, native soils consisting of dense to very dense silty to clayey gravel with cobble to boulder size material was noted below the fill material and extended to an approximate depth of 13 feet, overlying stiff to very stiff sandy clay with trace gravel in parts. A swell test performed in the stiff to very stiff sandy clay soil indicated low swell potential of 0.3 percent with a surcharge pressure of 1,000-psf.

At Borehole B-2, native soils consisting of dense to very dense silty to gravelly sand with cobble and boulder size rock in parts was encountered below the fill materials and extended to an approximate depth of 18 feet, overlying very dense to very hard clayey sand and sandy to silty clay with gravel in parts. Boulders ranging from 12 inches to greater than five feet in diameter were noted within the Creek channel and side slopes near borehole locations B-1 and B-2.

Bedrock was not encountered in Boreholes B-1 and B-2 to the maximum depth explored. Groundwater was noted at an approximate depth of 11 feet (elevation 6,077 feet) at Borehole B-1 and at an approximate depth of 18 feet (elevation 5,948 feet) at Borehole B-2. Groundwater levels at these locations likely correlate to the Kannah Creek water elevations within the channel.

Boreholes B-3 through B-6

Fill material consisting of medium dense slightly silty to clayey sand with gravel, cobble, and boulder size rock in parts, medium dense to dense clayey gravel with gravel, cobble, and boulder size rock in parts, and stiff to very stiff clay with sand, were noted to approximate depths ranging from 5 feet to 8 feet below existing grades. The fill material appears to have been placed as a cut and fill operation during the construction of Juniata Ditch for the ditch rider/access road.

Native soils consisting of dense to very dense silty to clayey sand with gravel, coble, and boulder size rock in parts were noted to depths of 15 feet at Boreholes B-3 and B-6.

Sedimentary bedrock consisting of hard to very hard claystone (identified in the USGS Geological Map as the Mancos Shale, see Section 3 of this report) was encountered at Boreholes B-4 and B-5 at depths of 5 feet and 8 feet, respectively, and extended to the maximum depth explored, approximately 15 feet below existing grades. Bedrock was not encountered in Boreholes B-3 and B-6 to the maximum depth explored. Groundwater was not noted during drilling operations to the maximum depth explored at Borehole locations B-3 through B-6.

Test Pit 1 (Huddleston-Berry)

The proposed location of Test Pit 1 aligned with a test pit from a previous geotechnical report by Huddleston-Berry. Due to this, the Test Pit 1 location was not excavated by RockSol. Based on the information provided in the Huddleston-Berry report, Test Pit 1 encountered *"…a thin layer of granular base course at the ground surface above brown, moist, medium dense to dense sandy silt with gravel, cobbles, and boulders to a depth of 4.0 feet. The silt was underlain by brown, moist, medium dense to dense cobbles and boulders in a sandy silt matrix to the bottom of the excavation. Groundwater was not encountered in TP-1 at the time of the investigation."*

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 6 feet and generally consisted of a sandy clay soil with gravel and cobbles intermixed. Cobbles ranged from 4 to 8 inches and increased in size with excavation depth. Larger boulders ranging from 12 to 18 inches were encountered at 2 feet below existing grade and again at 6 feet, maximum depth excavated.

Bedrock

Bedrock was not encountered at this location to the excavated depth of 6 feet.

Groundwater

Groundwater was not encountered at this location to the excavated depth of 6 feet.

Test Pit 3 (TP-3)

Fill Soils

Fill soils were not encountered at this location.

Native Soils

Topsoil in this location supported moderate vegetation with 6 to 12 inches of grass roots and organic material. Native soils were encountered immediately beneath the topsoil to the total excavated depth of 6 feet and generally consisted of a sandy clay soil with trace gravel and cobbles intermixed. Cobbles ranged from 8 to 10 inches and were encountered at 5 feet below existing grade.

Bedrock

Bedrock was not encountered at this location to the excavated depth of 6 feet.

Groundwater

Groundwater was not encountered at this location to the excavated depth of 6 feet.

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 the total excavated depth of 6 feet and generally consisted of a clayey gr with gravel with cobbles intermixed. Cobbles and larger rock/boulders were encountered at 1.5 feet excavated depth and many were present in this area at 6 feet below grade. Cobbles ranged from 6 to 12 inches and increased in size with excavation depth. There were mixed angular and rounded cobbles and boulders, with many basalt rocks from the Grand Mesa Volcanic Field, which caps the Grand Mesa, ranging from 6 to 12 inches at this test pit location. Boulders ranged from 18 to 24 inches and were encountered at 3 feet below grade to full excavation depth of 6 feet.

Bedrock

Bedrock was not encountered at this location to the excavated depth of 6 feet.

Groundwater

Groundwater was not encountered at this location to the excavated depth of 6 feet.

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 the total excavated depth of 5.5 feet and generally consisted of a sandy clay soil with gravel and cobbles intermixed. Cobbles ranged from 6 to 8 inches encountered at 2 feet below grade and increased in size with excavation depth. Larger cobbles/boulders ranging from 12 to 18 inches were encountered at 3 feet of excavated depth. Boulders ranging from 24 to 36 inches were encountered at 4.5 feet excavation, and refusal due to boulders occurred at 5.5 feet below existing grade.

Bedrock

Bedrock was not encountered at this location to the excavated depth of 5.5 feet.

Groundwater

Groundwater was not encountered at this location to the excavated depth of 5.5 feet.

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 the total excavated depth of 5.5 feet and generally consisted of a clayey sand soil with gravel and cobbles intermixed. Cobbles ranged from 6 to 8 inches encountered at 2 feet below grade and increased in size with excavation depth. Larger cobbles/boulders ranging from 12 to 18 inches were encountered at 4 feet of excavated depth. Boulders ranging from 24 to 36 inches were encountered at 4.5 feet excavation, and refusal due to boulders occurred at 5.5 feet below existing grade.

Bedrock

Bedrock was not encountered at this location to the excavated depth of 5.5 feet.

Groundwater

Groundwater was not encountered at this location to the excavated depth of 5.5 feet.

Table 1 – Test Pit Summary

Test Pit Number	Latitude (degree)	Longitude (degree)	Depth to Bedrock (feet)	Cobbles or Boulders Encountered? (Yes/No)	Excavation Refusal? (Yes/No)	Total Excavated Depth (feet)
TP-2	38.96058	-108.23667	Not encountered	Yes	No	6
TP-3	38.96043	-108.25375	Not encountered	Yes	No	6
TP-4	38.96174	-108.26412	Not encountered	Yes	No	6
TP-5	38.96206	-108.26590	Not encountered	Yes	Yes Yanmar Vio55 Mini-Ex (38.7hp)	5.5
TP-6	38.96174	-108.26936	Not encountered	Yes	Yes Yanmar Vio55 Mini-Ex (38.7hp)	5.5

Water-Soluble Sulfate Content

The City of Grand Junction uses the 2018 International Building Code (IBC 2018) for development of concrete resistance parameters. The IBC 2018 references the American Concrete Institute (ACI) for such parameters. Cementitious material requirements for concrete in contact with site soils or groundwater are based on the percentage of water-soluble sulfate in either soil or groundwater that will be in contact with concrete constructed for this project. Mix design requirements for concrete exposed to water-soluble sulfates in soils or water is considered by the ACI as shown in Table 2 and in the Building Code Requirements for Structural Concrete (ACI 318-14) (ACI Tables 19.3.1.1 & 19.3.2.1).

Table 2 - Requirements for Concrete by Sulfate Exposure Class

Exposure Class	Water-soluble sulfate (SO_4), in dry soil, percent	Water Cementitious Ratio, maximum	Cementitious Material Requirements (ASTM C150)	Minimum Compressive Strength (psi)
S0	0.00 to <0.10	Not Applicable	No Restriction	2500
S1	0.10 to < 0.20	0.50	Type II	4000
S2	0.20 to 2.0	0.45	Type V	4500
S3	2.01 or greater	0.45	Type V plus pozzolan	4500

The concentration of water-soluble sulfates measured in two soil samples obtained from Boreholes B-1 and B-2 resulted in 0.04 percent and 0.07 percent by weight (See Appendices C and D). Based on the results of the water-soluble sulfate testing, Exposure Class S0 may be considered for concrete in contact with subgrade materials at the two Kannah Creek crossing locations.

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 waterline. Depending on bedding requirements for the pipeline, the depth of the trench excavation will be approximately 5 to 5.5 feet below existing grades. 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 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 RockSol 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 or shale bedrock may be considered as OSHA Type B soil.

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 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 3 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 3 – 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. A bulk sample of soil obtained from Borehole B-4 from 0 to 4 feet below the existing grade was tested for moisture-density (standard proctor, AASHTO T-99/ASTM D698) relationship and resulted in a maximum dry density of 113.2-pcf at an optimum moisture content of 13.9 percent (See Appendix D).

9.0 SLOPE STABILITY DISCUSSION

Global stability analyses were performed by RockSol along the portion of the new waterline proposed to be installed within the Juniata Ditch access road (approximate Station No. 70+00 to 100+00, See Appendix A) using the RocScience slope stability program Slide2 2018, Version 8 (SLIDE). This portion of the waterline will follow Juniata Ditch along the Kannah Creek valley slope on the north side of Kannah Creek and extending to the west, as shown in Appendix A. To evaluate the stability of the trench excavation and waterline placement within the access road along the slope, two slope stability analyses were performed near Borehole locations B-4 and B-5 (See Sheet C2.1 in Appendix A). Slope cross sections near Borehole locations B-4 and B-5 were determined using cross sectional topographic survey data provided by the City (Sheet C2.1, Appendix A).

The existing soil parameters were assumed based on material properties and blow count information obtained from SPT values. A water surface was added to the models to represent ditch flow and potential seepage into the proposed waterline trench. The ditch access road fill material noted at Borehole locations B-4 and B-5 was modeled as saturated below the model water surface for slope stability analysis. Factors of Safety (FOS) of 1.6 and 1.7 (See Appendix F) were obtained from the two models.

Based on our observations of the existing conditions along the slope, the proposed excavation depth for the new waterline (assumed to be in the middle portion of the ditch access road), borehole data, laboratory testing, and on our engineering judgement, slope movement associated with the installation of the proposed waterline is not anticipated to occur (low risk). However, should the waterline break, and a significant amount of water is released, significant erosion and loss of access road fill material may occur.


Photo 1

10.0 WATERLINE CROSSING STRUCTURE RECOMMENDATIONS

Due to the numerous boulder size rocks noted during our field explorations, an alternative to subsurface crossings beneath Kannah Creek, above grade structures at approximate Station No. 105+00 and 131+50 may be considered, similar to the existing waterline crossing structure at Kannah Creek Road over Kannah Creek (near Borehole B-1, See Photo 1). Boreholes B-1 and B-2 were advanced for the purpose of characterizing the subsurface conditions and to provide geotechnical design recommendations

for new waterline crossing support structures. Since the 20-inch waterline creek crossing structures will be relatively lightly loaded, a shallow foundation system is recommended at both locations. RockSol recommends foundation embedment of 30 inches below grade for frost considerations. Foundation design, including sizing, will be controlled by settlement and lateral stability. Recommended bearing resistances for the crossing structures are included in Table 4 and are based on a minimum dimension of 5 feet for the footing. Protection of the waterline during flood events is recommended. Using the existing waterline structure (Sta.No.131+50) at Kannah Creek Road over Kannah Creek may be considered, provided a structural analysis of the existing foundation is performed. Scour analyses for both creek crossings were not performed by RockSol for use of shallow footing foundation systems but should be considered for design.

Table 4 – Kannah Creek Crossing Foundation Bearing Resistances
Station No. 105+00 and 131+50

Bearing Material	Strength Limit State (LRFD)		Service Limit State (LRFD)
	Ultimate (Nominal) Resistance (ksf)	Factored Resistance (ksf)	Service Bearing Resistance (ksf)
Silty SAND with gravel, cobbles, and boulders	13.1	5.9	3.0

Lateral Earth Pressures

Lateral earth pressures imposed on the crossing structures will be affected by the depth of the structure foundation. Lateral earth pressures will also be influenced by the width of the backfill zone adjacent to the structure walls. For narrow backfill zones, lateral earth pressures will be influenced by the existing, in-place soils. For relatively wide backfill zones, lateral earth pressures will be influenced by the backfill soils. RockSol recommends the use of CDOT Class 1 Structure backfill material or Class 2 Structure backfill for backfill of the structures. Class 2 Structure backfill shall be composed of suitable materials developed on the project (Refer to CDOT Standards and Specifications Section 703.08). To assist with design, lateral earth pressure parameters are presented in Table 5 for the existing native soils encountered in Boreholes B-1 and B-2. Also included are parameters for CDOT Class 1 Structure backfill material. Based on the subsurface conditions encountered in the boreholes, slightly silty to gravelly sand with cobbles and boulder size rock in parts, is anticipated to be predominately encountered at elevations above the Kannah Creek channel.

Table 5 – Lateral Earth Pressure Parameters

Soil Type	Total Unit Weight (γ) pcf	Effective Friction Angle, ϕ' (degrees)	Cohesion (psf)	Lateral Earth Pressure Coefficients (Notes 1 and 2)		
				Active (k_a)	At-Rest (k_o)	Passive (k_p) (Note 3)
CDOT Class 1 Structure Backfill (CDOT Section 703.08)	130	34	0	0.28	0.44	3.54
(Fill and Native) SAND, slightly silty to gravelly with cobbles and (CDOT Class 2)	130	32	0	0.31	0.47	3.25

Note 1: Based on Rankine Theory of earth pressure; Note 2: For horizontal backslope and foreslope.
Note 3: Full value, no reduction applied.

11.0 SEISMICITY DISCUSSION

The City of Grand Junction uses the 2018 International Building Code (IBC-2018) for development of seismic design parameters. The IBC-2018 references the American Society of Civil Engineers 7-16 (ASCE 7-16) seismic design code. Seismic design parameters were obtained from the United States Geological Survey (USGS) Earthquake Design Maps using the 2018 International Building Code specifications which reference ASCE 7-16. Values were obtained using the USGS site: https://seismicmaps.org.

11.1 Seismic Design Parameters

Based on the Standard Penetration Resistance encountered for the onsite subsurface conditions, it is our opinion that the Kannah Creek crossings meet criteria for Seismic Site Class D. Shear wave velocity testing was not performed by RockSol. Interpolated values for Peak Ground Acceleration Coefficient (PGA), Spectral Acceleration Coefficient at Period 0.2 sec (S_s), and Spectral Acceleration Coefficient at Period 1.0 sec (S_1) were obtained using the latitude and longitude for the proposed waterline alignment. The seismic acceleration coefficients obtained (data based on 0.05-degree grid spacing) are presented in Table 6.

Table 6 – Seismic Acceleration Coefficients (IBC 2018)

Approximate Location (Latitude°/Longitude°)	Peak Ground Acceleration (PGA)	Spectral Acceleration Coefficient - S_s (Period 0.2 sec)	Spectral Acceleration Coefficient - S_1 (Period 1.0 sec)
Kannah Creek (38.961/ -108.233)	0.148	0.261	0.067

The acceleration coefficients are then used to obtain Site Factors F_a, and F_v based on the defined Site Class as shown in Tables 1613.2.3(1) and 1613.2.3(2) of the *IBC-2018*. A summary of the Site Factor values obtained are shown in Table 7.

Table 7 – Seismic Site Factor Values

Approximate Location (Latitude°/Longitude°)	F_{pga} (at zero-period on acceleration spectrum)	F_a (for short period range of acceleration spectrum)	F_v (for long period range of acceleration spectrum)
Kannah Creek (38.961/ -108.233)	1.504	1.591	2.4

Table 8 summarizes the Seismic Zone determination and horizontal response spectral Acceleration Coefficients (S_{D1}) and (S_{DS}) obtained for the proposed structures. Seismic Performance Zone determination is based on the value of the horizontal response spectral Acceleration Coefficient at 1.0 Seconds, S_{D1}, as determined by *Eq. 16-39* of the IBC-2018 and the horizontal response spectral Acceleration Coefficient at 0.2 Seconds, S_{DS}, as determined by *Eq. 16-38.* Values for S_1 and F_v are presented in Tables 6 and 7, shown above. The seismic performance zone was determined *IBC-2018* Tables 1613.2.5(1) and (2). Seismic Design output sheets are summarized in Appendix G.

Table 8 – Seismic Performance Zone

Approximate Location (Latitude°/Longitude°)	Acceleration Coefficient at 1.0 seconds (S_{D1})	Acceleration Coefficient at 0.2 seconds (S_{DS})	Seismic Design Category (1)
Kannah Creek (38.961/ -108.233)	0.108	0.277	B

11.0 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.

12.0 LIMITATIONS

This geotechnical investigation was conducted in general accordance with the scope of work to provide geotechnical support for construction of the Kannah Creek Flowline Upper 3 Miles Project.

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 boreholes and test pits and does not take into account variations in the subsurface conditions that may exist between the boreholes and 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

KANNAH CREEK RAW WATERLINE ALIGNMENT PLANS (JVA)
AND
HUDDLESTON-BERRY GEOTECHNICAL INVESTIGATION REPORT (MAY 4, 2018)

CITY OF GRAND JUNCTION

KRISTEN A BREWER

SHAWN J WALLACE

JUNIATA ENLARGED DITCH

Approx. Location TP #3

Approx. Location Borehole #6 B6

NORTH AND SOUTH ALIGNMENT ALTERNATIVE SPLIT STA 62+24.04

APPROX EDGE OF GRAVEL DRIVE, TYP

PROPOSED 40' EASEMENT

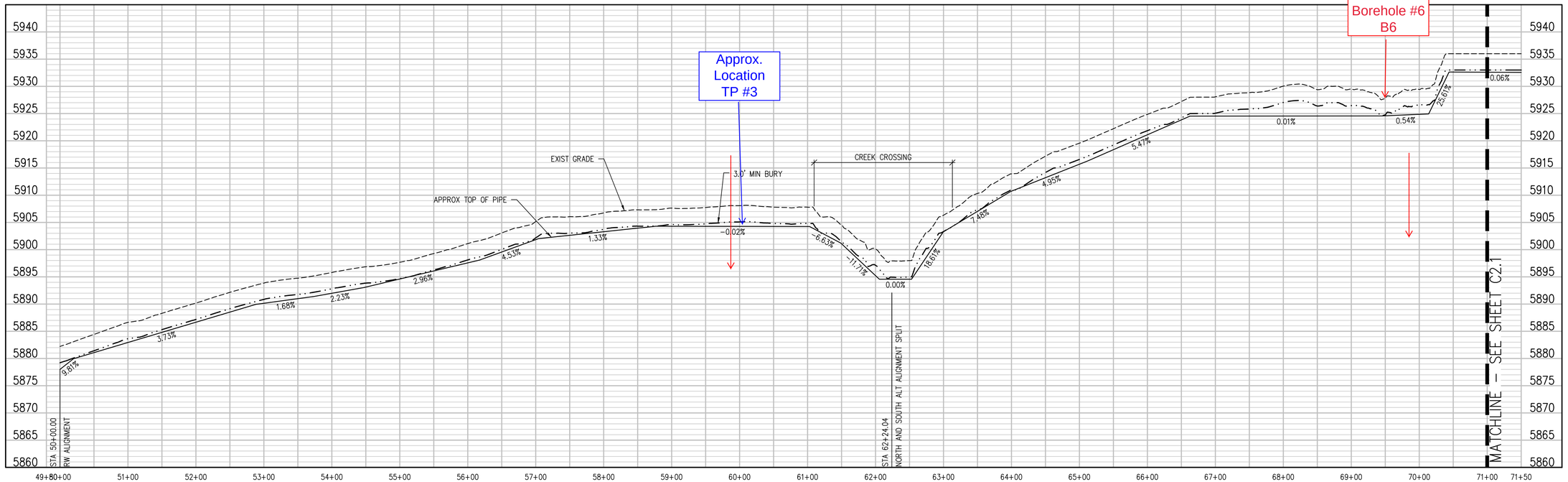
SOUTH ALIGNMENT OPTION SEE SHEET C3.0 STARTING AT STA 62+24.04

40' EXIST EASEMENT 20' OFF CENTERLINE OF RW PIPE

MATCHLINE - SEE SHEET C2.1

MIN 10'

SCALE IN FEET



NORTH ALIGNMENT PROFILE

SCALE: 1"=80' HORIZ
1"=10' VERT

JVA, Inc. 1319 Spruce Street
Boulder, CO 80302 303.444.1951
www.jvajva.com
Boulder • Fort Collins • Winter Park
Glenwood Springs • Denver

NO.	DATE	DESD	DWN	REVISION DESCRIPTION

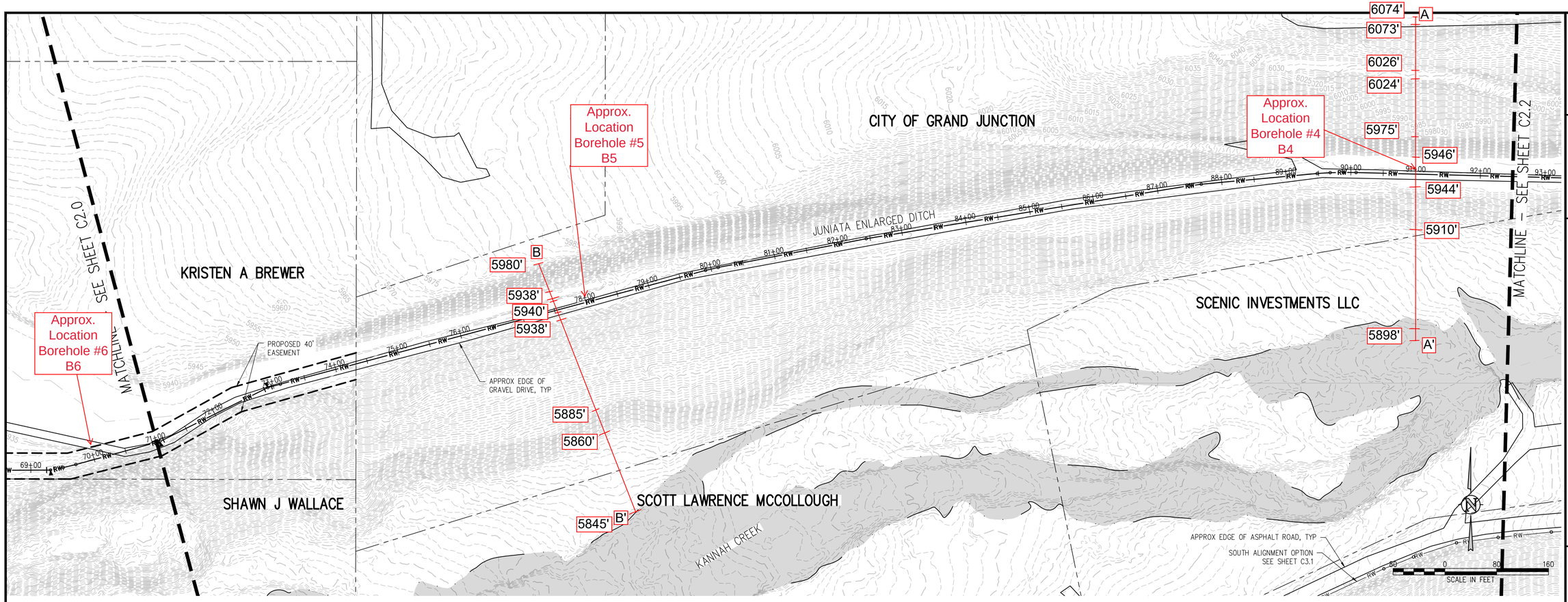
DESIGNED BY:	LAL
DRAWN BY:	LAL
CHECKED BY:	JJM
JOB #:	1071.11e
DATE:	OCTOBER 2021

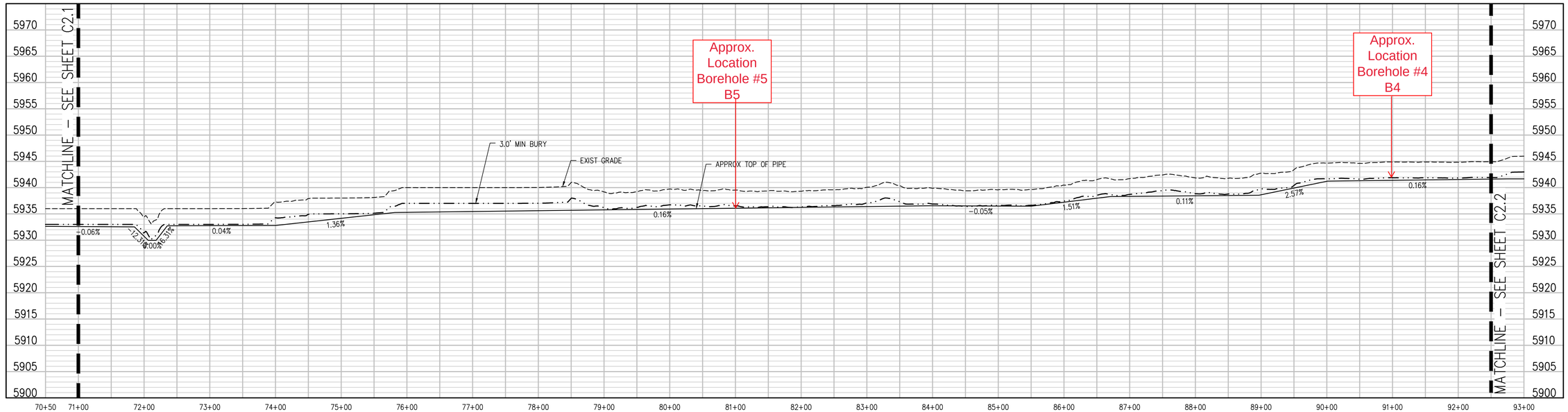
CITY OF GRAND JUNCTION
KANNAH CREEK RAW WATERLINE
PRELIMINARY ALIGNMENT ALT ANALYSIS

RAW WATERLINE ALIGNMENT AND NORTH ALIGNMENT

SHEET NO.

N:\1071.11e\Drawings\1071.11e-PNP-waterline_north_alignment_100scale.dwg, 12/20/2021 - 12:28 PM, lal





NORTH ALIGNMENT PROFILE

SCALE: 1"=80' HORIZ
1"=10' VERT

JVA CONSULTING ENGINEERS
JVA, Inc. 1319 Spruce Street
Boulder, CO 80302 303.444.1951
www.jvajva.com
Boulder • Fort Collins • Winter Park
Glenwood Springs • Denver

NO.	DATE	DES'D	D'WN	REVISION DESCRIPTION

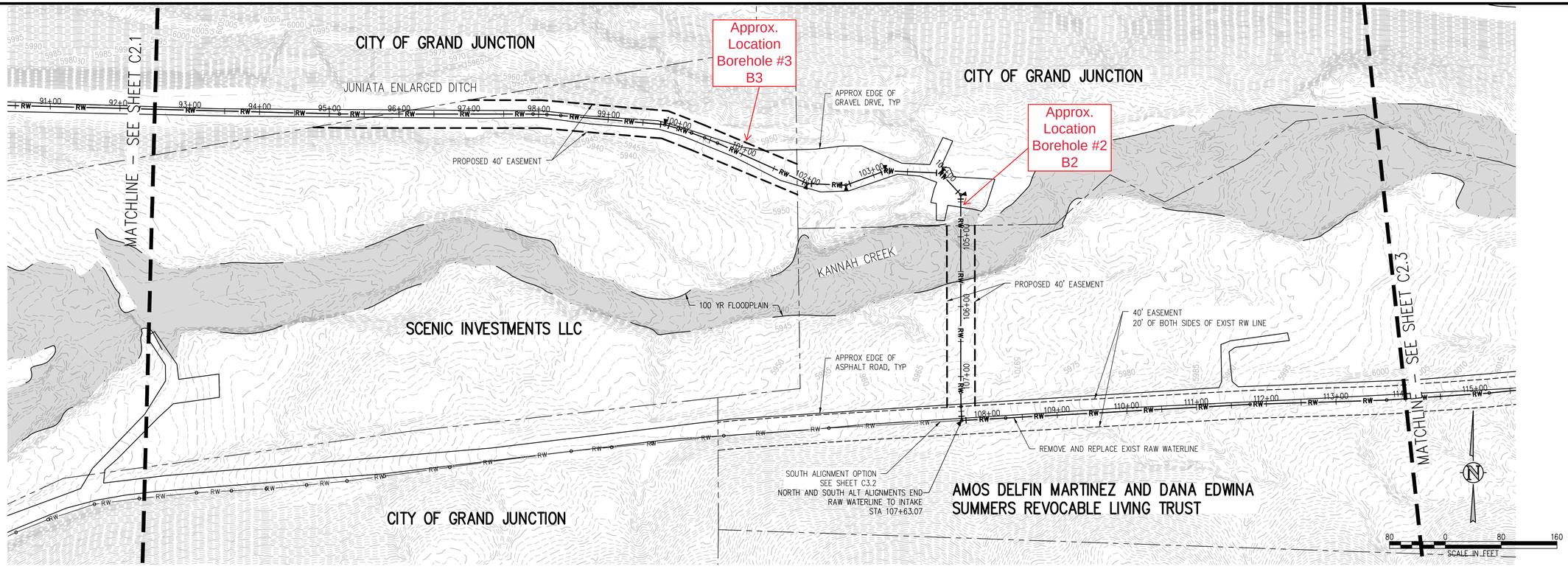
DESIGNED BY:	LAL
DRAWN BY:	LAL
CHECKED BY:	CDB
JOB #:	1071.11e
DATE:	DECEMBER 2021

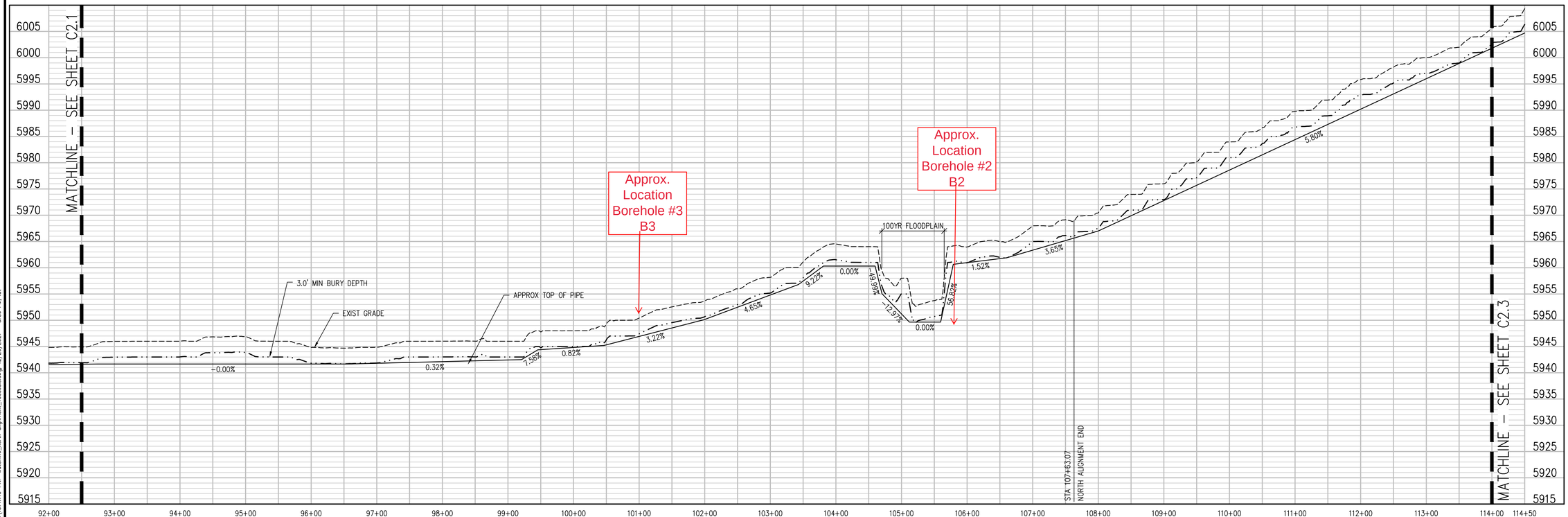
CITY OF GRAND JUNCTION
KANNAH CREEK RAW WATERLINE
PRELIMINARY ALIGNMENT ALT ANALYSIS

NORTH ALIGNMENT

SHEET NO.
C2.1

N:\1071.11e\Drawings\1071.11e-PWP-waterline_north alignment_100scale.dwg, 12/20/2021 - 12:45 PM, tot





NORTH ALIGNMENT PROFILE

SCALE: 1"=80' HORIZ
1"=10' VERT

JVA, Inc. 1319 Spruce Street
Boulder, CO 80302 303.444.1951
www.jvajva.com
Boulder • Fort Collins • Winter Park
Glenwood Springs • Denver

NO.	DATE	DES'D	DW'N	REVISION DESCRIPTION

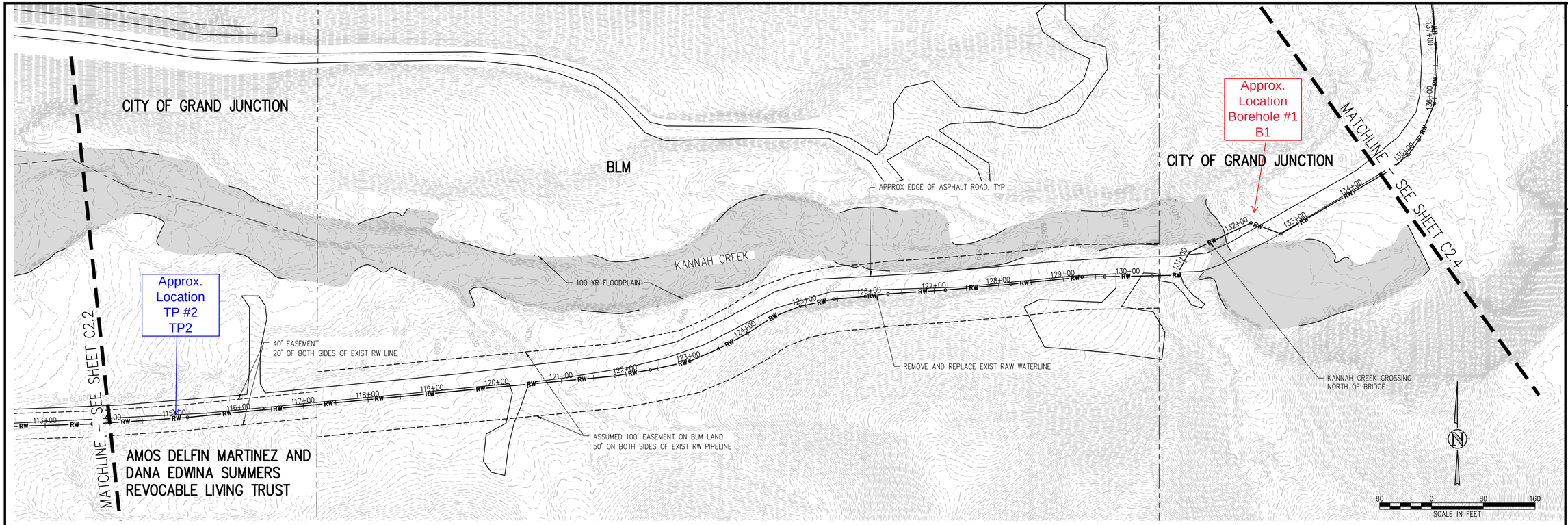
DESIGNED BY:	LAL
DRAWN BY:	LAL
CHECKED BY:	CDB
JOB #:	1071.11e
DATE:	DECEMBER 2021

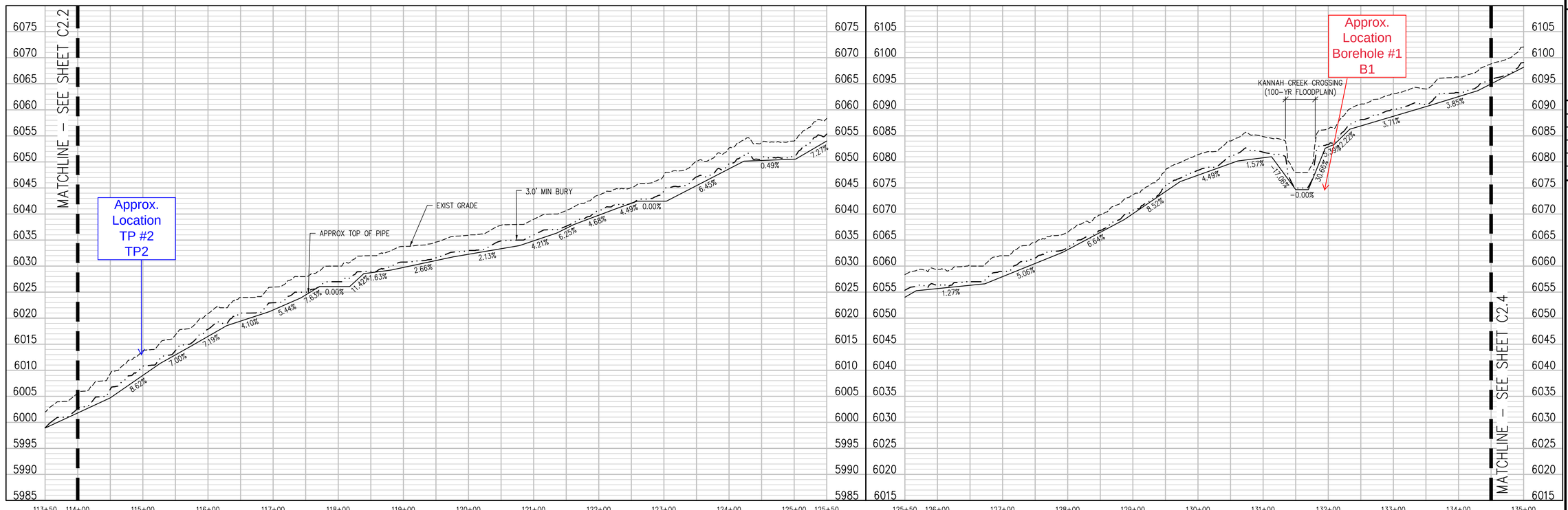
CITY OF GRAND JUNCTION
KANNAH CREEK RAW WATERLINE
PRELIMINARY ALIGNMENT ALT ANALYSIS

NORTH ALIGNMENT
AND RAW WATERLINE TO INTAKE

SHEET NO.
C2.2

N:\1071.11e\Drawings\1071.11e-PNP-waterline_north_alignment_100scale.dwg, 12/20/2021 - 3:56 PM, lot





JVA CONSULTING ENGINEERS
JVA, Inc. 1319 Spruce Street
Boulder, CO 80302 303.444.1951
www.jvajva.com
Boulder • Fort Collins • Winter Park
Glenwood Springs • Denver

NO.	DATE	DESD	DWN	REVISION DESCRIPTION

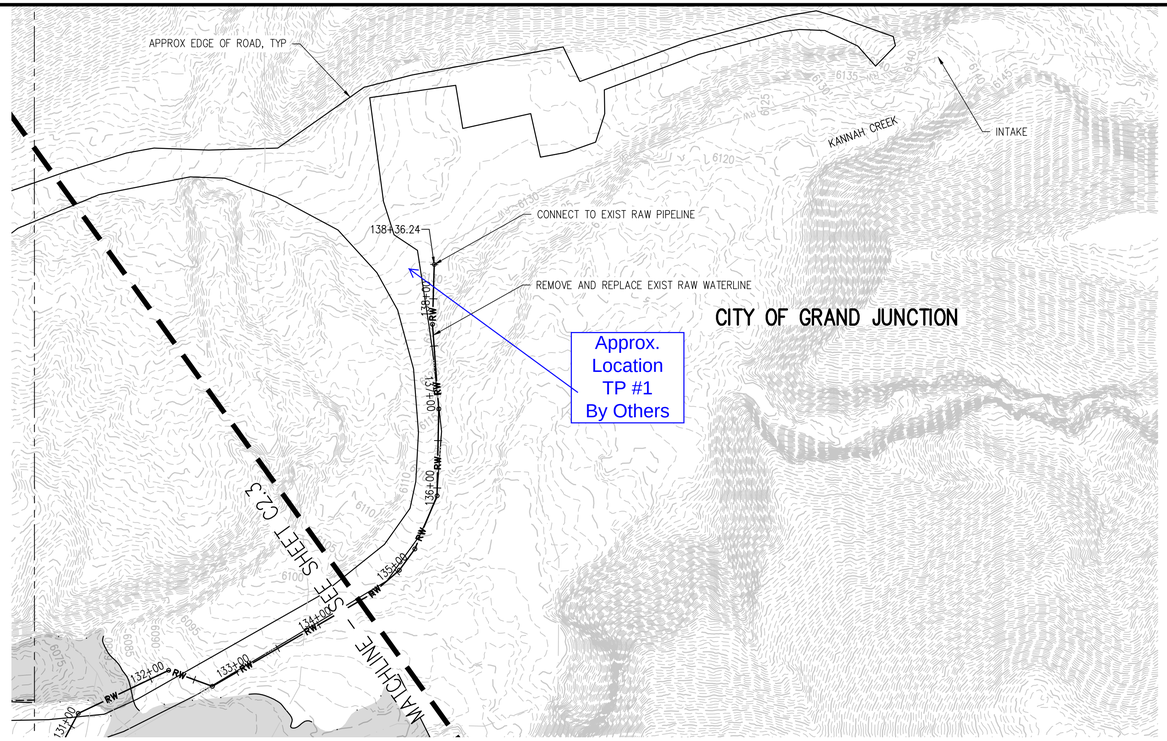
DESIGNED BY:	LAL
DRAWN BY:	LAL
CHECKED BY:	CDB
JOB #:	1071.11e
DATE:	DECEMBER 2021

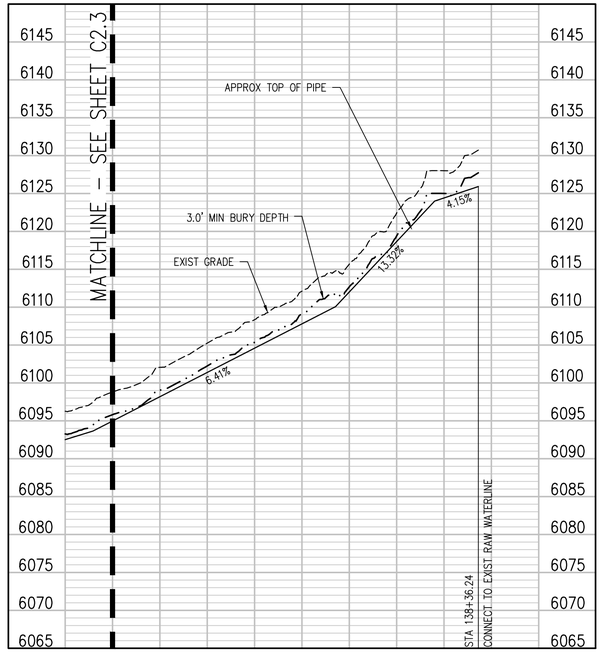
CITY OF GRAND JUNCTION
KANNAH CREEK RAW WATERLINE
PRELIMINARY ALIGNMENT ALT ANALYSIS

RAW WATERLINE TO INTAKE

SHEET NO.
C2.3

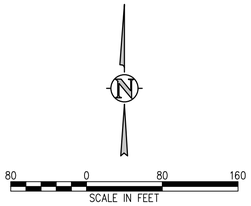
N:\1071.11e\Drawings\1071.11e-PNP-waterline_north_alignment_100scale.dwg, 12/20/2021 - 12:49 PM, iat





NORTH ALIGNMENT PROFILE

SCALE: 1"=80' HORIZ
1"=10' VERT



JVA, Inc. 1319 Spruce Street
Boulder, CO 80302 303.444.1951
www.jvajva.com
Boulder • Fort Collins • Winter Park
Glenwood Springs • Denver

NO.	DATE	DES'D	DW'N	REVISION DESCRIPTION

DESIGNED BY:	LAL
DRAWN BY:	LAL
CHECKED BY:	CDB
JOB #:	1071.11e
DATE:	DECEMBER 2021

CITY OF GRAND JUNCTION
KANNAH CREEK RAW WATERLINE
PRELIMINARY ALIGNMENT ALT ANALYSIS

RAW WATERLINE TO INTAKE

SHEET NO.
C2.4

Huddleston-Berry
Engineering & Testing, LLC

640 White Avenue
Grand Junction, Colorado 81501
Phone: 970-255-8005
Fax: 970-255-6818
Info@huddlestonberry.com

May 4, 2018
Project#00208-0079

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

Attention: Mr. John Eklund

Subject: Geotechnical Investigation
Kannah Creek Intake
Whitewater, Colorado

Dear Mr. Eklund,

This letter presents the results of a geotechnical investigation conducted by Huddleston-Berry Engineering & Testing, LLC (HBET) for the Kannah Creek Intake project in Whitewater, Colorado. The site location is shown on Figure 1 – Site Location Map. The proposed construction is anticipated to include construction of a new diversion dam. In addition, a portion of the existing flow measurement building is proposed to be replaced. The scope of our investigation included evaluating the subsurface conditions at the site to aid in developing foundation recommendations for the proposed construction.

Subsurface Investigation

The subsurface investigation included two test pits at the site as shown on Figure 2 – Site Plan. Test pits TP-1 and TP-2 were excavated to depths of 8.0 and 5.5 feet below the existing ground surface, respectively. Typed test pit logs are included in Appendix A.

Test Pit TP-1, conducted on the west side of the existing flow measurement building, encountered a thin layer of granular base course at the ground surface above brown, moist, medium dense to dense sandy silt with gravel, cobbles, and boulders to a depth of 4.0 feet. The silt was underlain by brown, moist, medium dense to dense cobbles and boulders in a sandy silt matrix to the bottom of the excavation. Groundwater was not encountered in TP-1 at the time of the investigation.

Test Pit TP-2, conducted on the west side of the existing diversion dam, encountered brown, moist, dense cobbles and boulders in a clay matrix with abundant organics from the ground surface to a depth of 1.5 feet. Below the organic rich material, brown, moist, dense to very dense cobbles and boulders in a sandy silty clay matrix extended to the bottom of the excavation. Backhoe bucket refusal was encountered on boulders at a depth of 5.5 feet. Groundwater was not encountered in TP-2 at the time of the investigation.

Flow Measurement Building Recommendations

Based upon the results of the subsurface investigation and nature of the proposed construction, shallow foundations are generally recommended for the new flow measurement building. Spread footings and monolithic (turndown) structural slab foundations are both appropriate alternatives. However, in order to provide a uniform bearing stratum and reduce the risk of excessive differential movements, it is recommended that the foundations be constructed above a minimum of 12-inches of structural fill.

The native soils are generally suitable for reuse as structural fill; provided particles in excess of 3-inches in diameter are removed. Imported structural fill should consist of a granular, non-expansive, non-free draining material such as crusher fines or CDOT Class 6 base course. Unless it can be demonstrated that they are not free-draining, pit-run materials may not be used as structural fill.

For spread footing foundations, the footing areas may be trenched. However, for monolithic slab foundations, the structural fill should extend across the entire building pad area to a depth of 12-inches below the turndown edges. Structural fill should extend laterally beyond the edges of the foundations a distance equal to the thickness of structural fill for both foundation types.

Prior to placement of structural fill, it is recommended that the bottom of the foundation excavation be moisture conditioned and proofrolled to the Engineer's satisfaction. Structural fill should be moisture conditioned, placed in maximum 8-inch loose lifts, and compacted to a minimum of 95% of the standard Proctor maximum dry density for fine grained soils and 90% of the modified Proctor maximum dry density for coarse grained soils, within ± 2% of the optimum moisture content as determined in accordance with ASTM D698 and D1557, respectively.

Structural fill should be extended to within 0.1-feet of the bottom of the foundation. No more than 0.1-feet of gravel should be placed below the footings or turndown edge as a leveling course.

For structural fill consisting of the native soils or imported granular materials, and foundation building pad preparation as recommended, a maximum allowable bearing capacity of 2,000 psf may be used. In addition a modulus of subgrade reaction of 150 pci may be used for structural fill consisting of the native sand soils and a modulus of 250 pci may be used for structural fill consisting of crusher fines or base course. Foundations subject to frost should be at least 24 inches below the finished grade. In general, for construction in accordance with the above recommendations, HBET anticipates that differential settlements will be less than 0.5 inch and total settlements will be less than 1.0 inch.

Diversion Dam Recommendations

Based upon the results of the subsurface investigation and upon our observations at the site, the existing concrete diversion dam appears to be founded on the native cobble and boulder soils. However, due to the site constraints, HBET was unable to evaluate the soil conditions on the east end of the existing dam.

In general, the native cobble and boulder materials are in a dense to very dense condition and will provide excellent support for the new structure. As a result, HBET recommends that the new diversion dam bear directly on the native soils. However, where numerous boulders are present in the subgrade, it may be preferable to pour a concrete leveling pad to interlock with the boulders and provide a uniform bearing surface for the base of the dam. In this case, the leveling pad should include dowels to provide a connection to the primary dam structure. Also, a keyway may be necessary at the base of the dam to limit the potential for seepage below the dam.

Prior to placement of concrete for the leveling pad and/or dam, it is recommended that the bottom of the foundation excavation be moisture conditioned and proofrolled to the Engineer's satisfaction. Large particles may need to be removed at the direction of the Geotechnical and/or Structural Engineer.

For construction above properly prepared dense native soils, a maximum allowable bearing capacity of 3,000 psf may be used. In addition a modulus of subgrade reaction of 200 pci may be used for the dense native soils. In general, for construction in accordance with the above recommendations, HBET anticipates that differential settlements will be less than 0.75 inch and total settlements will be less than 1.5 inches.

Lateral Earth Pressures

Any retaining walls should be designed to resist lateral earth pressures. For backfill consisting of the native soils or imported granular, non-free draining, non-expansive material, we recommend that the walls be designed for an equivalent active fluid unit weight of 45 pcf in areas where no surcharge loads are present. An at-rest equivalent fluid unit weight of 65 pcf is recommended for braced walls. Lateral earth pressures should be increased as necessary to reflect any surcharge loading behind the walls.

Corrosion of Concrete

Water soluble sulfates are common to the soils in Western Colorado. Therefore, at a minimum, Type I-II sulfate resistant cement is recommended for construction at this site.

Excavation

Excavations in the soils at the site may stand for short periods of time but should not be considered to be stable. Trenching and excavations should be sloped back, shored, or shielded for worker protection in accordance with applicable OSHA standards. The soils generally classify as Type C soil with regard to OSHA's *Construction Standards for Excavations*. For Type C soils, the maximum allowable slope in temporary cuts is 1.5H:1V.

As discussed previously, boulders were present in the subsurface at the site. Therefore, large equipment may be necessary to complete excavation at the site; particularly at the dam location.

General Notes

The recommendations included above are based upon the results of the subsurface investigation and on our local experience. These conclusions and recommendations are valid only for the proposed construction.

As discussed previously, only one test pit was conducted at each structure location. Therefore, the precise nature and extent of subsurface variability may not become evident until construction. HBET should be provided the opportunity to examine the actual subgrade conditions at the flow measurement building and diversion dam prior to concrete placement to verify the validity of the recommendations herein.

We are pleased to be of service to your project. Please contact us if you have any questions or comments regarding the contents of this report.

Respectfully Submitted:
Huddleston-Berry Engineering and Testing, LLC

Michael A. Berry, P.E.
Vice President of Engineering

FIGURES

FIGURE 1
Site Location Map

FIGURE 2
Site Plan

APPENDIX A
Typed Test Pit Logs

Huddleston-Berry Engineering & Testing, LLC
640 White Avenue, Unit B
Grand Junction, CO 81501
970-255-8005
970-255-6818

TEST PIT NUMBER TP-1

CLIENT City of Grand Junction
PROJECT NAME Kannah Creek Intake
PROJECT NUMBER 00208-0079
PROJECT LOCATION Whitewater, CO
DATE STARTED 4/12/18 **COMPLETED** 4/12/18
GROUND ELEVATION _____ **TEST PIT SIZE** _____
EXCAVATION CONTRACTOR Client
GROUND WATER LEVELS:
EXCAVATION METHOD Backhoe
AT TIME OF EXCAVATION dry
LOGGED BY CM **CHECKED BY** MAB
AT END OF EXCAVATION dry
NOTES _____
AFTER EXCAVATION ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0.0		Granular Base Course										
		Sandy SILT with Gravel, Cobbles, and Boulders (ml), brown, moist, medium dense										
2.5												
		COBBLES and BOULDERS in a Sandy SILT matrix (ml), brown, moist, dense										
5.0												
7.5												
		Bottom of test pit at 8.0 feet.										

Huddleston-Berry Engineering & Testing, LLC
640 White Avenue, Unit B
Grand Junction, CO 81501
970-255-8005
970-255-6818

TEST PIT NUMBER TP-2

CLIENT City of Grand Junction
PROJECT NAME Kannah Creek Intake
PROJECT NUMBER 00208-0079
PROJECT LOCATION Whitewater, CO
DATE STARTED 4/12/18 **COMPLETED** 4/12/18
GROUND ELEVATION _____ **TEST PIT SIZE** _____
EXCAVATION CONTRACTOR Client
GROUND WATER LEVELS:
EXCAVATION METHOD Backhoe
AT TIME OF EXCAVATION dry
LOGGED BY CM **CHECKED BY** MAB
AT END OF EXCAVATION dry
NOTES _____
AFTER EXCAVATION ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0.0		COBBLES and BOULDERS in a Sandy SILT matrix with Organics (TOPSOIL)										
2.5		COBBLES and BOULDERS in a Sandy SILT matrix (ml), brown, moist, dense to very dense	GB 1									
5.0		Bottom of test pit at 5.5 feet.										

City of Grand Junction

N

0 0.45 0.9 mi

Printed: 3/7/2022

1 inch = 1,505 feet

CITY OF Grand Junction COLORADO GEOGRAPHIC INFORMATION SYSTEM

APPENDIX B

TEST PIT SAMPLING PHOTOGRAPH SUMMARY (TP-2 THROUGH TP-6)

TP-2

Top Left: location looking east from Kannah Creek Road

Top Right: location looking north

Bottom Left: test pit to full depth of 6’

Bottom Right: pile of excavated material looking west with test pit in background

TP-3

Top Left: location looking east

Top Right: location looking south

Bottom Left: test pit to full depth of 6’

Bottom Right: pile of excavated material looking south with test pit in foreground

TP-4 (page 1 of 2)

Top Left: location looking east

Top Right: location looking south

Bottom Left: test pit to full depth of 6’

Bottom Right: pile of excavated material looking south with test pit in background

TP-4 (page 2 of 2)

Top Left: excavated material angular cobbles

Top Right: excavated material cobbles

Bottom Left: pile of material from first 2’

Bottom Right: test pit at 3’ depth

TP-5 (page 1 of 2)

Top Left: location looking east

Top Right: location looking south

Bottom Left: test pit to full depth of 5.5’

Bottom Right: location looking west at beginning of excavation

TP-5 (page 2 of 2)

Top Left: excavated material in first 3’

Top Right: smaller cobbles at 2-3’ deep

Bottom Left: test pit at 3’

Bottom Right: larger boulders 24”-36” encountered at ~4.5’ excavated depth

TP-6

Top Left: location looking east

Top Right: location looking south

Bottom Left: test pit to full excavated depth of 5.5’

Bottom Right: pile of excavated material

APPENDIX C

LEGEND AND INDIVIDUAL BOREHOLE AND TEST PIT SOIL LOGS

LEGEND

RockSol Consulting Group, Inc.

CLIENT City of Grand Junction **PROJECT NAME** Kannah Creek Flowline

PROJECT NUMBER 599.62 **PROJECT LOCATION** Grand Junction, Colorado

LITHOLOGY

- Fill - CLAY, sandy
- Fill - SAND, clayey to silty
- Native - SAND, silty
- Native - CLAY
- Native - CLAY, sandy
- Native - GRAVEL, silty
- Fill - SAND, gravelly
- TOPSOIL
- Native - SAND, clayey
- Native - SAND, silty to clayey
- Native - GRAVEL, clayey
- Bedrock - CLAYSTONE (Mancos Shale)

SAMPLE TYPE

Auger Cuttings

MODIFIED CALIFORNIA SAMPLER
2.5" O.D. AND 2" I.D.
WITH BRASS LINERS INCLUDED

SPLIT SPOON SAMPLER
2" O.D. AND 1 3/8" I.D.
NO LINERS

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

15/12 Indicates 15 blows of a 140 pound hammer falling 30 inches was required to drive the sampler 12 inches.

50/11 Indicates 50 blows of a 140 pound hammer falling 30 inches was required to drive the sampler 11 inches.

5,5,5 Indicates 5 blows, 5 blows, 5 blows of a 140 pound hammer falling 30 inches was required to drive the sampler 18 inches.

GROUND WATER LEVEL 1ST DEPTH

GROUND WATER LEVEL 2ND DEPTH

RockSol Consulting Group, Inc.

BORING : B-1

CLIENT City of Grand Junction
PROJECT NAME Kannah Creek Flowline
PROJECT NUMBER 599.62
PROJECT LOCATION Grand Junction, Colorado
DATE STARTED 10/18/22 **COMPLETED** 10/18/22
GROUND ELEVATION 6088.0 ft **STATION NO.**
DRILLING CONTRACTOR Colorado Drilling and Sampling
NORTH -2659.5 **EAST** 186309.3
DRILLING METHOD Solid Stem Auger **HOLE SIZE** 4.25"
BORING LOCATION: Kannah Creek Rd bridge over Kannah Creek, NE corner of abutn
LOGGED BY D. Compton **HAMMER TYPE** Automatic
GROUND WATER LEVELS:
NOTES Off shoulder, ~5' NW of white edge line
WATER DEPTH 11.0 ft on 10/18/22

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 (%)
6088.0	0		(Topsoil) SAND, silty, approximately 3 inches thick										
			(Fill) SAND, slightly silty to silty, gravelly with cobble and boulder size rock in parts, moist, brown to light brown and gray, very dense										
				SS	50/8								
6083.0	5		(Fill) SAND, clayey with gravel, cobble and boulder size rock in parts, moist, brown and gray, dense to very dense	B BULK			0.04			22	12	10	40.0
			(Native) GRAVEL, silty to clayey, with cobble and boulder size rock in parts, wet, dark brown, dense to very dense										
				SS	50/8					22	13	9	34.9
6078.0	10		**Approximate Bulk Depth 5-7** Liquid Limit= 22 Plastic Limit= 12 Plasticity Index= 10 Fines Content= 40.0 Sulfate = 0.04										
			(Native) CLAY, sandy with trace gravel in parts, very moist, dark brown, stiff to very stiff	B BULK						29	16	13	67.5
6073.0	15			SS	20/8/9								
6068.0	20			MC	9/12	0.3		116.6	16.1				74.2
			Bottom of hole at 20.0 feet.										

LOG - STANDARD 599.62_KANNAH CREEK FLOWLINE_GRAND JUNCTION.GPJ 12/16/22

RockSol Consulting Group, Inc.

BORING : B-2

CLIENT City of Grand Junction
PROJECT NAME Kannah Creek Flowline
PROJECT NUMBER 599.62
PROJECT LOCATION Grand Junction, Colorado
DATE STARTED 10/17/22 **COMPLETED** 10/17/22
GROUND ELEVATION 5966.0 ft **STATION NO.**
DRILLING CONTRACTOR Colorado Drilling and Sampling
NORTH -2676.5 **EAST** 183930.9
DRILLING METHOD Solid Stem Auger **HOLE SIZE** 4.25"
BORING LOCATION: ~ 280' N of Kannah Creek Rd, ~60' S of Juniata Ditch Inlet Struc
LOGGED BY D. Compton **HAMMER TYPE** Automatic
GROUND WATER LEVELS:
NOTES
WATER DEPTH 18.0 ft on 10/17/22

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 (%)
5966.0	0		(Fill) SAND, slightly silty to gravelly with cobble and boulder size rock in parts, medium dense to very dense										
5961.0	5		(Native) SAND, silty to gravelly with cobble and boulder size rock in parts, clayey in parts, moist to very moist, gray to brown, dense to very dense										
				SS	50/10								
5956.0	10												
				SS	50/5					18	15	3	46.0
5951.0	15		**Approximate Bulk Depth 19-20** Liquid Limit= 18 Plastic Limit= 14 Plasticity Index= 4 Fines Content= 72.1 Sulfate = 0.07										
			(Native) SAND, clayey and sandy to silty CLAY, gravel in parts, very moist to wet, brown, very dense to very hard										
				BULK SS	50/6		0.07			18	14	4	72.1 47.5
5946.0	20		Bottom of hole at 20.0 feet.										

LOG - STANDARD 599.62_KANNAH CREEK FLOWLINE_GRAND JUNCTION.GPJ 12/16/22

RockSol Consulting Group, Inc.

BORING : B-3

CLIENT City of Grand Junction
PROJECT NAME Kannah Creek Flowline
PROJECT NUMBER 599.62
PROJECT LOCATION Grand Junction, Colorado
DATE STARTED 10/17/22 **COMPLETED** 10/17/22
GROUND ELEVATION 5951.0 ft **STATION NO.**
DRILLING CONTRACTOR Colorado Drilling and Sampling
NORTH -2601.4 **EAST** 183627.3
DRILLING METHOD Solid Stem Auger **HOLE SIZE** 4.25"
BORING LOCATION: ~385' N of Kannah Creek Rd, S side of Juniata Creek Ditch
LOGGED BY D. Compton **HAMMER TYPE** Automatic
GROUND WATER LEVELS:
NOTES
WATER DEPTH None Encountered on 10/17/22

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 (%)
5951.0	0.0		(Fill) SAND, slightly silty to clayey with gravel, cobble and boulder size rock in parts, moist, brown, medium dense										
5948.5	2.5												
5946.0	5.0		**Approximate Bulk Depth 4-5** Liquid Limit= 27 Plastic Limit= 19 Plasticity Index= 8 Fines Content= 46.5	8 BULK						27	19	8	46.5
5943.5	7.5		(Native) SAND, silty with gravel, cobble and boulder size rock in parts, moist, light brown to dark brown, dense to very dense										
5941.0	10.0			MC	50/9					16	14	2	37.5
5938.5	12.5												
5936.0	15.0			MC	50/8					19	14	5	33.5
			Bottom of hole at 15.0 feet.										

LOG - STANDARD 599.62_KANNAH CREEK FLOWLINE_GRAND JUNCTION.GPJ 12/16/22

RockSol Consulting Group, Inc.

BORING : B-4

CLIENT City of Grand Junction
PROJECT NAME Kannah Creek Flowline
PROJECT NUMBER 599.62
PROJECT LOCATION Grand Junction, Colorado
DATE STARTED 10/17/22 **COMPLETED** 10/17/22
GROUND ELEVATION 5944.0 ft **STATION NO.**
DRILLING CONTRACTOR Colorado Drilling and Sampling
NORTH -2538.3 **EAST** 182535.5
DRILLING METHOD Solid Stem Auger **HOLE SIZE** 4.25"
BORING LOCATION: ~565' N of Kannah Creek Rd, S side of Juniata Ditch
LOGGED BY D. Compton **HAMMER TYPE** Automatic
GROUND WATER LEVELS:
NOTES Ditch access road
WATER DEPTH None Encountered on 10/17/22

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 (%)
5944.0	0.0		(Fill) CLAY, with sand, moist, light brown, stiff to very stiff										
5941.5	2.5		**Approximate Bulk Depth 0-5** Liquid Limit= 33 Plastic Limit= 15 Plasticity Index= 18 Fines Content= 80.2	B BULK						33	15	18	80.2
5939.0	5.0		(Bedrock) CLAYSTONE, weathered, moist, brownish gray, hard	MC	39/12			90.7	9.9				
5936.5	7.5		(Bedrock) CLAYSTONE, moist, orange brown to brownish gray, hard to very hard, iron staining										
5934.0	10.0			MC	49/12			122.9	9.0				91.7
5931.5	12.5												
5929.0	15.0			MC	50/10								
			Bottom of hole at 15.0 feet.										

LOG - STANDARD 599.62_KANNAH CREEK FLOWLINE_GRAND JUNCTION.GPJ 12/16/22

RockSol Consulting Group, Inc.

BORING : B-5

CLIENT City of Grand Junction
PROJECT NAME Kannah Creek Flowline
PROJECT NUMBER 599.62
PROJECT LOCATION Grand Junction, Colorado
DATE STARTED 10/17/22 **COMPLETED** 10/17/22
GROUND ELEVATION 5941.0 ft **STATION NO.**
DRILLING CONTRACTOR Colorado Drilling and Sampling
NORTH -2735.0 **EAST** 181358.5
DRILLING METHOD Solid Stem Auger **HOLE SIZE** 4.25"
BORING LOCATION: ~950' N of Kannah Creek Rd, S side of Juniata Ditch
LOGGED BY D. Compton **HAMMER TYPE** Automatic
GROUND WATER LEVELS:
NOTES Ditch access road
WATER DEPTH None Encountered on 10/17/22

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 (%)
5941.0	0.0		(Fill) GRAVEL, clayey with cobble and boulder size rock in parts, slightly moist to moist, brown, medium dense to dense										
5938.5	2.5		**Approximate Bulk Depth 0-10** Liquid Limit= 34 Plastic Limit= 17 Plasticity Index= 17 Fines Content= 48.0										
5936.0	5.0			B BULK						34	17	17	48.0
5933.5	7.5												
5931.0	10.0		(Bedrock) CLAYSTONE , weathered, moist, light brown to brown, very stiff to hard, minor iron staining, slightly calcareous	MC	47/12			115.3	12.4				90.8
5928.5	12.5												
5926.0	15.0			MC	27/12								
			Bottom of hole at 15.0 feet.										

LOG - STANDARD 599.62_KANNAH CREEK FLOWLINE_GRAND JUNCTION.GPJ 12/16/22

RockSol Consulting Group, Inc.

BORING : B-6

CLIENT City of Grand Junction
PROJECT NAME Kannah Creek Flowline
PROJECT NUMBER 599.62
PROJECT LOCATION Grand Junction, Colorado
DATE STARTED 10/17/22 **COMPLETED** 10/17/22
GROUND ELEVATION 5938.0 ft **STATION NO.**
DRILLING CONTRACTOR Colorado Drilling and Sampling
NORTH -2949.3 **EAST** 180620.1
DRILLING METHOD Solid Stem Auger **HOLE SIZE** 4.25"
BORING LOCATION: ~1060' N of Kannah Creek Rd, S side of Juniata Ditch
LOGGED BY D. Compton **HAMMER TYPE** Automatic
GROUND WATER LEVELS:
NOTES Ditch access road
WATER DEPTH None Encountered on 10/17/22

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 (%)
5938.0	0.0		(Fill) SAND, slightly silty to gravelly with cobble and boulder size rock in parts, slightly moist to moist, light brown to gray, dense to very dense, clayey SAND in parts										
5935.5	2.5												
5933.0	5.0			SS	8, 21, 32/4								33.5
5930.5	7.5		(Native) SAND, silty to clayey, slightly moist to moist, light brown to gray, dense to very dense, gravel in parts										
5928.0	10.0			SS	50/11					22	16	6	34.6
5925.5	12.5												
5923.0	15.0			SS	13, 26, 24/2								33.9
			Bottom of hole at 15.2 feet.										

RockSol Consulting Group, Inc.

TEST PIT : TP-2

CLIENT City of Grand Junction
PROJECT NAME Kannah Creek Flowline
PROJECT NUMBER 599.62
PROJECT LOCATION Grand Junction, Colorado
DATE STARTED 10/28/22 **COMPLETED** 10/28/22
GROUND ELEVATION 6001.0 ft **STATION NO.**
EXCAVATION CONTRACTOR RockSol Consulting Group, Inc.
NORTH -2956.6 **EAST** 184490.4
EXCAVATION METHOD **TEST PIT SIZE** N/A
BORING LOCATION: EB Kannah Creek Rd, ~0.35 mi W of bridge over Kannah Creek
LOGGED BY D. Compton **HAMMER TYPE** None
GROUND WATER LEVELS:
NOTES ~2' S of pavement edge Sta. 115+00
WATER DEPTH None Encountered on 10/28/22

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 (%)
6001.0	0		(Topsoil) SAND, silty, slightly moist, loose to medium dense, sparse vegetation cover, approximately 3 inches thick										
			(Native) CLAY, sandy, with gravelly SAND and 4" to 8" cobbles in parts, slightly moist to very moist, light brown to dark brown, 12" to 18" boulders noted at 2 ft and 6 ft										
6000.0	1												
5999.0	2		12"-18" boulders at 2 ft										
5998.0	3		**Approximate Bulk Depth 0-6** Liquid Limit= 31 Plastic Limit= 14 Plasticity Index= 17 Fines Content= 58.4	B	BULK					31	14	17	58.4
5997.0	4												
5996.0	5												
5995.0	6		12"-18" boulders at 6 ft										
			Bottom of test pit at 6.0 feet.										

TEST PIT : TP-3

RockSol Consulting Group, Inc.

CLIENT City of Grand Junction
PROJECT NAME Kannah Creek Flowline
PROJECT NUMBER 599.62
PROJECT LOCATION Grand Junction, Colorado
DATE STARTED 10/28/22 **COMPLETED** 10/28/22
GROUND ELEVATION 5905.0 ft **STATION NO.**
EXCAVATION CONTRACTOR RockSol Consulting Group, Inc.
NORTH -3024.6 **EAST** 179627.6
EXCAVATION METHOD **TEST PIT SIZE** N/A
BORING LOCATION: ~1500' N of Kannah Creek Rd. ~1055' W of Juniata Ditch
LOGGED BY D. Compton **HAMMER TYPE** None
GROUND WATER LEVELS:
NOTES Sta 60+00
WATER DEPTH None Encountered on 10/28/22

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 (%)
5905.0	0		(Topsoil) SAND, silty, slightly moist, loose to medium dense, sparse vegetation cover, approximately 6 inches thick										
			(Native) CLAY, sandy with trace gravel, moist to very moist, reddish brown										
5904.0	1												
5903.0	2		**Approximate Bulk Depth 0-6** Liquid Limit= 35 Plastic Limit= 16 Plasticity Index= 19 Fines Content= 77.6										
5902.0	3			B	BULK					35	16	19	77.6
5901.0	4												
			8" to 10" cobbles at 5 ft										
5900.0	5												
5899.0	6												
			Bottom of test pit at 6.0 feet.										

LOG - STANDARD 599.62_KANNAH CREEK FLOWLINE_GRAND JUNCTION.GPJ 12/16/22

RockSol Consulting Group, Inc.

TEST PIT : TP-4

CLIENT City of Grand Junction
PROJECT NAME Kannah Creek Flowline
PROJECT NUMBER 599.62
PROJECT LOCATION Grand Junction, Colorado
DATE STARTED 10/28/22 **COMPLETED** 10/28/22
GROUND ELEVATION 5823.0 ft **STATION NO.**
EXCAVATION CONTRACTOR RockSol Consulting Group, Inc.
NORTH -2556.6 **EAST** 176688.2
EXCAVATION METHOD **TEST PIT SIZE** N/A
BORING LOCATION: ~760' S of Purdy Mesa Rd, ~500' E of oil/gas tank property
LOGGED BY A. Kachin **HAMMER TYPE** None
GROUND WATER LEVELS:
NOTES
WATER DEPTH None Encountered on 10/28/22

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 (%)
5823.0	0		(Topsoil) SAND, silty, slightly moist, loose to medium dense, sparse vegetation cover, approximately 3 inches thick										
			(Native) GRAVEL, clayey with angular cobbles (6" to 12" diameter), and 12" to 24" diameter boulders, moist, light brown and tan to brown, sandy CLAY and silty SAND in parts										
5822.0	1												
5821.0	2												
5820.0	3		18" to 24" boulders at 3 ft **Approximate Bulk Depth 0-6** Liquid Limit= 33 Plastic Limit= 19 Plasticity Index= 14 Fines Content= 16.3	B	BULK					33	19	14	16.3
5819.0	4												
5818.0	5												
5817.0	6												
			Bottom of test pit at 6.0 feet.										

TEST PIT : TP-5

RockSol Consulting Group, Inc.

CLIENT City of Grand Junction **PROJECT NAME** Kannah Creek Flowline

PROJECT NUMBER 599.62 **PROJECT LOCATION** Grand Junction, Colorado

DATE STARTED 10/28/22 **COMPLETED** 10/28/22 **GROUND ELEVATION** 5820.0 ft **STATION NO.**

EXCAVATION CONTRACTOR RockSol Consulting Group, Inc. **NORTH** -2439.0 **EAST** 176179.3

EXCAVATION METHOD **TEST PIT SIZE** N/A **BORING LOCATION:** ~450' S of Purdy Mesa Rd, at access road to oil/gas tank property

LOGGED BY A. Kachin **HAMMER TYPE** None **GROUND WATER LEVELS:**

NOTES **WATER DEPTH** None Encountered on 10/28/22

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 (%)
5820.0	0		(Topsoil) SAND, silty, slightly moist, loose to medium dense, sparse vegetation cover, approximately 3 inches thick										
			(Native) CLAY, sandy, 6" to 8" angular cobbles in parts, slightly moist to moist, light brown to tan, 12" to 36" boulders in parts										
5819.0	1												
5818.0	2		**Approximate Bulk Depth 0-5.5** Liquid Limit= 31 Plastic Limit= 16 Plasticity Index= 15 Fines Content= 56.5	B	BULK					31	16	15	56.5
5817.0	3		12" to 18" boulders at 3 ft										
5816.0	4												
			24" to 36" boulders at 4.5 ft										
5815.0	5												
			Bottom of test pit at 5.5 feet.										

LOG - STANDARD 599.62_KANNAH CREEK FLOWLINE_GRAND JUNCTION.GPJ 12/13/22

RockSol Consulting Group, Inc.

TEST PIT : TP-6

CLIENT City of Grand Junction
PROJECT NAME Kannah Creek Flowline
PROJECT NUMBER 599.62
PROJECT LOCATION Grand Junction, Colorado
DATE STARTED 10/28/22 **COMPLETED** 10/28/22
GROUND ELEVATION 5798.0 ft **STATION NO.**
EXCAVATION CONTRACTOR RockSol Consulting Group, Inc.
NORTH -2563.5 **EAST** 175195.2
EXCAVATION METHOD **TEST PIT SIZE** N/A
BORING LOCATION: ~50' SE of Purdy Mesa Rd, adjacent to private property at 5330 Purdy Mesa Rd
LOGGED BY A. Kachin **HAMMER TYPE** None
GROUND WATER LEVELS:
NOTES
WATER DEPTH None Encountered on 10/28/22

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 (%)
5798.0	0		(Topsoil) SAND, silty, slightly moist, loose to medium dense, sparse vegetation cover, approximately 3 inches thick										
			(Native) SAND, clayey, 6" to 12" cobbles in parts, moist to slightly moist, dark brown to light brown and tan, 12" to 36" boulders in parts										
5797.0	1												
5796.0	2		6" to 8" cobbles at 2 ft										
5795.0	3		**Approximate Bulk Depth 0-5.5** Liquid Limit= 34 Plastic Limit= 21 Plasticity Index= 13 Fines Content= 39.9	B	BULK					34	21	13	39.9
5794.0	4		12" to 18" boulders at 4 ft										
			24" to 36" boulders at 4.5 ft										
5793.0	5		Bottom of test pit at 5.5 feet.										

LOG - STANDARD 599.62_KANNAH CREEK FLOWLINE_GRAND JUNCTION.GPJ 12/13/22

APPENDIX D

SUMMARY OF LABORATORY TEST RESULTS

RockSol Consulting Group, Inc.

SUMMARY OF PHYSICAL & CHEMICAL TEST RESULTS

CLIENT City of Grand Junction

PROJECT NAME Kannah Creek Flowline

PROJECT NUMBER 599.62

PROJECT LOCATION Grand Junction, Colorado

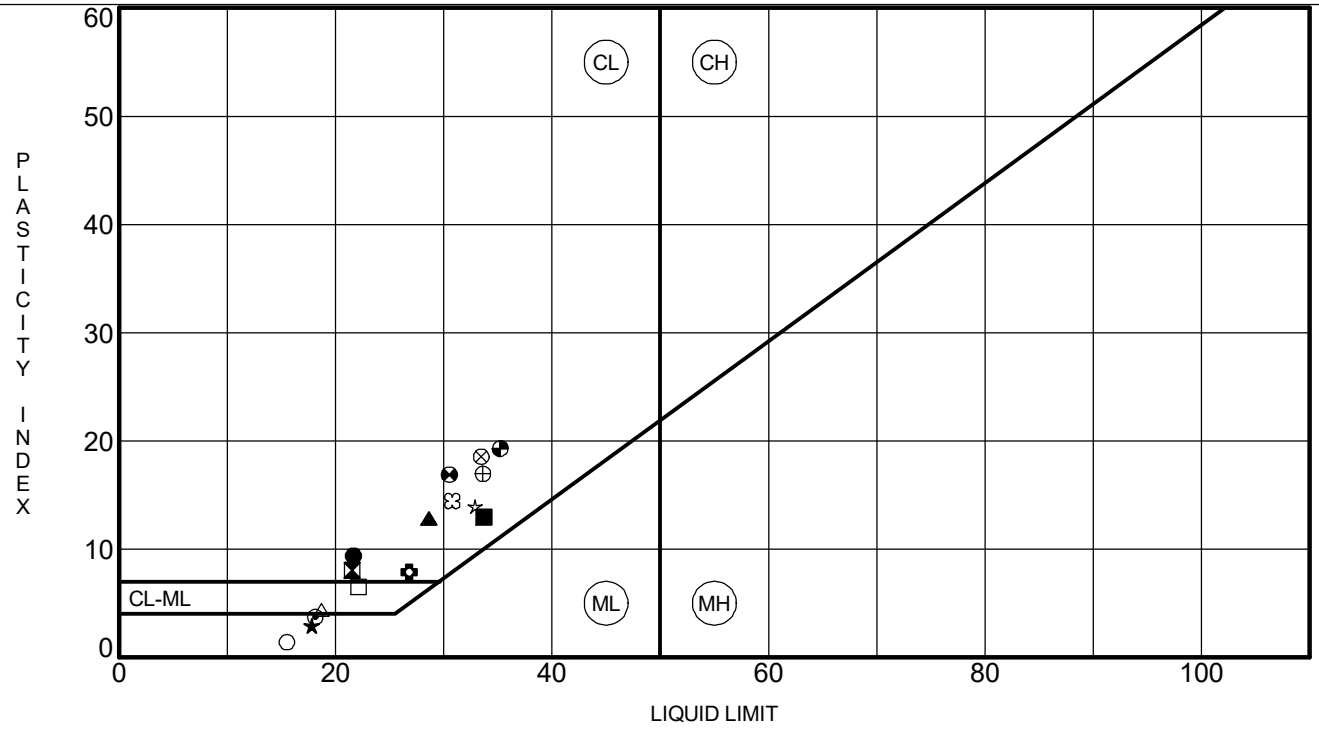
Borehole	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	Swell Potential (%)	%<#200 Sieve	Classification		Water Content (%)	Dry Density (pcf)	Unconfined Compressive Strength (psi)	Sulfate (%)	Resistivity (ohm-cm)	pH	Chlorides (%)	Proctor S=Standard M=Modified		
							USCS	AASHTO								MDD	OMC	S/M
B-1	5-7	22	12	10		40	SC	A-4 (1)				0.04		8.1				
B-1	9	22	13	9		35	GC	A-2-4 (0)										
B-1	13-14	29	16	13		67	CL	A-6 (6)										
B-1	19				0.3	74			16.1	116.6								
B-2	14	18	15	3		46	SM	A-4 (0)										
B-2	19-20	18	14	4		72	CL-ML	A-4 (0)				0.07		8.6				
B-2	19.5					48												
B-3	4-5	27	19	8		47	SC	A-4 (1)										
B-3	9	16	14	2		37	SM	A-4 (0)										
B-3	14	19	14	5		34	SC-SM	A-2-4 (0)										
B-4	0-5	33	15	18		80	CL	A-6 (13)								113.2	13.9	S
B-4	5								9.9	90.7								
B-4	9					92			9.0	122.9								
B-5	0-10	34	17	17		48	GC	A-6 (5)										
B-5	10					91			12.4	115.3								
B-6	4					33												
B-6	9	22	16	6		35	SC-SM	A-2-4 (0)										
B-6	14					34												
TP-2	0-6	31	14	17		58	CL	A-6 (7)										
TP-3	0-6	35	16	19		78	CL	A-6 (13)										
TP-4	0-6	33	19	14		16	GC	A-2-6 (0)										
TP-5	0-5.5	31	16	15		56	CL	A-6 (5)										
TP-6	0-5.5	34	21	13		40	SC	A-6 (2)										

ATTERBERG LIMITS RESULTS
AASHTO T89 Method A/T90

RockSol Consulting Group, Inc.

CLIENT City of Grand Junction **PROJECT NAME** Kannah Creek Flowline

PROJECT NUMBER 599.62 **PROJECT LOCATION** Grand Junction, Colorado



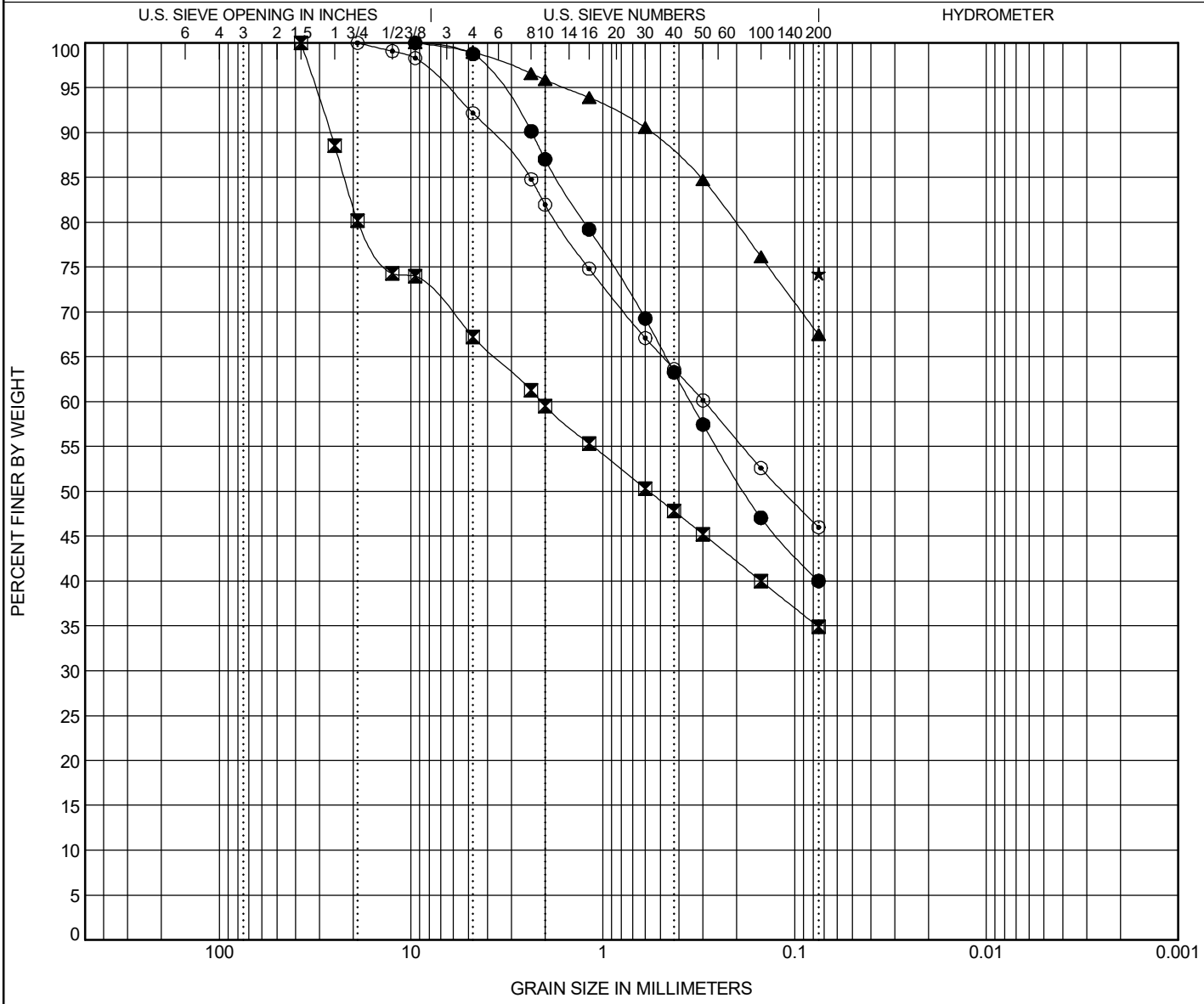
	Specimen Identification		LL	PL	PI	Fines	Classification
●	B-1	5.0-7.0	22	12	10	40.0	CLAYEY SAND (SC) (A-4)
⊠	B-1	9.0	22	13	9	34.9	CLAYEY GRAVEL with SAND (GC) (A-2-4)
▲	B-1	13.0-14.0	29	16	13	67.5	SANDY LEAN CLAY (CL) (A-6)
★	B-2	14.0	18	15	3	46.0	SILTY SAND (SM) (A-4)
⊙	B-2	19.0-20.0	18	14	4	72.1	SILTY CLAY with SAND (CL-ML) (A-4)
✿	B-3	4.0-5.0	27	19	8	46.5	CLAYEY SAND with GRAVEL (SC) (A-4)
○	B-3	9.0	16	14	2	37.5	SILTY SAND (SM) (A-4)
△	B-3	14.0	19	14	5	33.5	SILTY, CLAYEY SAND with GRAVEL (SC-SM) (A-2-4)
⊗	B-4	0.0-5.0	33	15	18	80.2	LEAN CLAY with SAND (CL) (A-6)
⊕	B-5	0.0-10.0	34	17	17	48.0	CLAYEY GRAVEL with SAND (GC) (A-6)
□	B-6	9.0	22	16	6	34.6	SILTY, CLAYEY SAND with GRAVEL (SC-SM) (A-2-4)
⊛	TP-2	0.0-6.0	31	14	17	58.4	SANDY LEAN CLAY with GRAVEL (CL) (A-6)
◕	TP-3	0.0-6.0	35	16	19	77.6	LEAN CLAY with SAND (CL) (A-6)
☆	TP-4	0.0-6.0	33	19	14	16.3	CLAYEY GRAVEL with SAND (GC) (A-2-6)
⊠	TP-5	0.0-5.5	31	16	15	56.5	SANDY LEAN CLAY (CL) (A-6)
■	TP-6	0.0-5.5	34	21	13	39.9	CLAYEY SAND with GRAVEL (SC) (A-6)

GRAIN SIZE DISTRIBUTION

RockSol

CLIENT City of Grand Junction **PROJECT NAME** Kannah Creek Flowline

PROJECT NUMBER 599.62 **PROJECT LOCATION** Grand Junction, Colorado



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	B-1	5.0-7.0	CLAYEY SAND (SC) (A-4)	22	12	10		
⊠	B-1	9.0	CLAYEY GRAVEL with SAND (GC) (A-2-4)	22	13	9		
▲	B-1	13.0-14.0	SANDY LEAN CLAY (CL) (A-6)	29	16	13		
★	B-1	19.0	CLAY, weathered CLAYSTONE					
⊙	B-2	14.0	SILTY SAND (SM) (A-4)	18	15	3		

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
●	B-1	5.0-7.0	9.5	0.349			13.0	23.8	23.3	40.0	
⊠	B-1	9.0	37.5	2.092			40.5	11.7	12.9	34.9	
▲	B-1	13.0-14.0	9.5				4.1	8.2	20.2	67.5	
★	B-1	19.0	0.075							74.2	
⊙	B-2	14.0	19	0.296			18.0	18.3	17.6	46.0	

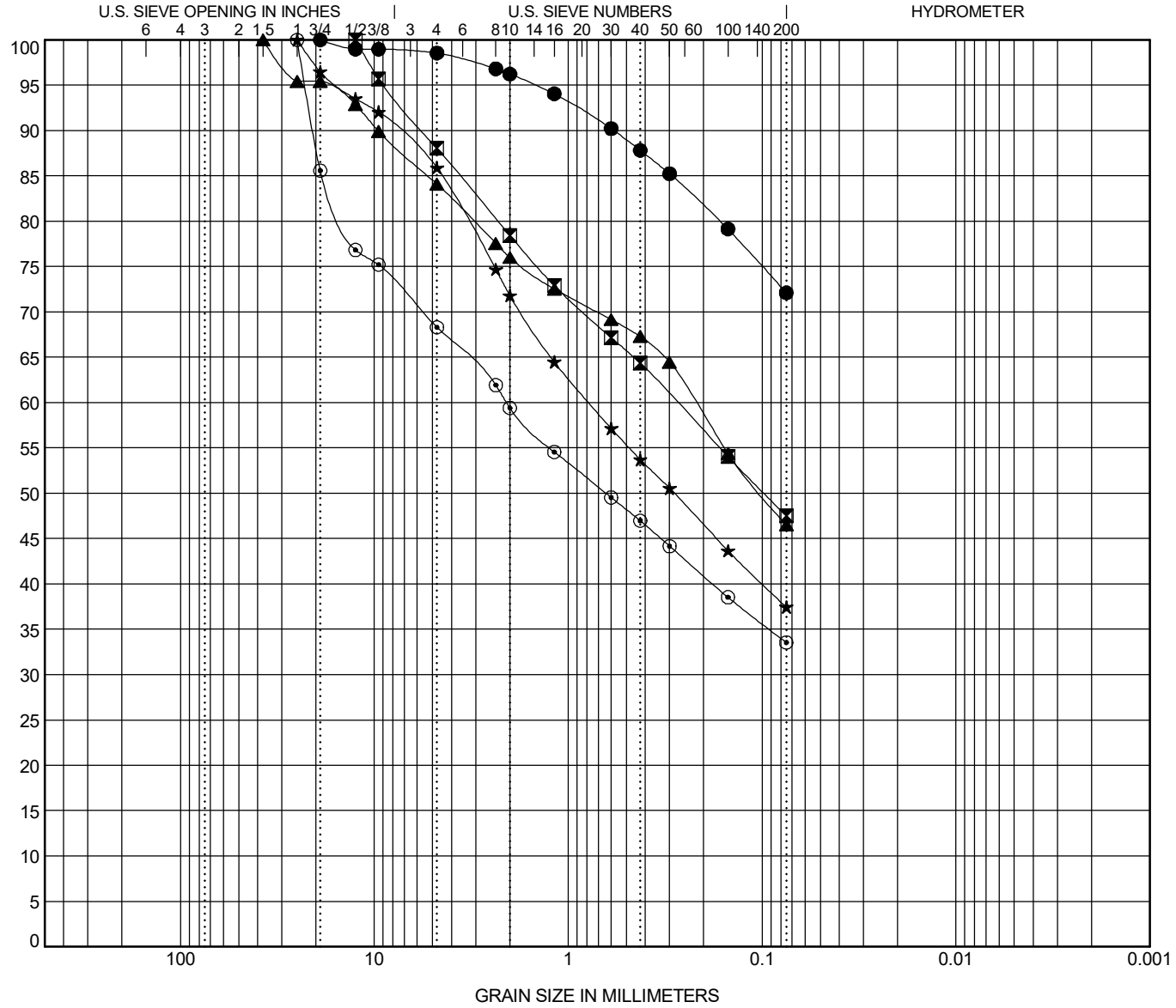
GRADATION - STANDARD 599.62_KANNAH CREEK FLOWLINE_GRAND JUNCTION.GPJ ROCKSOL TEMPLATE.GDT 12/13/22

GRAIN SIZE DISTRIBUTION

RockSol

CLIENT City of Grand Junction **PROJECT NAME** Kannah Creek Flowline

PROJECT NUMBER 599.62 **PROJECT LOCATION** Grand Junction, Colorado



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification			Classification	LL	PL	PI	Cc	Cu
●	B-2	19.0-20.0	SILTY CLAY with SAND (CL-ML) (A-4)	18	14	4		
⊠	B-2	19.5	silty to clayey SAND					
▲	B-3	4.0-5.0	CLAYEY SAND with GRAVEL (SC) (A-4)	27	19	8		
★	B-3	9.0	SILTY SAND (SM) (A-4)	16	14	2		
⊙	B-3	14.0	SILTY, CLAYEY SAND with GRAVEL (SC-SM) (A-2-4)	19	14	5		

Specimen Identification			D100	D60	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
●	B-2	19.0-20.0	19				3.8	8.4	15.7	72.1	
⊠	B-2	19.5	12.5	0.274			21.6	14.1	16.8	47.5	
▲	B-3	4.0-5.0	37.5	0.221			24.0	8.7	20.8	46.5	
★	B-3	9.0	25	0.78			28.2	18.1	16.2	37.5	
⊙	B-3	14.0	25	2.08			40.6	12.4	13.4	33.5	

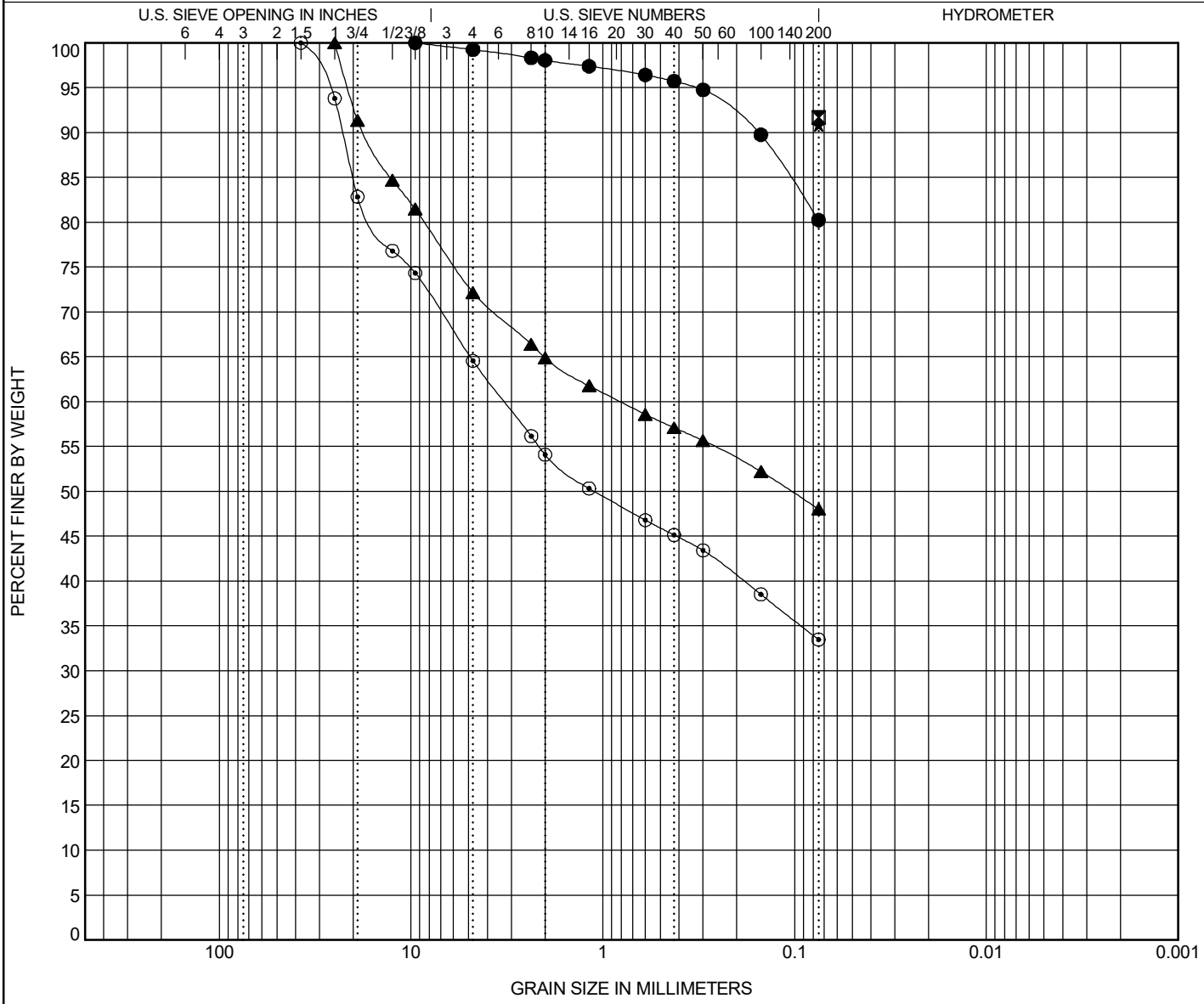
GRADATION - STANDARD 599.62_KANNAH CREEK FLOWLINE_GRAND JUNCTION.GPJ ROCKSOL TEMPLATE.GDT 12/13/22

GRAIN SIZE DISTRIBUTION

RockSol

CLIENT City of Grand Junction **PROJECT NAME** Kannah Creek Flowline

PROJECT NUMBER 599.62 **PROJECT LOCATION** Grand Junction, Colorado



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	B-4	0.0-5.0	LEAN CLAY with SAND (CL) (A-6)	33	15	18		
⊠	B-4	9.0	(Bedrock) CLAYSTONE, slightly silty					
▲	B-5	0.0-10.0	CLAYEY GRAVEL with SAND (GC) (A-6)	34	17	17		
★	B-5	10.0	CLAY, weathered CLAYSTONE					
⊙	B-6	4.0	slightly silty to gravelly SAND					

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
●	B-4	0.0-5.0	9.5				1.9	2.3	15.5	80.2	
⊠	B-4	9.0	0.075							91.7	
▲	B-5	0.0-10.0	25	0.81			35.1	7.8	9.1	48.0	
★	B-5	10.0	0.075							90.8	
⊙	B-6	4.0	37.5	3.252			45.9	9.0	11.7	33.5	

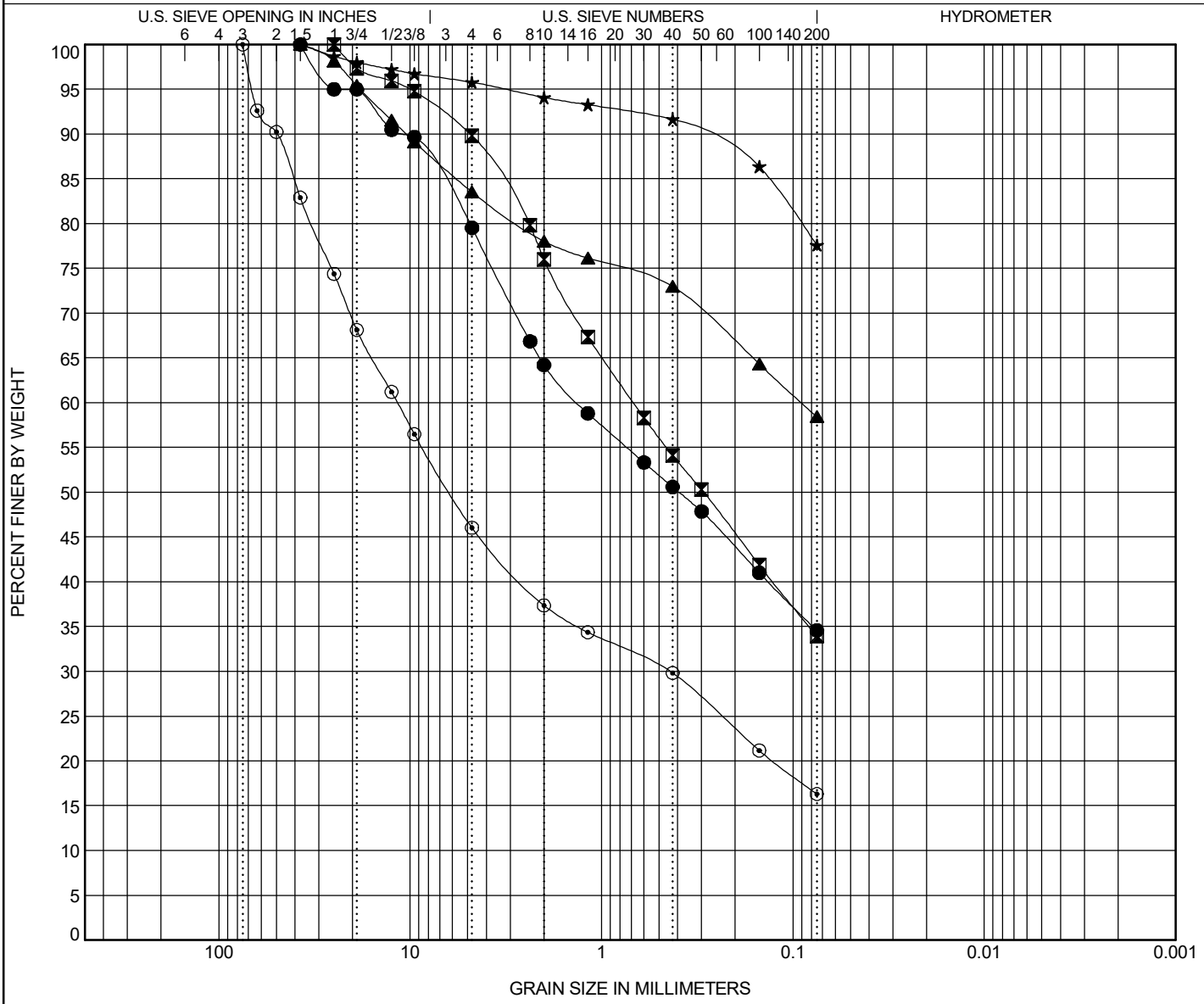
GRADATION - STANDARD 599.62_KANNAH CREEK FLOWLINE_GRAND JUNCTION.GPJ ROCKSOL TEMPLATE.GDT 12/13/22

GRAIN SIZE DISTRIBUTION

RockSol

CLIENT City of Grand Junction **PROJECT NAME** Kannah Creek Flowline

PROJECT NUMBER 599.62 **PROJECT LOCATION** Grand Junction, Colorado



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification			Classification	LL	PL	PI	Cc	Cu
●	B-6	9.0	SILTY, CLAYEY SAND with GRAVEL (SC-SM) (A-2-4)	22	16	6		
⊠	B-6	14.0	silty to clayey SAND with gravel					
▲	TP-2	0.0-6.0	SANDY LEAN CLAY with GRAVEL (CL) (A-6)	31	14	17		
★	TP-3	0.0-6.0	LEAN CLAY with SAND (CL) (A-6)	35	16	19		
⊙	TP-4	0.0-6.0	CLAYEY GRAVEL with SAND (GC) (A-2-6)	33	19	14		

Specimen Identification			D100	D60	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
●	B-6	9.0	37.5	1.325			35.8	13.6	16.0	34.6	
⊠	B-6	14.0	25	0.681			24.0	21.9	20.2	33.9	
▲	TP-2	0.0-6.0	37.5	0.09			22.0	5.0	14.5	58.4	
★	TP-3	0.0-6.0	37.5				5.9	2.4	14.1	77.6	
⊙	TP-4	0.0-6.0	75	11.658	0.443		62.6	7.5	13.5	16.3	

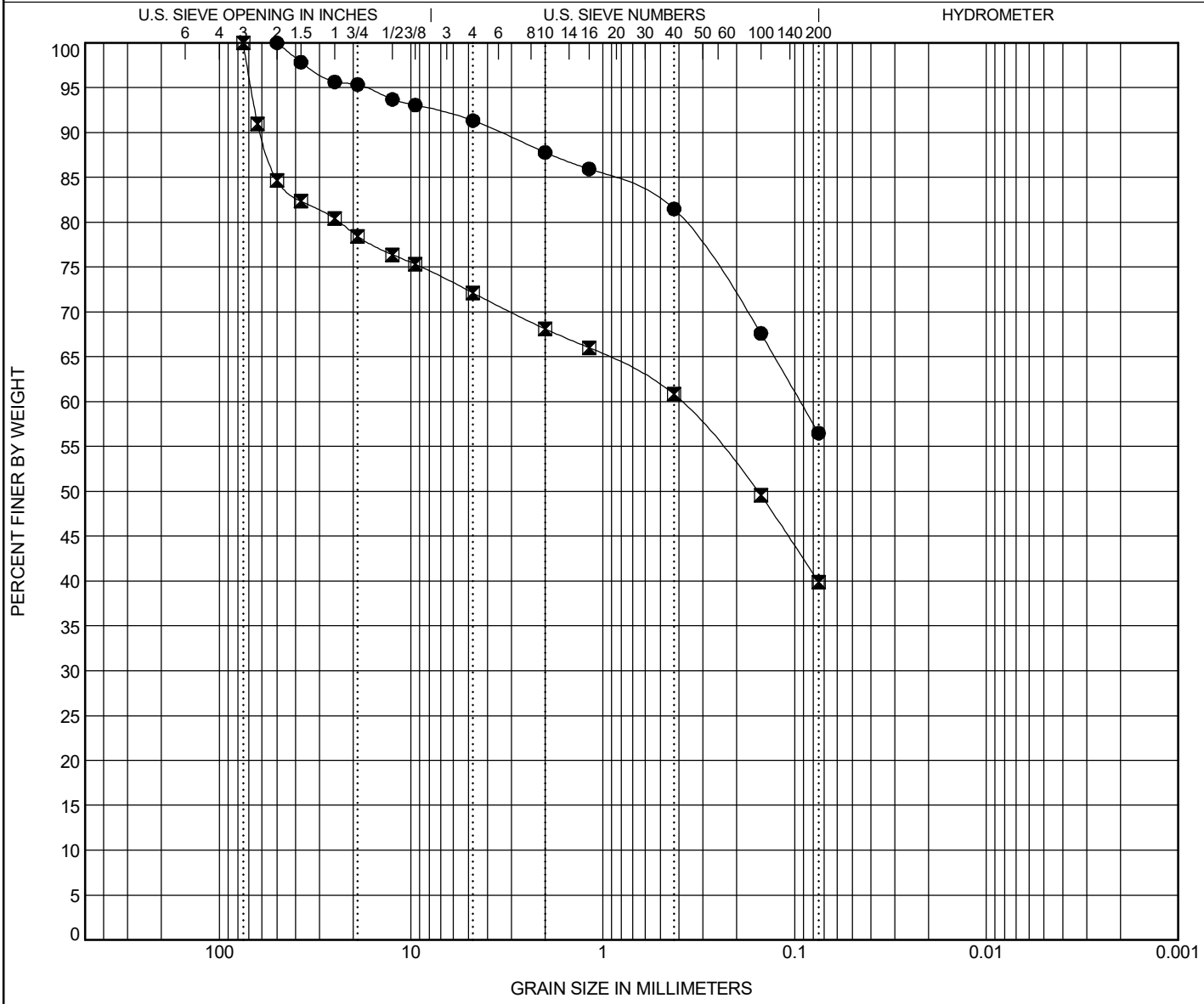
GRADATION - STANDARD 599.62_KANNAH CREEK FLOWLINE_GRAND JUNCTION.GPJ ROCKSOL TEMPLATE.GDT 12/13/22

GRAIN SIZE DISTRIBUTION

RockSol

CLIENT City of Grand Junction **PROJECT NAME** Kannah Creek Flowline

PROJECT NUMBER 599.62 **PROJECT LOCATION** Grand Junction, Colorado



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

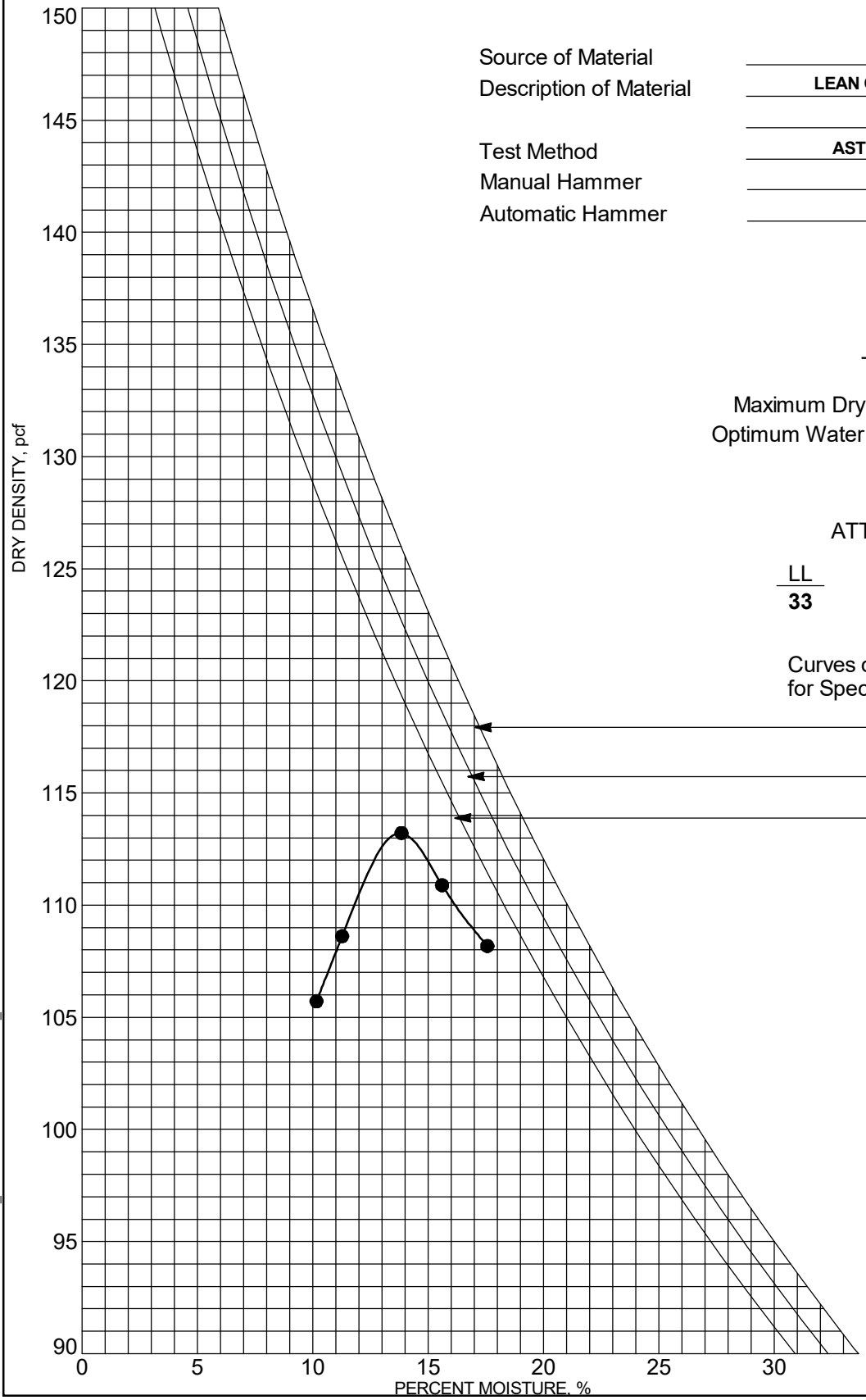
Specimen Identification			Classification	LL	PL	PI	Cc	Cu
●	TP-5	0.0-5.5	SANDY LEAN CLAY (CL) (A-6)	31	16	15		
⊠	TP-6	0.0-5.5	CLAYEY SAND with GRAVEL (SC) (A-6)	34	21	13		

Specimen Identification			D100	D60	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
●	TP-5	0.0-5.5	50	0.093			12.2	6.3	25.0	56.5	
⊠	TP-6	0.0-5.5	75	0.394			31.9	7.3	20.9	39.9	

RockSol

CLIENT City of Grand Junction **PROJECT NAME** Kannah Creek Flowline

PROJECT NUMBER 599.62 **PROJECT LOCATION** Grand Junction, Colorado



Source of Material	**B-4 0-5 ft**
Description of Material	**LEAN CLAY with SAND(CL)**
	A-6 (13)
Test Method	**ASTM D698 Method A**
Manual Hammer	X
Automatic Hammer	

TEST RESULTS

Maximum Dry Density	**113.2**	**PCF**
Optimum Water Content	**13.9**	**%**

ATTERBERG LIMITS

LL	PL	PI
33	**15**	**18**

Curves of 100% Saturation for Specific Gravity Equal to:

2.80

2.70

2.60

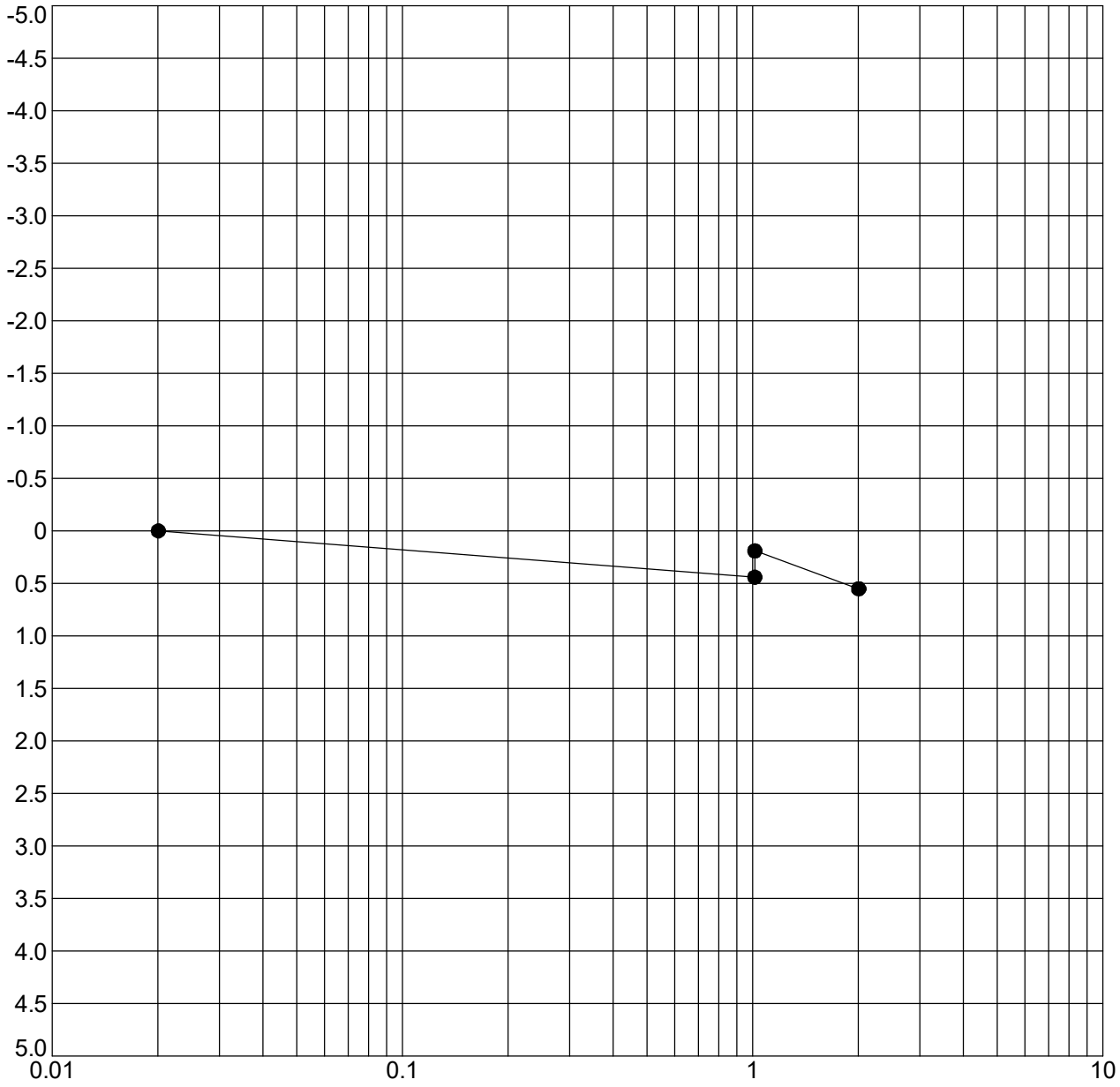
PROCTOR - STANDARD 599.62_KANNAH CREEK FLOWLINE_GRAND JUNCTION.GPJ ROCKSOL TEMPLATE.GDT 11/28/22

SWELL - CONSOLIDATION TEST

RockSol Consulting Group, Inc.

CLIENT City of Grand Junction **PROJECT NAME** Kannah Creek Flowline

PROJECT NUMBER 599.62 **PROJECT LOCATION** Grand Junction, Colorado

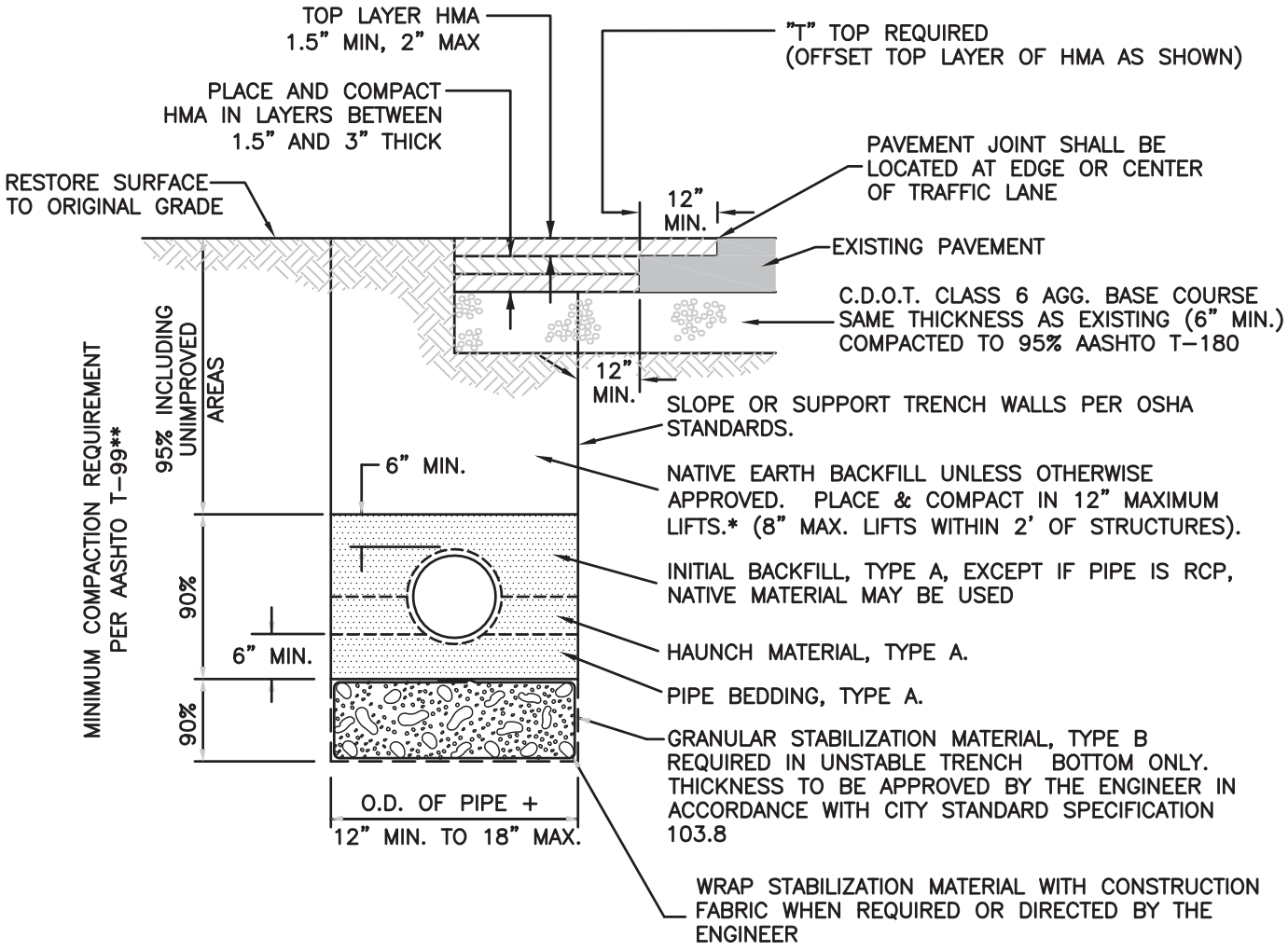


Specimen Identification		Classification	Swell/Consol. (%)	γ_d (pcf)	MC%
● **B-1**	**19**	**CLAY, sandy**	**0.3**	**116.6**	**16.1**

SWELL - STANDARD 599.62_KANNAH CREEK FLOWLINE_GRAND JUNCTION.GPJ ROCKSOL TEMPLATE.GDT 12/21/22

APPENDIX E

TYPICAL TRENCH DETAIL
(CITY OF GRAND JUNCTION, JULY 2010)



	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

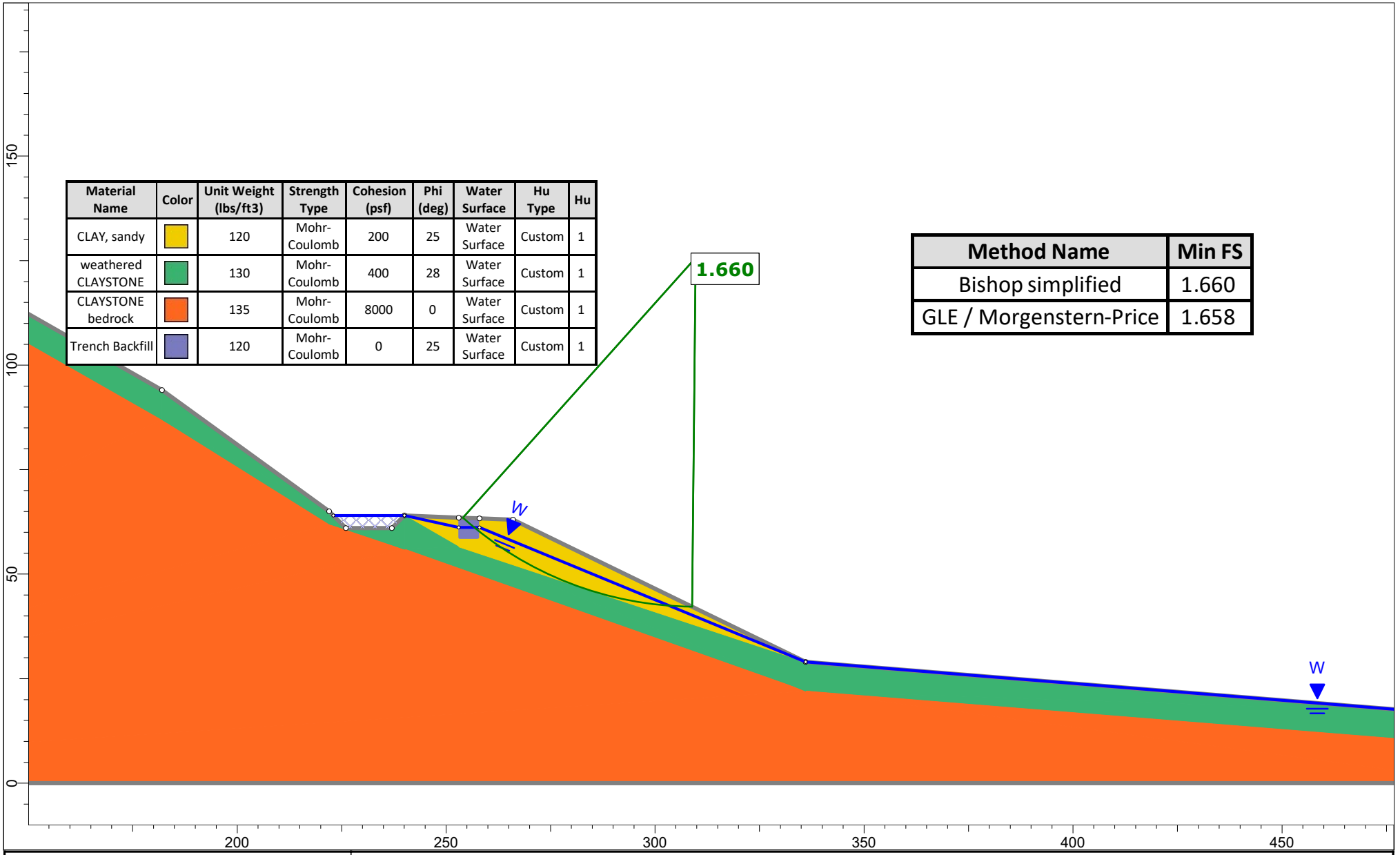
DEPARTMENT OF PUBLIC WORKS AND PLANNING ENGINEERING DIVISION CITY OF GRAND JUNCTION, COLORADO	GENERAL UTILITY DETAIL	APPROVED: DN REVISED: JAN 2009 DRAWN: JAH	PAGE GU-03

APPENDIX F

SLOPE STABILITY OUTPUT SHEETS

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu
CLAY, sandy		120	Mohr-Coulomb	200	25	Water Surface	Custom	1
weathered CLAYSTONE		130	Mohr-Coulomb	400	28	Water Surface	Custom	1
CLAYSTONE bedrock		135	Mohr-Coulomb	8000	0	Water Surface	Custom	1
Trench Backfill		120	Mohr-Coulomb	0	25	Water Surface	Custom	1

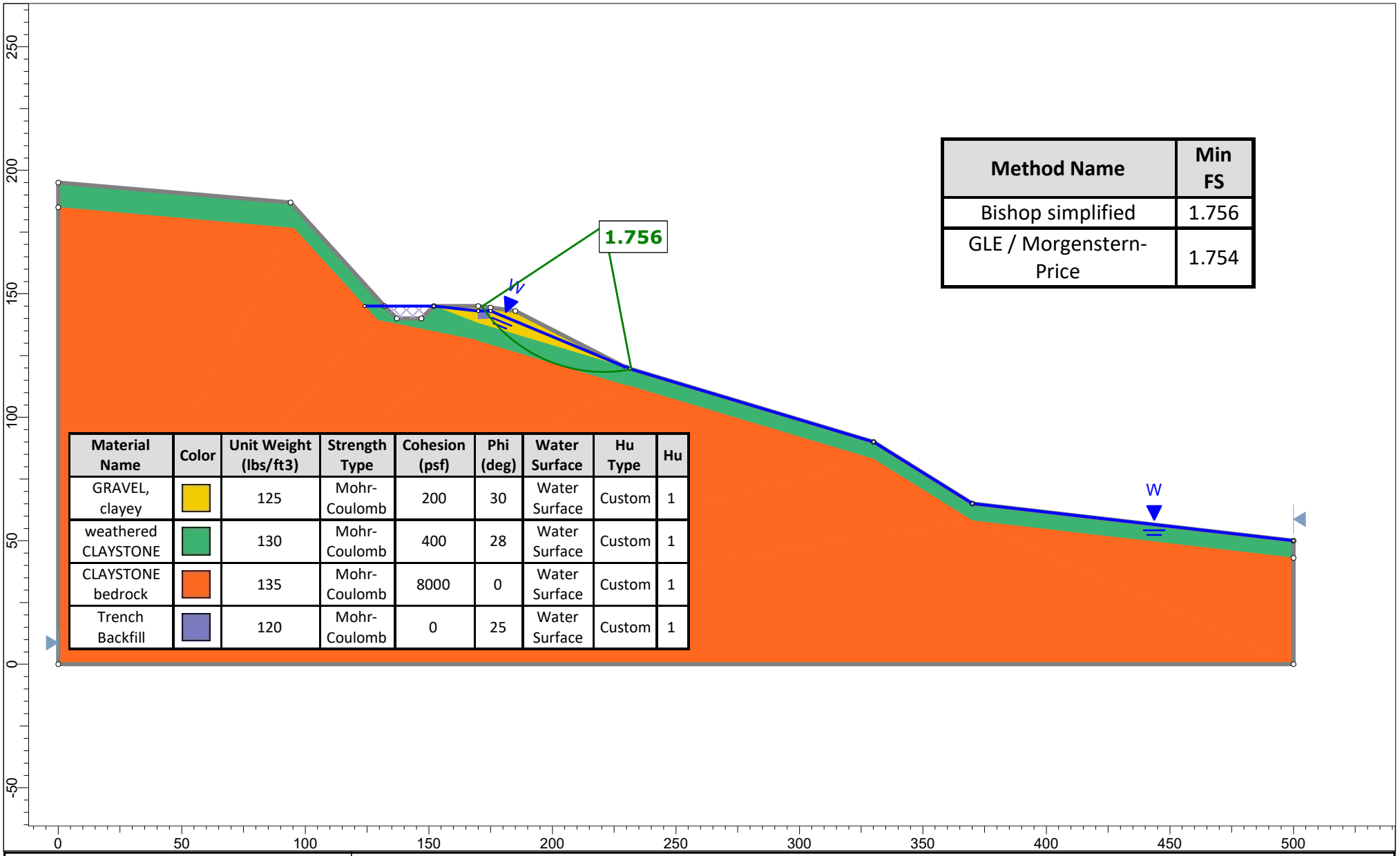
Method Name	Min FS
Bishop simplified	1.660
GLE / Morgenstern-Price	1.658



rocscience

SLIDEINTERPRET 9.026

Project	Slide2 - An Interactive Slope Stability Program		
Group	Group 1	Scenario	Master Scenario
Drawn By		Company	
Date	12/15/2022, 9:45:15 AM	File Name	B-4 Area.slmd



Method Name	Min FS
Bishop simplified	1.756
GLE / Morgenstern-Price	1.754

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu
GRAVEL, clayey		125	Mohr-Coulomb	200	30	Water Surface	Custom	1
weathered CLAYSTONE		130	Mohr-Coulomb	400	28	Water Surface	Custom	1
CLAYSTONE bedrock		135	Mohr-Coulomb	8000	0	Water Surface	Custom	1
Trench Backfill		120	Mohr-Coulomb	0	25	Water Surface	Custom	1

rocscience

SLIDEINTERPRET 9.026

Project	Slide2 - An Interactive Slope Stability Program		
Group	Group 1	Scenario	Master Scenario
Drawn By		Company	
Date	12/15/2022, 9:45:15 AM	File Name	B-5 Area.slmd

APPENDIX G

SEISMIC DESIGN OUTPUT VALUES

Kannah Creek

Latitude, Longitude: 38.961203, -108.233839

Date	12/16/2022, 3:36:31 PM
Design Code Reference Document	ASCE7-16
Risk Category	II
Site Class	D - Default (See Section 11.4.3)

Type	Value	Description
S_S	0.261	MCE_R ground motion. (for 0.2 second period)
S_1	0.067	MCE_R ground motion. (for 1.0s period)
S_{MS}	0.415	Site-modified spectral acceleration value
S_{M1}	0.161	Site-modified spectral acceleration value
S_{DS}	0.277	Numeric seismic design value at 0.2 second SA
S_{D1}	0.108	Numeric seismic design value at 1.0 second SA

Type	Value	Description
SDC	B	Seismic design category

Type	Value	Description
F_a	1.591	Site amplification factor at 0.2 second
F_v	2.4	Site amplification factor at 1.0 second
PGA	0.148	MCE_G peak ground acceleration
F_{PGA}	1.504	Site amplification factor at PGA
PGA_M	0.223	Site modified peak ground acceleration
T_L	4	Long-period transition period in seconds
SsRT	0.261	Probabilistic risk-targeted ground motion. (0.2 second)
SsUH	0.276	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
SsD	1.5	Factored deterministic acceleration value. (0.2 second)
S1RT	0.067	Probabilistic risk-targeted ground motion. (1.0 second)
S1UH	0.072	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration.
S1D	0.6	Factored deterministic acceleration value. (1.0 second)
PGAd	0.5	Factored deterministic acceleration value. (Peak Ground Acceleration)
PGA_{UH}	0.148	Uniform-hazard (2% probability of exceedance in 50 years) Peak Ground Acceleration
C_{RS}	0.945	Mapped value of the risk coefficient at short periods
C_{R1}	0.93	Mapped value of the risk coefficient at a period of 1 s
C_V	0.822	Vertical coefficient

DISCLAIMER

While the information presented on this website is believed to be correct, SEAOC /OSHPD and its sponsors and contributors assume no responsibility or liability for its accuracy. The material presented in this web application should not be used or relied upon for any specific application without competent examination and verification of its accuracy, suitability and applicability by engineers or other licensed professionals. SEAOC / OSHPD do not intend that the use of this information replace the sound judgment of such competent professionals, having experience and knowledge in the field of practice, nor to substitute for the standard of care required of such professionals in interpreting and applying the results of the seismic data provided by this website. Users of the information from this website assume all liability arising from such use. Use of the output of this website does not imply approval by the governing building code bodies responsible for building code approval and interpretation for the building site described by latitude/longitude location in the search results of this website.

SECTION 01035

MODIFICATION PROCEDURES

Refer to City of Grand Junction Department of Public Works and Planning Engineering Division General Contract Conditions – Section VIII: Changes in Work or Contract Price

END OF SECTION

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

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

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. Engineer, and his professional consultants as needed
3. Contractor's Superintendent
4. Subcontractors as appropriate to the agenda
5. Suppliers as appropriate to the agenda
6. 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: Concrete Encasement
      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 the total number listed in the bid schedule and will include all of the Contractor's costs. 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 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; furnishing all new materials and labor required to install improvements; installation of all materials as indicated, including all required surface and subgrade preparation; 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: Per actual number of linear feet of distance from the utility crossing concrete is installed. Payment will be based on units completed and accepted of the Work required by this bid item.

2. Bid Item No. 2: Export Common Fill
   a. Description: No separate measurement for payment will be made for any labor, equipment, and materials required for this item. The unit 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: locating and protecting all existing above and below ground utilities; topsoil removal, stockpiling, and replacement; required excavation and transportation of excess trench fill material sifted for rock greater than 6" diameter and debris; disposing of materials off-site in accordance with the Drawings and Specifications and any applicable local, state or federal requirements; site for disposing of materials is located at 5321 Purdy Mesa Rd accessed at the Juniata Trailhead gates. It will be no more than a 10-mile round trip from any point along the project to the disposal site; furnishing all new materials and labor required to install improvements; 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: Per actual number of cubic yards (volume) of onsite trench fill material excavated during pipe installation and sifted clean to remove any rock greater than 6" diameter or any other debris. Payment will be based on units completed and accepted of the Work required by this bid item.
3. Bid Item No. 3: Gravel Road Restoration
   a. Description: No separate measurement for payment will be made for any labor, equipment, and materials required for this item. The unit 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: installation of Class 6 road base material minimum of 2-inches thick to the limits specified on the drawings, contractor may strip out existing gravel and stockpile to be reused if existing gravel is kept clean and approved by Owner.
   b. Unit of Measurement: Per actual number of ton(s) installed. Payment will be based on units completed and accepted of the Work required by this bid item.
4. Bid Item No. 4: Purdy Mesa Rd Drive Entrance
   a. Description: No separate measurement for payment will be made for any labor, equipment, and materials required for this item. The unit 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: importing fill material, grading and compacting fill materials per the Geotech and Engineered plans and standards, importing asphalt road millings, grading and compacting of asphalt millings.

b. Unit of Measurement: No separate 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.

5. Bid Item No. 5: Fence Removal and Replacement
   a. Description: No separate measurement for payment will be made for any labor, equipment, and materials required for this item. The unit 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: demolition of existing fence to the extents necessary to complete installation of the waterline (salvaged when possible), installing new fence material matching in kind to return the fence line to historical conditions or better.
   b. Unit of Measurement: Per actual number of linear feet of fence installed. Payment will be based on units completed and accepted of the Work required by this bid item.
6. Bid Item No. 6: Scar Rehabilitation and Erosion Control
   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: importing common fill, importing rip rap for slope stabilization, seeding, and any geotextile material used to stabilize the scar.
   b. Unit of Measurement: No separate 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: Tree Removal
   a. Description: No separate measurement for payment will be made for any labor, equipment, and materials required for this item. The unit 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: cutting down and stumping trees labeled for removal on the plans or significantly damaged during construction.
   b. Unit of Measurement: Per actual number of trees over 8" in diameter cut down. Payment will be based on units completed and accepted of the Work required by this bid item.
8. Bid Items No. 8 & 9: Engineering Excavation
   a. 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 to complete the waterline crossing of Kannah Creek and restore the Creek to existing or better conditions. 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: Prior to excavation, trenching, shoring, and bypass pumping in or adjacent to Kannah Creek the Contractor will need to submit plans stamped by a licensed Professional Engineer in the state of Colorado showing the Creek crossing means and methods during construction and how the Contractor will restore the Creek back to historical conditions or better with embankments achieving a 98% compaction.

b. Unit of Measurement: No separate 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.

9. Bid Items No. 10 & 11: Water Pipe – 20-inch PVC C900 DR-18 & DR-25 (INSTALL ONLY)
   a. 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 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, dewatering, rock and muck removal and backfill with suitable material(s), and compaction of excavations; furnishing, transporting, and installing all pipe, detectable marking tape, tracer wire, flowfill groundwater barriers, and materials as indicated; 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 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.
10. Bid Item No. 12: Water Pipe – 20-inch PVC C900 DR-18 & DR-25 (INSTALL ONLY) (No Pipe Bedding)
    a. 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 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

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, dewatering, rock and muck removal and backfill with suitable material(s), and compaction of excavations; furnishing, transporting, and installing all pipe, detectable marking tape, tracer wire, flowfill groundwater barriers, and materials as indicated; 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; 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.

11. Bid Item No. 13: Water Pipe – 2-inch HDPE (DR-11)
    a. 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 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, dewatering, backfilling, and compaction of excavations with suitable material(s); rock and muck removal and backfill with suitable material(s); furnishing, transporting, and installing all pipe, detectable marking tape, tracer wire, and materials as indicated; 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 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.

12. Bid Item No. 14-16: 20-inch Elbow – 11.25, 22.5, 45 degrees (INSTALL 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.
    b. Unit of Measurement: Per actual number of bends installed. Payment will be based on units completed and accepted of the Work required by this bid item.
13. Bid Item No. 17: Air Vacuum Valves (INSTALL 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; tapping connection; valve; 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.
14. Bid Item No. 18: 5-Foot Diameter Manhole w/ Vent to House Air Vacuum Valves

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; 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.

15. Bid Item No. 19: End Cap – 18"
    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 end caps installed. Payment will be based on units completed and accepted of the Work required by this bid item.
16. Bid Item No. 20 Water Service Connection (Douglas Martin Property)
    a. Description: The measurement for payment for this item will be the number of linear feet of pipe as listed in the bid schedule, 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; new corporation stop tap connection to the existing watermain connection using a brass coupling; replacement of entire water service to curb stop if exist service line is not Type K copper; excavating, including exploratory excavation; 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 linear feet of pipe installed. Payment will be based on units completed and accepted of the Work required by this bid item.

17. Bid Item No. 21: Water Service Connection (City of Grand Junction Property)
    a. Description: The measurement for payment for this item will be the number of linear feet of pipe as listed in the bid schedule, 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; new corporation stop tap connection to the existing watermain connection using a brass coupling; replacement of entire water service to curb stop if exist service line is not Type K copper; excavating, including exploratory excavation; 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 linear feet of pipe installed. Payment will be based on units completed and accepted of the Work required by this bid item.
18. Bid Item No. 22: Clearing and Grubbing
    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 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: completing the clearing and grubbing only the necessary area to install the waterline, including tree, shrub and brush removal not covered under another bid item; disposing of materials off-site in accordance with the Drawings and Specifications and any

applicable local, state or federal requirements; and providing all other related and necessary labor, equipment, and materials to complete the Work not covered by other items in this section. Any areas cleared outside of the limits of disturbance shown on the plans may be omitted from payment by the project engineer and revegetation shall be required at the expense of the contractor. Any clearing or disturbance outside the easement shall be revegetated at the expense of the contractor.

b. Unit of Measurement: Per the actual number of acres cleared and grubbed. Payment will be made upon completion and acceptance of the Work required by this bid item.

19. Bid Item No. 23: Abandon Pipe w/ Concrete Plug
    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; installing transition coupling for unlike materials, capping abandoned pipe, removal of all existing gate valve box on the abandoned water lines and installing kick block in accordance with the Drawings and Specifications and any applicable local state or federal requirements; excavating, including exploratory excavation; 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 plugs installed. Payment will be based on units completed and accepted of the Work required by this bid item.
20. Bid Items No. 24 & 25: Removal of Asphalt Material, T-Top and Full Depth
    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 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: protecting all existing items, materials, and surfaces not to be demolished; saw cutting, demolishing, hauling, and disposing of existing asphalt materials to be demolished as required; 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: Per square feet (surface area) of actual asphalt removed. Payment will be based on units completed and accepted of the Work required by this bid item.

21. Bid Item No. 26: Removal of Existing Pipe
    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 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: protecting all existing items, materials, and surfaces not to be demolished; demolishing, hauling, and disposing of existing water main materials to be demolished as required including existing fire hydrant assemblies; disposing of debris, excess excavated material, and damaged materials as required; 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: Per the actual number of linear feet of water main demolished. Payment will be based on units completed and accepted of the Work required by this bid item.
22. Bid Item No. 27: Rock Excavation
    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 defined by the City as boulders measuring a total of one cubic yard, 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 four feet on center of the pipe.
        i) Contractor shall have Engineer verify that there is presence of rock material prior to excavation
        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.
23. Bid Item No. 28: Wetland Restoration
    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 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: removal and salvaging of wetland topsoil, stockpiling onsite, reusing once construction of the waterline is complete in the wetland area for surface restoration.

b. Unit of Measurement: Per square foot (surface area) of wetlands restored. Payment will be based on units completed and accepted of the Work required by this bid item.

24. Bid Item No. 29: Erosion & 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; maintaining BMPs throughout the project duration as needed to keep all BMPs in proper working order; 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 separate 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.
25. Bid Item No. 30: Gate
    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 12-foot 6-bar Tube Style Gate, gate openers and connection hardware to connect gate to existing fence, color to be decided by City and coordinate with private property owner if on private property, height is to be determined based on existing fence height the gate will be installed on; 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 gates installed. Payment will be based on units completed and accepted of the Work required by this bid item.

26. Bid Item No. 31: Seeding

    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.

27. Bid Item No. 32: Aggregate Base Course
    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 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 Class II aggregate base with CDOT Class VI gradation; site grading to establish grade prior to placement of Road Base; subgrade preparation; removing debris and excess materials; 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 tons of road base installed. Payment will be based on units completed and accepted of the Work required by this bid item.
28. Bid Item No. 33: Hot Bituminous Pavement (3" thick Base Course)
    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 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: saw cutting and patching or repairing existing asphalt and concrete as required to install improvements; furnishing all new materials and labor required to install improvements; installation of all materials as indicated, including all required surface and subgrade preparation; tack coat; 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: Per actual number of square feet (surface area) of 3-inch base course asphalt road surface paved. Payment will be based on units completed and accepted of the Work required by this bid item.
29. Bid Item No. 34: Hot Bituminous Pavement (2" thick Wearing Course)

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 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: saw cutting and patching or repairing existing asphalt and concrete as required to install improvements; furnishing all new materials and labor required to install improvements; installation of all materials as indicated, including all required surface and subgrade preparation; tack coat; 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: Per actual number of square feet (surface area) of 2-inch wearing course asphalt road surface paved. Payment will be based on units completed and accepted of the Work required by this bid item.

30. Bid Item No 35: Riprap Type M (d50 = 18")
    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 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 or Specifications or as otherwise directed by Engineer: locating and protecting all existing above and below ground utilities and connections along and around the item; excavating, backfilling, and compaction of excavations with suitable material(s); repairing all structures as necessary; excavating, including exploratory excavation; constructing the specific bedding including the furnishing, placing, and compacting of sand, gravel, and rock; disposing of debris, excess excavated material, and damaged materials; 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 cubic yards (volume) of riprap installed. Payment will be based on units completed and accepted of the Work required by this bid item.
31. Bid Item No 36: Portable Sanitary Facility
    a. Description: The lump sum price will include all of Contractor's costs associated with the procurement, maintenance, and staging of the portable sanitary facility; protecting all existing aboveground utilities, items, materials, and surfaces along and around the portable sanitary facility and providing all other related and necessary labor, equipment, and materials for the use of the portable sanitary facility not covered by other items in this section.
    b. Unit of Measurement: No separate measurement for payment will be made for this item. It shall be paid for at the Contract Price based upon the percentage of project completed and accepted of the work required by this bid item.
32. Bid Item No. 37: Construction Surveying
    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 in accordance with the Drawings and Specifications and in conformance with the CDOT Survey Manual.

b. Unit of Measurement: No separate 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.

33. Bid Item No. 38: 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.
34. Bid Item No. 39: Traffic Control
    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: preparing, implementing, adjusting as necessary, and maintaining the approved Traffic Control Plan in accordance with the Drawings and Specifications and accepted Traffic Control Plan; temporary traffic lights; 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 separate 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.

35. Bid Item No. 40: Douglas Martin Property Improvement 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 labor, equipment, and materials to protect and move landscaping items as identified by the property owner and/or City within the easement boundary and restore the property in accordance with any agreement with the property owner.
    b. Unit of Measurement: No payment will be provided for property improvement allowance for the noted properties greater than the rate shown on the Bid Form. No payments will be made unless written prior approval is obtained by the City. Included for approval will be specific work to be completed and cost to complete the work. Partial payments will be made based on the labor, equipment, and material costs documentation provided by the Contractor and reviewed by the Engineer and City.
36. Bid Item No. 41: Alexander Yater III Property Improvement 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 labor, equipment, and materials to protect and move landscaping items as identified by the property owner and/or City within the easement boundary and restore the property in accordance with any agreement with the property owner.
    b. Unit of Measurement: No payment will be provided for property improvement allowance for the noted properties greater than the rate shown on the Bid Form. No payments will be made unless written prior approval is obtained by the City. Included for approval will be specific work to be completed and cost to complete the work. Partial payments will be made based on the labor, equipment, and material costs documentation provided by the Contractor and reviewed by the Engineer and City.
37. Bid Item No. 42: Scenic Investments LLC Property Improvement 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 labor, equipment, and materials to protect and move landscaping items as identified by the property owner and/or City within the easement boundary and restore the property in accordance with any agreement with the property owner.
    b. Unit of Measurement: No payment will be provided for property improvement allowance for the noted properties greater than the rate shown on the Bid Form. No payments will be made unless written prior approval is obtained by the City. Included for approval will be specific work to be completed and cost to complete the work. Partial payments will be made based on the labor, equipment, and material costs documentation provided by the Contractor and reviewed by the Engineer and City.
38. Bid Item No. 43: Delfin Martinez and Dana Amos Property Improvement 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

labor, equipment, and materials to protect and move landscaping items as identified by the property owner and/or City within the easement boundary and restore the property in accordance with any agreement with the property owner.

b. Unit of Measurement: No payment will be provided for property improvement allowance for the noted properties greater than the rate shown on the Bid Form. No payments will be made unless written prior approval is obtained by the City. Included for approval will be specific work to be completed and cost to complete the work. Partial payments will be made based on the labor, equipment, and material costs documentation provided by the Contractor and reviewed by the Engineer and City.

39. Bid Item No. 44: Import Common Fill Allowance
    a. Description: No separate measurement for payment will be made for any labor, equipment, and materials required for this item. The unit 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: transportation of imported fill material meeting City of Grand Junction standards.
    b. Unit of Measurement: Per actual number of cubic yards (volume) of fill material imported that has been sifted clean to remove any rock greater than 6" diameter or any other debris. Payment will be based on units completed and accepted of the Work required by this bid item.

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. Refer to City of Grand Junction Engineering Division – General Contract Conditions Section XII: Measurement, Payment and Acceptance.

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 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 delay in reviewing submittals unless all the following criteria are met:
      a. Contractor has notified 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 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 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 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 will require more than 21 calendar days to perform review, Engineer shall so notify Contractor

B. Review drawings and data submitted only for general conformity with Contract Documents
   1. 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 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 otherwise in writing which is acknowledged by 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 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:

JVA, Inc. Received: _____

☐ No Exceptions Noted ☐ Exceptions Noted

☐ Revise and Resubmit ☐ Rejected

JVA's review is limited to general conformance with the design intent as expressed in the Construction Documents. Notations and comments made on the product submittal or shop drawing during this review do not relieve the Contractor from compliance with the Construction Documents, as well as applicable laws, codes, and regulations. Review of a specific item shall not be construed to include review of an assembly of which the item is a component. The Contractor is responsible for dimensions and quantities to be confirmed and correlated at the job site; information that pertains solely to the fabrication processes or to the means, methods, techniques, sequences, and procedures of construction; coordination of the Work with that of all other trades; and performing all Work in a safe and satisfactory manner.

By: _____ Date: _____ 10/21

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 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 or Owner 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
02740	Flexible Paving	QA	O
02740	Flexible Paving	QC	C
03000	Rigid paving	QA	O
03000	Rigid paving	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
02740	Asphalt	QA	O
02740	Asphalt	QC	C
03300	Cast-In-Place Concrete	QA	O
03300	Cast-In-Place Concrete	QC	C

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

SECTION 01550

CUTTING AND PATCHING

PART 1 GENERAL

1.1 SUMMARY

A. This Section specifies administrative and procedural requirements for cutting and patching

B. Work included in this Section
   1. Cutting and patching not required to be performed as part of the work of other sections
   2. Cutting and patching existing work altered or disturbed to accommodate new construction
   3. Cutting and patching existing work damaged or defaced during new construction as required to restore to existing or better condition at the time of award of Contract
   4. Cutting and patching required to:
      a. Install or correct non-coordinated work
      b. Remove and replace defective and non-conforming work
      c. Remove samples of installed work for testing

C. 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

1.2 DEFINITIONS

A. Cutting includes cutting into nominally completed or existing construction including, but not limited to, the following, in order to provide for the coordination of Work, installation of Work, uncovering of other facilities and structures for access or inspection, or obtaining samples for testing or other similar purposes
   1. Concrete
   2. Steel
   3. Wood
   4. Miscellaneous metal structures
   5. Piping and pavement

B. Patching includes the repair required to restore cut materials to original or better condition

C. Submittals
   1. Submit a proposal describing procedures in advance of the time cutting and patching will be performed, requesting approval to proceed. Include the following information:

a. Extent: For each occurrence, describe the cutting and patching required, show how it will be performed and indicate the reason(s) it cannot be avoided
b. In-place construction changes: Describe anticipated results and include changes to structural elements and operating components in addition to changes in building's appearance and other significant visual elements
c. Products: List products to be used and firms or entities that will perform the Work
d. Dates: Indicate when cutting and patching will be performed
e. Utility services and mechanical and electrical systems:
    i) List services and systems that cutting and patching procedures will disturb or affect
    ii) List services and systems that will be relocated and that will be temporarily out of service
    iii) Indicate how long services and systems will be disrupted
f. Structural elements: Where cutting and patching involve adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with the original structure
g. Approval by Engineer:
    i) Obtain approval of cutting and patching proposal before cutting and patching
    ii) Approval does not waive right to later require removal and replacement of unsatisfactory work

D. Quality Assurance
1. Structural work requirements: Do not cut and patch structural elements in a manner that would reduce their load-carrying or load-deflection ratio
    a. Obtain Engineer approval of cutting and patching proposal before cutting and patching the following structural elements:
        i) Bearing and retaining walls, foundation construction, and structural concrete and structural steel
        ii) Lintels
        iii) Timber and primary wood framing
        iv) Structural decking and stair systems
        v) Equipment supports, piping, ductwork, vessels, and equipment
        vi) Miscellaneous structural metals
2. Operational limitations: Do not cut and patch operating elements or safety related components in a manner that would result in reducing their capacity to perform as intended, or result in increased maintenance or decreased operational life or safety
    a. Obtain Engineer approval of cutting and patching proposal before cutting and patching the following operating elements or safety related systems:
        i) Primary operational systems and equipment
        ii) Air, smoke, water, moisture, or vapor barriers
        iii) Membrane and flashings
        iv) Fire protection, control, communication, or electrical wiring systems
        v) Noise and vibration control elements and systems
3. Visual requirements: Do not cut and patch construction exposed on the exterior or in occupied spaces, in a manner that would, in the Engineer's opinion, reduce the building's aesthetic qualities, or result in visual evidence of cutting and patching

a. Retain the original installer or fabricator throughout construction phases to cut and patch the following categories of exposed work, if possible, or if it is not possible to engage the original installer or fabricator, engage another recognized experienced and specialized firm:
   i) Concrete finishes
   ii) Pre-formed metal panels
   iii) Painting
   iv) Wall covering
   v) HVAC enclosures, cabinets, or covers
   vi) Firestopping

E. Warranty
   1. For existing warranties, Contractor shall replace, patch, and repair material and/or surfaces cut and/or damaged by methods and with materials in order to not void any warranties required or existing

PART 2 PRODUCTS

A. Materials
   1. Use materials identical to existing materials unless not available
      a. If identical materials are not available or cannot be used where exposed surfaces are involved, use materials matching existing adjacent surfaces to the fullest extent possible with regard to visual effect
      b. Before proceeding, Contractor shall obtain approval of the Engineer
      c. Use materials whose installed performance will equal or surpass that of existing materials

PART 3 EXECUTION

3.1 INSPECTION

A. Inspect existing conditions of the Project, including elements subject to damage or to movement during cutting and patching. Take corrective action before proceeding, if unsafe or unsatisfactory conditions are encountered

B. After uncovering work, inspect the conditions affecting the installation of products, or performance of the work

C. Report unsatisfactory or questionable conditions to the Engineer in writing; do not proceed with the work until the Engineer has provided further instructions

3.2 PREPARATION

A. Provide devices and methods to protect other portions of the Project from damage

B. Provide temporary support of Work to be cut where required

C. 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
   1. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations

D. Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas

E. Take all precautions necessary to avoid cutting existing pipe, conduit or ductwork serving the building, but scheduled to be removed or relocated until provisions have been made to bypass them

F. Execute fitting and adjustment of products to provide a finished installation to comply with specified products, functions, tolerances and finishes

G. Restore work which has been cut or removed; install new products to provide completed Work in accordance with requirements of Contract Documents

3.3 PERFORMANCE

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time and complete without delay

B. Cut existing construction to provide for installation of other components or performance of other construction activities and the subsequent fitting and patching required to restore surfaces to their original condition
   1. Cutting: Cut existing construction using methods least likely to damage elements to be retained or adjoining construction. Where possible review proposed procedures with the original installer; comply with the original installer's recommendations
      a. In general, where cutting is required use hand or small power tools designed for sawing or grinding, not hammering and chopping. Cut holes and slots neatly to size required with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use
      b. To avoid marring existing finished surfaces, cut or drill from the exposed or finished side into concealed surfaces
      c. Cut through concrete and masonry using a cutting machine such as a carborundum saw or diamond core drill
      d. By-pass utility services such as pipe or conduit, before cutting, where services are shown or required to be removed, relocated or abandoned. Cut-off pipe or conduit in walls or partitions to be removed. Cap, valve or plug and seal the remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after by-passing and cutting
      e. Provide fire-safe seals to maintain fire rating at all penetrations
   2. Patching: Patch with durable seams that are as invisible as possible. Comply with specified tolerances
      a. Where feasible, inspect and test patched areas to demonstrate integrity of the installation

b. Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing
c. Where removal of walls or partitions extends one finished area into another, patch and repair floor and wall surfaces in the new space to provide an even surface of uniform color and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary to achieve uniform color and appearance
d. Where patching occurs in a smooth painted surface, extend final paint coat over entire unbroken containing the patch, after the patched area has received primer and second coat
e. Patch, repair or re-hang existing ceilings as necessary to provide an even plane surface of uniform appearance
f. Replace concrete walkways to nearest construction joint

3. Plaster Installation: Comply with manufacturer's instructions and install thickness and coats as indicated

3.4 CLEANING

A. Thoroughly clean areas and spaces where cutting and patching is performed or used as access. Remove completely paint, mortar, oils, putty and items of similar nature. Thoroughly clean piping, conduit and similar features before painting or other finishing is applied. Restore damaged pipe covering to its original condition

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 survey/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 will either proceed with inspection or advise Contractor of unfilled requirements. Engineer will prepare the Certificate of Substantial Completion following inspection or advise Contractor of construction that must be completed or corrected before the certificate will be issued
   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. Submit consent of surety to final payment
   6. 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
        i) Includes as-built survey points on top of pipe, tees, elbows, valves, service line taps, etc.
    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; digital drawings are also acceptable.
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

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

END OF SECTION

SECTION 02220

DEMOLITION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Demolition, removal, salvage and disposal of existing site features, piping, structures and materials where indicated on the drawings and as specified in this section

B. Demolition and removal of asphaltic paving

1.2 RELATED SECTIONS

A. Section 02300 – Earthwork

B. Section 02950 - Seeding

1.3 SUBMITTALS

A. Permits and Certificates.
   1. Permits and notices authorizing demolition
   2. Certificates of severance of utility service
   3. Permit for transport and disposal of debris

1.4 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Division 1 specifications

B. Accurately record actual locations of capped utilities and subsurface obstructions

1.5 REGULATORY REQUIREMENTS

A. Conform to applicable State and City of Grand Junction codes for demolition of structures, safety of adjacent structures, dust control, and disposal

B. Obtain required permits from authorities

C. Notify affected utility companies before starting work and comply with their requirements

D. Do not close or obstruct roadways, sidewalks, or hydrants without written permission from Owner

E. Conform to applicable regulatory procedures when discovering hazardous or contaminated materials

1.6 SCHEDULING

A. Schedule and submit under provisions of Division 1 specifications

B. Provide detailed descriptions for demolition and removal procedures

C. Notify Engineer and Owner of any demolition work one (1) week prior to commencement

D. Coordinate all demolition work with Engineer and Owner

PART 2 PRODUCTS

2.1 SALVAGE OF MATERIALS

A. All existing construction and items not salvaged to Owner shall be considered waste and shall become the property of Contractor for off-site disposal

2.2 HANDLING AND STORAGE

A. Contractor shall carefully disassemble Equipment and Materials that are to be reused and returned to Owner in such a way to avoid any damage. Contractor shall store such Equipment and Materials in such a way to avoid any damage, corrosion, or staining

2.3 FILL MATERIALS

A. Fill Material: Use on site fill material under provisions of Section 02300 and in accordance with Geotechnical recommendation

PART 3 EXECUTION

3.1 INSPECTION

A. Verify areas to be demolished are unoccupied and discontinued in use

B. Do not commence work until conditions are acceptable to Engineer and Owner

C. Existing conditions of Equipment and Materials, structures, surfaces, or properties that could be misinterpreted as damaged as a result of demolition work shall be photographed and filed with Owner and Engineer prior to commencement of Work

3.2 PREPARATION

A. Provide, erect, and maintain temporary barriers, enclosures, security fences and shoring at demolition locations in accordance with Division 1 and other related specifications to protect personnel

B. Protect existing structures and utilities which are not to be demolished

C. Provide temporary wiring and connections to maintain existing telephone, electrical, instrumentation and control systems in service during construction

D. Protect existing electrical and controls equipment and cabinets from dust and debris intrusion. Set up temporary barriers to preclude dust from being introduced into cabinets and equipment. Additionally, seal all cabinets and equipment while demolition is occurring. Control and or turn off existing heating and ventilation systems that will introduce or distribute dust and debris from the demolition operations.

E. Mark location of existing utilities

3.3 GENERAL REQUIREMENTS

A. Sprinkle Work with water to minimize dust where applicable. Provide hoses and water connections for this purpose.

B. Do not use water to extent causing flooding, contaminated runoff, or icing

C. Remove demolished material from the site

D. Repair damage to adjacent structures

E. Remove existing exposed piping and electrical wiring and conduit to be abandoned to structural surface, cut flush, and finish to match existing surfaces

F. Remove buried piping, wiring, and conduit to be abandoned as required for the Work. Plug the remainder flush.

3.4 DISPOSAL

A. Do not store or burn waste materials on-site

B. Transport demolition debris to designated off-site disposal area

C. If hazardous materials are encountered during demolition work, Contractor shall comply with applicable regulations and laws regarding the removal, handling, and protection of environment and human health

3.5 CONNECTION TO EXISTING CONSTRUCTION

A. Cut and remove portions of existing construction as necessary to allow for proper installation of new construction Equipment and Materials

B. Shore and brace existing structures to maintain safe structure conditions and until permanent structures and supports are completed
   1. Contractor shall repair all damage in result of installation of shoring and bracing

C. Cap, seal or abandon pipe and cable as indicated on Drawings and specified herein

3.6 CLEANUP AND REPAIR

A. Contractor shall remove tools, equipment and demolished materials from Site upon completion of demolition work
   1. Remove protections
   2. Interior areas shall be broom clean
   3. Inspect and clean all electrical control cabinets, interior and exterior, exposed to dust and debris during the demolition process

B. Contractor shall repair demolition performed in excess of that required or indicated
   1. Surfaces and structures to remain shall be repaired to the existing conditions prior to commencement of demolition work

3.7 SITE DEMOLITION

A. Disconnect, remove, cap and identify designated utilities within demolition area

B. Remove asphalt paving and parkway to facilitate construction. Remove concrete to nearest joint beyond demolition area.

C. Backfill areas excavated caused as a result of demolition, in accordance with Section 02300

D. Rough grade and compact areas affected by demolition to maintain site grades and contours as shown on drawings

E. Remove demolished materials from site

F. Do not burn or bury materials on site, unless otherwise directed by Owner. Leave site in clean condition.

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. Excavation for buildings & structures

J. Pavement Subgrade preparation

K. Trench Stabilization

L. Groundwater Barriers

M. Final grading

N. Slope Stabilization

O. Appurtenant work

1.3 RELATED SECTIONS

A. Section 02370 – Erosion and Sedimentation Control

B. Section 02740 – Flexible Paving

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

G. Rocksol Consulting Group Geotechnical Investigation Report Kannah Creek Flowline Upper 3 Miles (dated Dec. 20, 2022)

H. RockSol Consulting Group Geotechnical Memorandum (dated March 16, 2021)

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 City of Grand Junction 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 City of Grand Junction 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 City of Grand Junction 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. Imported Fill for Fills and Embankments:
   1. The Contractor is responsible for obtaining additional material for fills and embankments as necessary to meet the requirements as stated in Geotechnical Investigation Report Kannah Creek Flowline Upper 3 Miles (Dec. 20, 2022) and the RockSol Geotechnical Memo (March 16, 2021), if the project is anticipated to take more than two years from the date of the memos.

E. 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.

F. 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.

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

   2. 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

H. 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

I. 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

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

Sieve Size	Percent Passing by Weight
3/4"	90-100
No. 4	30-65
No. 8	22-55
No. 200	3-12

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 or Engineer.
   4. Removal of trees with trunks 6” or larger shall be removed by certified arborist.

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.

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 per City of Grand Junction spec section 103.8. If further excavation needs to be completed to achieve a suitable subbase for the pipe contractor to inform Owner and Engineer and receive approval prior to continuing excavation.

C. Reinforce subgrades with crushed rock or gravel and geotextile fabric if trench conditions become mucky during construction activities per City of Grand Junction details.

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 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 0.10 foot

B. Remove existing unsuitable/uncompacted fill, old foundations, rubble/debris, soft or otherwise unsuitable material, and replace with suitable material in excavation

C. Extend excavations to a sufficient distance from structures for placing and removing concrete formwork, installing services and other construction and inspections

D. Trim to neat lines where details call for concrete to be deposited against earth

E. Excavate by hand in areas where space and access will not permit use of machines

F. Provide dewatering and temporary drainage as required to keep excavations dry.

G. Reshape subgrade and wet as required

H. Notify Geotechnical Engineer when structure excavation has reached designated depth. Do not proceed with structure construction until excavation is approved by Geotechnical Engineer.

I. Proof roll at a maximum of 24 hours prior to paving or concrete placement to located any soft spots in grade. Contractor to stabilize any soft areas with aggregate base course and compact to 95% of maximum density at optimum moisture content, per ASTM D1557, to a minimum depth of 6 inches. Reshape subgrade and wet as required.

3.9 PAVEMENT OVEREXCAVATION AND SUBGRADE PREPARATION

A. Excavate subgrade for asphalt pavement areas per the lines, grades, and dimensions indicated on Drawings within a tolerance of plus or minus 0.10 foot. Excavate subgrade for concrete pavement areas per the lines, grades, and dimensions indicated on Drawings within a tolerance of plus or minus 0.05 foot.

B. Overexcavate and scarify existing soil as required under pavement areas, slabs, curbs and walks to meet the moisture and compaction specifications herein to depth shown on Drawings.

C. Extend subgrade preparation a minimum of one foot beyond back of proposed pavement, slabs, curbs and walks.

D. Proof roll with a pneumatic tire equipment with a minimum axle load of 18 kips per axle a maximum of 24 hours prior to paving to locate any soft spots that exhibit instability and deflection beyond subgrade tolerances listed above. Areas that are observed to have soft spots in the subgrade, where deflection is not uniform or is excessive as determined by the Geotechnical Engineer, will be ripped, scarified, dried or wetted as necessary and recompacted to the requirements for density and moisture at the Contractor's expense. After recompaction, these areas will be proof rolled again and all failures again corrected at the Contractor's expense.

E. If the Contractor fails to place the sub base, base course, or initial pavement course within 24 hours or the condition of the subgrade changes due to weather or other conditions, proof rolling and correction will be performed again at the Contractor's expense.

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

D. 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

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

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

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

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

I. 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

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

3.11 COMPACTION

A. Place backfill and fill materials in layers not more than 12 inches, 8-inches within 2’ of structure 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. 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
Structures	98%	-2 to +2
Paved Areas	95%	-2 to +2
Utility Trenches	95%	-2 to +2
Lawns or Unpaved Areas	90%	-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.

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

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

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

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

H. Use material free of debris and deleterious material

I. Contractor is responsible for compliance with Colorado Discharge Permit System and City of Grand Junction erosion control permitting requirements for any and all onsite 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.

3.12 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. 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 or specified on the Drawings.

D. Remove debris, junk, broken concrete, broken asphalt, rock, stones, stumps, logs, roots,

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. 2.0 feet for drainage piping
   2. 2.5 feet for gas piping
   3. 2.5 feet for electric, telecom, and fiber optic conduit
   4. 2.0 feet for irrigation piping
   5. 3.0 feet for sanitary sewer
   6. 4.0 feet for water piping
   7. 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 24 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”
24	3’ 0”	3’ 2”
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.
5. Salvage wetland topsoil to be used for wetland surface restoration

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 GROUNDWATER BARRIERS

A. Groundwater barriers shall be installed along utility lines to inhibit the movement of groundwater through the pipe bedding material. Pipe bedding and haunching materials will not be installed at groundwater barrier locations.

B. Barriers shall be a minimum of four feet thick and extend one foot beyond the trench limits on either side. Barriers shall extend one and a half feet below the pipe and one and a half feet above the pipe.

C. Barriers shall be concrete, flowfill, or other impervious material approved by the City and Engineer.

D. Barriers will be spaced based off the average trench slope and generally follow the table below.

Trench Slope (%)	Spacing (ft)
< 5	1,000
5 – 15	500
15 – 25	300
25 – 35	200
35 – 100	100
> 100	50

3.17 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.

3.18 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 the City of Grand Junction.
   2. Reuse grubbings and surface topsoil containing plants and seeds in designated revegetation areas only.

L. 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

M. 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

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

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

P. Maintain integrity of erosion control fabric

Q. Prior to laying fabric, seed disturbed areas under provisions of related seeding and landscaping specification sections.

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, for QA purposes only. Refer to 1.12 and 1.13 in Section 01400: Quality Control for designation of QA vs QC responsibilities.

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 schedule with the Owner so to provide the testing agency contractually required, 24-hour, one business day, advance notification to schedule tests. Refer to City's General Contract Conditions – VII.66: Inspection of Work and City's Standard Specifications for Road and Bridge Construction – Quality Control and Quality Assurance.

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.

D. Refer to Geotechnical Final Memo by RockSol Consulting Group (dated March 16, 2021).

1.2 RELATED SECTIONS

A. Section 02220 – Demolition

B. Section 02300 – Earthwork

C. Section 02740 – Flexible Paving

D. Section 02950 – Seeding

1.3 REFERENCES AND STANDARDS

A. CDOT – Colorado Department of Transportation

B. UDFCD – Urban Drainage and Flood Control District

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 City of Grand Junction 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. All costs for this permit shall be the responsibility of Contractor.
   3. This permit requires that specific actions be performed at designated times.
   4. Contractor is legally obligated to comply with all terms and conditions of the permit including testing for effluent limitations.
   5. 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.
   6. 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 City of Grand Junction.
   2. Changes to the Erosion Control Sequencing Plan may be considered by City of Grand Junction only if presented in writing by the Contractor.

B. Temporary Erosion Control:
   1. When so indicated in the Contract Documents, or when directed by City of Grand Junction. 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, City of Grand Junction, and in accordance with local regulations prior to installation.

E. Fertilizer and soil conditioners shall be approved by Engineer, City of Grand Junction, and in accordance with local regulations prior to installation.

F. Silt Fence Fabric: woven polypropylene
   1. Mirafi 100X, "Envirofence"
   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. City of Grand Junction will monitor Contractor's erosion control methods. If the overall function and intent of erosion control is not being met, the City of Grand Junction will require Contractor to provide additional measures as required to obtain the desired results.
   1. Refer to Rocksol Consulting Group Geotechnical Investigation Report Kannah Creek Flowline Upper 3 Miles (dated Dec. 20, 2022) and Geotechnical Memo by RockSol Consulting Group (dated March 16, 2021) on recommendations for Final Stabilization and Erosion Protection along the project site.

C. The erosion control features installed by Contractor shall be adequately maintained by Contractor until the project has reached final acceptance.

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 City of Grand Junction.

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 City of Grand Junction and as specified in Division 1 for Closeout Procedures.

PART 4 MEASUREMENT FOR PAYMENT

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 City of Grand Junction 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, valves, appurtenances, and associated accessories for water distribution and transmission lines

B. Disinfection of potable water piping

1.2 RELATED SECTIONS

A. Section 02300 – Earthwork

B. Section 02605 – Manholes, Catch Basins & Inlets

C. 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. 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

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

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

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

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

H. 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 using a surveyor 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

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 of Grand Junction 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 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.

END OF SECTION

SECTION 02605

MANHOLES, CATCH BASINS AND INLETS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Precast concrete manholes and risers, catch basins and inlets

B. Valve vaults

C. Payment procedures:
   1. Work specified in this Section is considered incidental and payment shall be included as part of appropriate unit prices included in Bid Form

1.2 RELATED SECTIONS

A. 03300 – Cast-In-Place Concrete

B. 03600 - Grout

1.3 REFERENCE STANDARDS AND GUIDES

A. American Standards and Testing Materials (ASTM)
   1. A48 – Gray Iron Castings
   2. C270 – Mortar for Unit Masonry
   3. C443 - Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
   4. C478 – Precast Reinforced Concrete Manhole Sections
   5. C497 – Concrete Pipe, Concrete Box Sections, Manhole Sections, or Tile
   6. C923 – Resilient Connectors between Reinforced Concrete Manhole Structures, Pipes, and Laterals
   7. C1433 – Precast Reinforced Concrete Monolithic Box Sections for Culverts, Storm Drains, and Sewers
   8. D4101 – Standard Classification System and Basis for Specification for Polypropylene Injection and Extrusion Materials

1.4 SUBMITTALS

A. Submit in accordance with Section 01340.

B. Product data:
   1. Manufacturer’s specifications and other data needed to prove compliance with specified requirements
   2. Manufacturer’s recommended installation procedures.

C. Provide certification reports attesting that materials supplied meet referenced specifications.

D. Shop drawings for manholes showing all components to be installed.

E. If manufacturer's test data in inadequate or unavailable. Engineer reserves right to require cores drilled for compressive strength tests.

F. A buoyancy calculation for each manhole, valve vault documenting that buoyancy is not a problem. Criteria for buoyancy calculations are as follows.
   1. Minimum safety factor: 1.1
   2. Surface friction with backfill material shall not be included
   3. Submerged soil weight of 55 pounds per cubic foot where soil weight is used to help hold down the structure. Only soil directly above structure or any anti-floatation devices may be included.
   4. Water table taken from Geotech Report
   5. No water weight to be included inside structure
   6. Weights for castings, all precast components and any manufacturer supplied fillets in bottom of manhole may be included.

1.5 QUALITY ASSURANCE

A. Manufacturer shall conform to the requirements of ASTM C478

PART 2 PRODUCTS

2.1 PRECAST CONCRETE SECTIONS

A. Precast sections:
   1. Provide reinforced precast concrete manhole, catch basin or inlet sections complying with ASTM C478
   2. No "see through" lift holes shall be allowed on precast concrete manholes and risers 48 inches diameter or less.
   3. All lift holes on structures greater than 48 inches in diameter shall be thoroughly wetted and completed filled with non-shrink grout or epoxy grout; then smoothed and covered on the outside with a trowelable grade butylrubber base backplaster material to minimize leakage.
   4. Provide integral anti-flotation collars (extended bases) with a minimum width of 6 inches around bottom of all manholes. Provide larger collars for manholes that calculations indicate buoyancy safety factors less than 1.2 so that required factor of safety is achieved. Other methods of buoyancy control may also be acceptable upon Engineer's approval.
   5. Provide flat top slabs as shown on Drawings. (City of Grand Junction will not allow for cone sections along transmission lines.)
   6. Wall Thickness:

Structure/Riser Diameter	Minimum Wall Thickness
4 feet	5 inches
5 feet	6 inches

6 feet	7 inches
7 feet	8 inches
8 feet	9 inches
10 feet	11 inches

B. Joints:
1. Tongue and groove with butyl-rubber gaskets meeting requirements of ASTM C443.
2. Joints shall be watertight.
3. Manholes shall have an exterior joint sealer applied to each joint, meeting requirements of ASTM C877, Type II. Manufacturers:
   a. MacWrap External Collar by Mac Wrap Construction Products Co Inc.
   b. Cretex Wrap by Cretex Specialty Products
   c. EZ-wrap by Press Seal Gasket Corporation

C. Pipe to Manhole Connections: All connections shall provide for a watertight seal between pipe and manhole.
1. Connect sanitary sewer pipe and flexible storm sewer pipe to manhole by means of boot-type or compression-type connector, meeting the requirements of ASTM C923
   a. Kor-N-Seal I, by Trelleborg
   b. A-Lok, by A-Lok Products, Inc
   c. Z-Lok Cast in Boots, by A-Lok Products, Inc
   d. PSX Direct Drive, by Press-Seal Gasket Corporation
   e. Or Equal

D. Mark each precast section with name or trademark of manufacturer and date of manufacture. Marking shall be indented into manhole section or shall be painted thereon with waterproof paint.

E. Source Quality control:
1. Test risers and tops in accordance with ASTM C497 for compressive strength compliance by compression tests on cores drilled from 5% of lot.
2. Number of compression tests may be reduced to 1% or lot, with minimum of two cores per lot, for manhole sections fabricated on sewer pipe machine.
3. Manufacturer's core drilling machine shall conform to ASTM C497. Operator shall take test cores as directed by testing laboratory.
4. Stamp base sections, risers and tops, meeting strength requirements, with appropriate monogram.

2.2 STEPS

A. Conform to requirements of ASTM C478 and U.S. Department of Labor Occupational Safety and Health Standards.

B. Steel Reinforced Plastic:
1. Approved Plastic such as copolymer polypropylene meeting with requirements of ASTM D4101, Type II, Grade 49108, reinforced with deformed 3/8 inch diameter reinforcing bar which conforms to requirements of ASTM A615, Grade 60

C. Equally space steps in true vertical alignment to form continuous ladder at distance of 16 in on center. Place steps within allowable tolerance of ±1 inch.

D. Manufacturer shall install steps. Embed steps into wall minimum of 3 inches.

2.3 CONCRETE

A. 4500 psi with 6± 1.5% air content

2.4 MORTAR

A. Comply with ASTM C270, Type M

2.5 ADJUSTING RINGS

A. Precast concrete with one line of steel reinforcements, centered in normal handling and use.

B. Mating Faces: Smooth parallel, and free from cracks, chips, spalls, or casting irregularities.

C. Minimum thickness: 2 inches

D. Maximum thickness: 6 inches

E. Adjusting rings not allowed on above or below grade frames and covers

2.6 INTERNAL CHIMNEY SEAL

A. Internal chimney seal as manufactured by Cretex Specialty Products, or equal.

2.7 EXTERNAL CHIMNEY SEAL

A. External Chimney seal as manufactured by Cretex Specialty Products, or equal

2.8 FRAMES AND COVERS

A. ASTM A48, Class 30-B minimum

B. Free from cracks, holes, swells, and cold shuts.

C. Provide all frames, gratings and covers from the same manufacturer unless approved by Engineer.

D. Provide standard finish, supplied as a total unit.
   1. Manhole Frames and Covers: Solid Lid with sealed pick holes.
      a. Per City standards only flat lids to be used along transmission lines.

PART 3 EXECUTION

3.1 SURFACE CONDITIONS

A. Examine areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 FIELD MEASUREMENTS

A. Make necessary measurements in the field to assure precise fit of items in accordance with the approved design.

3.3 INSTALLATION

A. Trench, backfill, and compact for work of this Section in accordance with pertinent provisions of Section 02300.

B. Standard Precast Manhole with integral Base:
   1. Excavate deep enough so bottom manhole barrel section with integral base rests on 4 in. minimum of bedding material.
   2. Bedding material shall conform to requirements of adjacent pipe.
   3. Set manholes plumb with orientation of cast-in items as shown on Drawings.

3.4 BACKFILL

A. Backfill with pipe bedding and cover material to spring line of incoming pipe in accordance with Section 02300.

3.5 MANHOLE BENCH (CONSTRUCTED IN FIELD)

A. Shape invert channels to be smooth and semicircular, conforming to inside of adjacent sewer sections.

B. Make changes in size and grade of channels smoothly and evenly.

C. Form invert channels directly within manhole base with concrete, on manholes with straight through pipe invert may be formed by laying full section sewer pipe through manhole and cleanly breaking out top half after surrounding concrete has hardened.

D. Smooth floor of manhole outside channels, and slope toward channels at not less than 1 inch per foot or more than 2 inches per foot.

E. Construct outside drop at sanitary manholes whenever free drop inside manhole exceeds 24 inches measured from invert of inlet pipe to top of floor of manhole outside channels.

3.6 PIPE TO MANHOLE CONNECTION

A. Support pipe entering manhole above manhole base from wall of manhole back to face of first pipe joint bell with wall of backfill concrete, brick or solid concrete block columns.

B. Connect by means of an approved flexible watertight pipe to manhole seal.

3.7 SETTING CASTINGS

A. Set at elevation shown on Drawings.

B. Adjust castings to grade with adjusting rings. Do not use more than 8 inches of adjusting rings.

C. Sealing: Seal interior and exterior of adjusting rings and castings with trowelable mastic sealing material.

D. Provide internal chimney seals with extensions as necessary, on manholes. Install seals and extensions in accordance with manufacturer's instructions.

3.8 MANHOLE OVER EXISTING PIPE

A. Construct new manhole as specified, breaking upper half of existing pipe after base of manhole is completed so as to not obstruct flow of existing pipe.

3.9 TESTING AND INSPECTING

A. Do not allow or cause any Work of this Section to be covered up or enclosed until after it has been inspected.

B. Precast reinforced concrete manholes, inlets, catch basins, risers and tops shall be subject to rejection on account of failure to conform to any specification requirements. In addition, individual sections may be rejected because of any of the following reasons:
   1. Fractures or crack passing through shell, except for single end crack not exceeding depth of joint.
   2. Defects indicating imperfect proportioning, mixing, and molding.
   3. Surface defects indicating honeycombed or open texture.
   4. Damaged ends where such damage would prevent making satisfactory joint.
   5. Manhole steps out of line, or not properly spaced.
   6. Infiltration into sanitary sewer exceeding 0.0758 gal/vert ft/hr.
   7. Internal diameter of section varying more than 1% from nominal diameter.
   8. Any continuous crack having surface width of 0.01 inches or more and extending for length of 12 inches of more, regardless of position.

C. Manhole seals shall be approved by inspecting Engineer after application and prior to backfilling.

END OF SECTION

SECTION 02740

FLEXIBLE PAVING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Full depth and/or composite hot bituminous pavement (asphalt) over prepared subgrade

B. Overlay, patch and/or pavement rehabilitation applications for streets, parking lots and other miscellaneous asphalt pavement

1.2 RELATED SECTIONS

A. Section 02300 – Earthwork

1.3 REFERENCES

A. American Association of State Highway and Transportation Officials (AASHTO):
   1. T 230: Standard Method of Test of Determining Degree of Pavement Compaction of Bituminous Aggregate Mixtures

B. American Society for Testing and Materials (ASTM):
   1. C29: Unit Weight and Voids in Aggregate
   2. C88: Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
   3. C117: Materials Finer than No. 200 Sieve in Mineral Aggregates by Washing
   4. C128: Specific Gravity Test and Absorption of Fine Aggregate
   5. C131: Resistance to Degradation of Small Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
   6. C136: Sieve or Screen Analysis of Fine and Coarse Aggregates
   7. D70: Specific Gravity of Semi-Solid Bituminous Materials
   8. D2726: Bulk Specific Gravity of Compacted Bituminous Mixtures
   9. D2041: Theoretical Maximum Specific Gravity of Bituminous Paving Mixtures
   10. D4462: Viscosity of Asphalts (Bitumens)
   11. D2172: Quantities Extraction of Bitumens from Bituminous Paving Mixtures
   12. D2419: Sand Equivalent Value of Soils and Fine Aggregate
   13. D290: Bituminous Mixing Plant Inspection
   14. D6373: Performance Graded Asphalt Binder
   15. D692: Course Aggregate for Bituminous Paving
   16. D1073: Fine Aggregate for Bituminous Paving Mixtures
   17. D1241: Materials for Soil-Aggregate Subbase, Base and Surface Courses
   18. D2026: Cutback Asphalt (Slow-Curing Type)
   19. D2027: Cutback Asphalt (Medium-Curing Type)
   20. D2028: Cutback Asphalt (Rapid-Curing Type)
   21. D2950: Density of Bituminous Concrete in Place by Nuclear Methods

C. Surface Preparation Standards (SSPC):
   1. SP-2: Superior Performing Asphalt Pavement System (Superpave) Level 1 Mix Design

D. Colorado Department of Transportation

E. Colorado Asphalt Pavement Association

F. City of Grand Junction construction specifications, standards and details.

1.4 SUBMITTALS

A. Submit under provisions of Division One Specifications

B. Record of Work: Maintain record of time and date of placement, temperature, and weather conditions, retain until completion and furnish copy to engineer.

C. Proposed Design Job Mix Formula for each mixture required by the contract. The mixture design shall be determined using AASHTO T-312 or Colorado Procedure CP-L 5115 for the Superpave Method of Mixture Design.

D. Test Reports: Proposed Design Job Mix testing shall be performed in a materials laboratory under the direct supervision of; and shall be stamped and signed by a Professional Engineer licensed in the State of Colorado practicing in this field. In addition, the General Contractor shall submit as part of the Proposed Design Job Mix, documents to verify the following:
   1. Source of materials
   2. Gradation, specific gravity, source and description of individual aggregates and the final blend
   3. Aggregate physical properties
   4. Source and Grade of the Performance Graded Binder (PG Binder)
   5. Proposed Design Job Mix – aggregate and additive blending, final gradation shown on 0.45 power graph, optimum asphalt content
   6. Required mixing and compaction temperatures
   7. Mixture properties determined at a minimum of four asphalt contents and interpolated at optimum and graphs showing mixture properties versus asphalt content.
   8. Sampling and testing of asphalt concrete mixtures for quality control during paving operations
      a. Uncompacted asphalt concrete mix
         i) Asphalt cement content: ASTM D2172 (AASHTO T164)
         ii) Maximum Specific Gravity: ASTM D2041 (AASHTO T209)
      b. Compacted asphalt concrete mix
         i) Bulk density: ASTM D1188 (AASHTO T166)
      c. Perform at least one test for each day's paving but not less than one test per each 4000 sf of each lift.

1.5 QUALITY ASSURANCE

A. Materials and installation shall conform to applicable portions of Colorado Department of Transportation (CDOT) and City of Grand Junction construction specifications, standards and details.

1.6 REGULATORY REQUIREMENTS

A. For work on public streets or rights-of-way conform to the requirements of City of Grand Junction construction specifications, standards and details for the construction of concrete, curbs, gutters, sidewalks, driveways, roadways, street paving, and other public right-of-way Improvements.

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

1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, protect and handle materials under provisions of Division One Specifications

B. Transport mixture from mix plant in trucks with tight, clean, smooth, non-sticking compartments. Thinly coat hauling compartments with lime-water mixture, paraffin oil or other approved release agent to prevent sticking. Petroleum distillates such as kerosene or fuel oil are not approved release agents. Elevate and drain compartment of excess solution before loading mix.

C. Cover to protect from weather and prevent loss of heat

D. Provide insulated truck beds during temperature below 50 degrees F on long distance deliveries

1.8 ENVIRONMENTAL REQUIREMENTS

A. Do not apply when underlying surface is muddy, frozen or wet

B. Weather conditions permit pavement to be properly placed and compacted

C. The hot mix asphalt will be placed only when both the air and surface temperatures are equal to or exceed the temperatures specified in the table below:

CDOT Table 401-3: Placement Temperature Limitations in F

Compacted Layer Thickness (Inches)	Minimum Air and Surface Temp. (Degrees F and rising)	
	Top Layer	Other Layers
1½ or less	60	50
>1½ to 3	50	40
3 to 4	45	35

Note: Air temperature shall be taken in the shade. Surface is defined as the existing base on which the new pavement is to be placed.

PART 2 PRODUCTS

2.1 MATERIALS

A. General: Pavement shall be asphalt of the plant hot mix type. Materials and construction shall comply with Section 403 and 702 of the CDOT Standards and Specifications for Road and Bridge Construction.

B. Tack Coat:
   1. SS-1 or CSS-1h
   2. AASHTO M208 or M140

C. Asphaltic Cement:
   1. Superpave Performance Graded (PG) binder of PG64-22 or PG58-28 Table 702-1 of CDOT standard section 702
   2. Will not be acidic modified or alkaline modified
   3. Will not contain any used oils that have not been refined
   4. Modifiers will not be carcinogenic

D. Aggregate for Asphaltic Concrete, General
   1. Sound, angular crushed stone, crushed gravel, or crushed slag: ASTM D692
   2. Sand, stone, or slag screening: ASTM D1073
   3. Percent wear: ASTM C131, less than 45 for aggregates retained in #10 sieve

E. Base Course Aggregates for Asphaltic Concrete
   1. Uncrushed gravel may be used in mixture if it meets design criteria specified
   2. Provide uniform quality combined aggregates with a minimum sand equivalent value of 40
   3. Provide aggregate in gradations for courses to comply with Class S and SG, Colorado Department of Transportation, ASTM C136

F. Surface Course Aggregates for Asphaltic Concrete
   1. Provide natural sand, unless sand prepared from stone, slag, or gravel or combinations are required to suit local conditions
   2. Provide uniform quality combined aggregate with a minimum sand equivalent value of 50
   3. Provide aggregate in gradations for courses to comply with Class SX, Colorado Department of Transportation, ASTM C136.

G. Hydrated Lime for Aggregate:
   1. May be added at the rate of 1% by dry weight of the aggregate and shall be included in the amount of material passing the No. 200 sieve. Hydrated lime for aggregate pretreatment will conform to ASTM C207, Type N. Residue retained on a No. 200

sieve will not exceed 10% when determined in accordance with ASTM C110. Drying of the residue in an atmosphere free from carbon dioxide will not be required.

H. Weed Control: First application, “Roundup.” Second application, Casoron “W-50" or “G-10” with colored marker dye, manufactured by Pacific Coast Borax Company or an accepted substitute of non-flammable type.

2.2 ACCESSORIES

A. Traffic Control Devices
   1. Signs.
      a. Comply with City of Grand Junction standards and specifications for signs within the public right-of-way.
      b. Sign faces, posts and bases shall be in conformance with the following materials specifications. All nonstandard sign faces, posts and bases must be approved by City of Grand Junction. Private property or nonstandard signs will be maintained by the owner. Submit shop drawings for approval prior to fabrication. All signs shall conform to current M.U.T.C.D. Standards and Colorado Supplements. All signs shall be 3M-engineer grade reflective sheeting or accepted substitute.
      c. Traffic/Parking Signs: Sign blanks shall be 6061 or 5052-H38 aluminum alloy .080 inches thick. Facing shall be specified reflective sheeting with standard sign colors based on standard graphics and as shown on the plans.
   2. Sign Posts.
      a. For large signs greater than 12”W x 18”H and for multiple signs of any size mounted on the same post: sign posts shall be two (2) inch by two (2) inch galvanized telespar tube.
      b. For regular single signs 12”W x 18”H or smaller: sign posts shall be one and one-half (1-1/2) inch by one and one-half (1-1/2) inch galvanized telespar tube.
      c. Galvanized telespar tube shall have 0.120-inch wall thickness, and three-eighths (3/8) inch holes drilled on one (1) inch centers, all sides over full length, ten (10) feet in length (min).
   3. Sign Post Anchor Bases (Stubs). All sign post anchor bases shall be twist resistant square galvanized telespar tube post with thickness and hole pattern the same as sign posts. Use 2-1/4” by 2-1/4” anchor for large posts and 1-3/4” by 1-3/4” anchor for regular posts. Bases shall be embedded a minimum of 36” below finished grade and shall extend 3” above finished grade.
   4. Signs Post Anchor Bases with concrete footing: Sign, post, base and compacted soil shall be rigid and able to withstand wind loads. Where predominantly clay soils are present which will not properly compact at sign base, install a 6” diameter by 36” deep concrete footing around signs post anchor base for all signs in landscaped areas.
   5. All signs and posts shall be mounted and secured with municipal-approved vandal-proof type TL-3896 drive rivets with washers, or accepted substitute.

B. Pavement Marking. Specified pavement marking materials shall be used at locations as identified below.

1. Comply with City of Grand Junction standards and specifications for pavement marking within the public right-of-way. If there are no City of Grand Junction R-O-W standards, use CDOT standards.
2. FS TT-P-1952, Type I Alkyd, white, blue, yellow and red color paint meeting requirements of CDOT Standard Specification 708. Verify colors and extent of painting prior to painting. Unless noted on plans, evident at existing striping or instructed, provide white in color for traffic striping, parking stalls, and other control markings on internal pavement, yellow in color for traffic control markings or restricted parking or where indicated, blue in color for accessible parking stalls, and red in color for curbs where no parking is indicated. Reflectorized paint required for traffic stripes and control markings on internal drive, road or street pavements.
3. Furnish paint with a no-pick-up maximum drying time of 20 minutes, when tested according to ASTM D711 using a wet film thickness of 0.015-inch when tested and applied at 77 degrees F.
4. 3M Stamark 5730 preformed plastic marking material or an accepted substitute shall be used for crosswalks, stop bars, symbols (i.e. turn arrows) and striping for separation of turn and through lanes in right-of-way. Use of thermoplastic pavement marking is not permitted.

2.3 MIXES/SOURCE QUALITY CONTROL

A. Determine full depth design mix based upon aggregates furnished
   1. Test mix by independent laboratory at Contractor's expense
   2. Grade dependent on temperature during placement
   3. Submit mix designs under provisions of Division One specifications for review and acceptance by Engineer

B. Submit mix design giving unit weight and to meet following requirements prior to placement of asphalt:

Property	S(75)	SX(75)
Air Voids in Mix, % (N Design)	3.5-4.5	3.5-4.5
Initial Gyrations	7	7
Design Gyrations	75	75
Hveem Stability	28 min	28 min
Voids Filled w/ Asphalt	65-80	65-80

Establish a single percentage passing each sieve size, a single percent of asphalt and a mix temperature. Maintain job mixes within following percentages of design mix:

Aggregates:	
¾" and larger	± 6%
#4 to #8	± 5%
#30	± 4%
#200	± 2%

Asphalt Content Tolerance	± 0.3%
Discharge Mix temp	± 20˚ F

PART 3 EXECUTION

3.1 EXAMINATION

A. Establish and maintain required lines and elevations. Provide grade and location stakes under this section as required for asphaltic concrete paving work.

B. Operate heavy, rubber-tired front loader over subgrade of paved areas. Where soft spots occur, remove loose materials and replace with Class 6 road base aggregate complying with CDOT standards compacted to level of subgrade.

3.2 PREPARATION

A. Prepare subgrade under provisions of Section 02300

B. Loose and Foreign Material
   1. Remove loose and foreign material from compacted subgrade surface immediately before application of paving. Clean surface with mechanical sweeper, blowers, or hand brooms, until surfaces are free from dust

C. Weed Control
   1. If weeds or vegetation exist at or on the subgrade, apply “Round-up” at rates following manufacturer’s instructions. Apply “Round-up” three days prior to removal of vegetation, subgrade preparation and application of Casoron as described below to allow “Round-up” to kill all vegetation. Remove all living and dead weeds, root balls, tree/shrub roots, vegetation, and/or any organic matter from on or in the subgrade per applicable earthwork specifications prior to subgrade preparation and paving at all areas to be paved.
   2. After all fine grading, checking, shaping, and compacting of the subgrade has been completed, and just prior to placing asphalt or aggregate base course, all subgrade soil in the area to receive asphalt pavement shall be thoroughly treated with Casoron soil sterilant (in addition to “Round-up” and regardless of presence of existing weeds or vegetation). Casoron shall be thoroughly sprinkled to distribute the chemical through the first two or three inches of the subgrade. For all areas to be paved, apply Casoron weed control at a minimum rate per 100 square yards of 2.4 pounds for G-10 or 4.0 pounds for 50w at rates and methods recommended by manufacturer within one day of paving.
   3. The Contractor shall provide all necessary protection to prevent injury to animal, fish, or plant life and property occasioned by the application of the soil sterilant. Apply on a calm, wind-free day. The Contractor will be held responsible for all application of soil sterilant or the storage of same. Protect existing and new trees and shrubs beyond the limit of paving from damage due to weed killer or soil sterilant overspray or root

contact. Extra caution is required to prevent over-application of products in areas to be paved under tree canopies. Trees and shrubs damaged or killed by weed killer or sterilant application shall be replaced by the contractor at contractor's expense.

4. Do not apply within 20 feet of trees or shrubs

D. Tack Coat
   1. Apply in similar manner as prime coat, except as modified
   2. Dilute material with equal parts of water and apply to contact surfaces of previously constructed asphaltic concrete or portland cement concrete and surfaces
   3. Apply at rate of 0.05 to 0.15 gallons per square yard of surface
   4. Apply tack coat by brush to contact surfaces of curbs, gutters, catch basins, and other structures projecting into or abutting asphaltic concrete pavement
   5. Allow surfaces to dry until material is at condition of tackiness to receive pavement
   6. Where asphaltic concrete will adhere to surface, tack coat may be eliminated by Engineer

3.3 COLD MILLING

A. Clean existing pavement surface of loose and deleterious material immediately before cold milling. Remove existing asphalt pavement by cold milling to grades and cross sections indicated.
   1. Mill to minimum depth of 1 ½-inches, or as indicated on the plans.
   2. Mill to a uniform finished surface free of gouges, grooves, and ridges of more than ¼ inch depth.
   3. Control rate of milling to prevent tearing of existing asphalt course.
   4. Repair or replace curbs, manholes, and other construction damaged during cold milling.
   5. Excavate and trim unbound-aggregate base course, if encountered, and keep material separate from milled hot-mix asphalt.
   6. Transport milled hot-mix asphalt to asphalt recycling facility.
   7. Keep milled pavement surface free of loose material and dust.

3.4 RING/FRAME ADJUSTMENTS

A. Set ring/frames of subsurface structures to final grade as a part of this work.

B. Placing Ring/Frames
   1. Surround ring/frames set to elevation with a ring of compacted asphalt concrete base prior to paving
   2. Place asphalt concrete mixture up to 1-inch below top of ring/frame, slope to grade, and compact by hand tamping

C. Adjust frames to proper position to meet paving

D. If permanent covers are not in place, provide temporary covers over openings until completion of rolling operations

E. Set ring/frames to grade, flush with surface of adjacent pavement

3.5 PREPARING THE MIXTURE

A. Comply with ASTM D995 for material storage, control, and mixing and for plant equipment and operation

B. Stockpile
   1. Keep each component of the various sized combined aggregates in separate stockpiles
   2. Maintain stockpiles so that separate aggregate sizes will not be intermixed and to prevent segregation

C. Heating
   1. Heat the asphalt cement at the mixing plant to viscosity at which it can be uniformly distributed throughout mixture
   2. Use lowest possible temperature to suite temperature viscosity characteristics of asphalt
   3. Do not exceed 350 degrees F

D. Aggregate
   1. Heat-dry aggregates to acceptable moisture content
   2. Deliver to mixer at recommended temperature to suite penetration grade and viscosity characteristics of asphalt cement, ambient temperature, and workability of mixture
   3. Accurately weigh or measure dry aggregates and weigh or meter asphalt cement to comply with job-mix formula requirements

E. Mix aggregate and asphalt cement to achieve 90-95 percent coated particles for base mixtures and 85-90 percent coated particles for surface mixture, per ASTM D2489

3.6 EQUIPMENT

A. Bituminous Pavers:
   1. Self-propelled, spreads without tearing surfaces, equipped with an activated screed assembly, heated if necessary, controls pavement edges to true lines without use of stationary forms and capable of spreading and finishing the asphalt plant mix material in widths applicable to the typical sections and thicknesses shown in the contract documents.
   2. Pavers used for roadway shoulders, recreational paths and similar construction will be capable of spreading and finishing the courses of asphalt plant mix material in width shown in the contract documents.
   3. Pavers will be equipped with automatic screed controls with sensors capable of sensing grade from an outside reference line, and maintaining the screed at the specified longitudinal grade and transverse slope. The sensor will be constructed to operate from either or both sides of the paver and will be capable of working with the following devices:
      a. Ski-type device at least 30 feet in length
      b. Short ski or short shoe
      c. At least 5,000 feet of control line and stakes

4. The controls will be capable of maintaining the screed at the specified transverse slope within plus or minus 0.1 percent.
5. Manual operation will be permitted:
    a. For constructing irregularly shaped or minor areas
    b. If the automatic controls fail or malfunction the equipment may be operated manually for the remainder of the normal working day, provided specified results are obtained. However, if specified surface tolerances cannot be achieved, paving operations will be suspended until satisfactory correction, repairs of equipment replacements are made.
6. Placement of hot mix asphalt on a waterproofed bridge deck shall be accomplished with equipment that will not damage the membrane or other protective covering

B. Rolling Equipment
1. Steel-wheel roller: Self-propelled, contact pressure of 250 to 350 psi per inch of width of roller wheel, equipped with adjustable scrapers and means for keeping wheel wet to prevent mix from sticking
2. Pneumatic-tired rollers: Self-propelled, contact pressure under each tire of 85 to 110 psi, wheels spaced so that one pass will accomplish one complete coverage equal to rolling width of machine, oscillating wheels. Remove and replace immediately tires picking up fines

C. Hand Tools: Provide rakes, lutes, shovels, tampers, smoothing irons, pavement cutters, portable heaters, and other miscellaneous small tools

3.7 PLACING THE MIX

A. Place asphalt concrete mixture on prepared surface, spread and strike-off using paving machine

B. Complete placement over full width of section on each day's run

C. Spread mixture at minimum temperature specified by CDOT Table 401-5 for the specific binder used in the asphalt mix:
1. PG 64-22: 320 F minimum mix discharge temperature, 235 F minimum delivered mix temperature
2. PG 58-28: 275 F minimum mix discharge temperature, 235 F minimum delivered mix temperature
3. The maximum mix discharge temperature will not exceed the minimum discharge temperature by more than 30 F.
4. Delivered mix temperature will be measured behind the paver screed
5. Hot asphalt mixture will be produced at the lowest temperature with the specified temperature range:
    a. producing a workable mix and provides for uniform coating of aggregates, in accordance with AASHTO T195
    b. allowing the required compaction to be achieved

D. Inaccessible and small areas may be placed by hand

E. Conform to the grade, cross section, finish thickness, and density indicated.

F. Lift Thickness
1. Place in multiple lifts. Place asphalt in lifts such that each compacted lift thickness is no less than 2.0" thick and no greater than 3.0" thick. Top lift to be 2" thick.
2. Typical Lift Thickness Sequencing:

Final Asphalt Section Required (inches)	No. of Lifts	Thickness of each Lift (inches) from bottom to top lift
2"	1	2
3"	1	3
4"	2	2-2
5"	2	3-2
6"	3	2-2-2
7"	3	3-2-2
8"	3	3-3-2
9"	4	3-2-2-2
10"	4	3-3-2-2
>10	Review with Engineer	

G. Paver Placing
1. Unless otherwise directed, being placing along centerline of areas in crowned section and at high side on one-way slope and in direction of traffic flow
2. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips
3. Complete base courses before placing surface courses
4. Place mixture in continuous operation as practicable

H. Hand Placing
1. Spread, tamp, and finish mixing using hand tools in areas where machine spreading is not possible as acceptable to Engineer
2. Place mixture at a rate that will insure handling and compaction before mixture becomes cooler than acceptable working temperature

I. Joints
1. Construct transverse joint at right angles to centerline when operations are suspended long enough for mixture to chill
2. Construct joints to have same texture, density, and smoothness as adjacent sections of asphalt concrete course
3. Clean contact surfaces free of sand, dirt, or other objectionable material and apply tack coat
4. Offset transverse joints in succeeding courses not less than 24 inches
5. Cut back edge of existing pavement or previously placed course to expose an even, vertical surface for full course thickness
6. Offset longitudinal joints in succeeding courses not less than 6 inches

7. When the edges of longitudinal joints are irregular, honeycombed or inadequately compacted, cut back unsatisfactory sections to expose an even, vertical surface for full course thickness
8. Wearing course constructed in even number of strips; place 1 longitudinal joint on centerline of road
9. Wearing course constructed in odd number of strips; place the centerline of 1 strip on centerline of road

J. Gutter: Finish surface high adjacent to concrete gutter so when compacted surface is 0" to 3/8" maximum higher than edge of curb and flashing.

3.8 COMPACTING THE MIX

A. All paving will be compacted to 94 +/- 2% of Maximum Theoretical (RICE) density, CP-51 or AASHTO T209: Maximum Specific Gravity of Bituminous Paving Mixtures, as determined by ASTM D 2950. RICE values will be used in calculating Relative Compaction according to CP-44 or AASHTO T166.

B. Provide pneumatic and steel-wheel type rollers to obtain the required pavement density, surface texture and rideability

C. Begin rolling operations when the mixture will bear weight of roller without excessive displacement and complete as quickly as possible after placement occurs.

D. Compaction operations will be continuous until the required density is achieved or the density requirements are not met and the mix temperature falls below 185˚ F or there is obvious surface distress or breakage. Minimum compaction temperatures may be adjusted according to the asphalt binder supplier recommendations. Adjusted minimum compaction temperatures must be shown on the approved mix design or on the asphalt binder supplier documentation kept on file at the jobsite.

E. Do not permit heavy equipment, including rollers to stand on finished surface before it has thoroughly cooled or set

F. Compact mixture with hot hand tampers or vibrating plate compactors in areas inaccessible to rollers

G. Start rolling longitudinally at extreme lower side of sections and proceed toward center of pavement. Roll to slightly different lengths on alternate roller runs

H. Do not roll centers of sections first under any circumstances

I. Breakdown Rolling
1. Accomplish breakdown or initial rolling immediately following rolling of transverse and longitudinal joints and outside edge
2. Operate rollers as close as possible to paver without causing pavement displacement
3. Check crown, grade, and smoothness after breakdown rolling

4. Repair displaced areas by loosening at once with lutes or rakes and filling, if required, with hot loose material before continuing rolling

J. Second Rolling
1. Follow breakdown rolling as soon as possible, while mixture is hot and in condition for compaction
2. Continue second rolling until mixture has been thoroughly compacted

K. Finish Rolling
1. Perform finish rolling while mixture is still warm enough for removal of roller marks by combination of steel and pneumatic rollers
2. Continue rolling until roller marks are eliminated and course has attained specified density, and required surface texture and surface tolerances
3. After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened. Erect barricades to protect paving from traffic until mixture has cooled and attained its maximum degree of hardness

L. Patching
1. Remove and replace defective areas
2. Cut-out and fill with fresh, hot asphaltic concrete
3. Remove deficient areas for full depth of course
4. Cut sides perpendicular and parallel to direction of traffic with edges vertical
5. Apply tack coat to exposed surfaces before placing new asphaltic concrete mixture
6. Compact by rolling to specified surface density and smoothness

3.9 JOINING TO EXISTING WORK

A. Cut sides vertically and apply tack coat to exposed asphalt surfaces before placing new pavement. Meet existing thickness of surface and base courses, but not less than specified for new work.

B. All joins shall be compacted to 92.0% +/- 2.0% of RICE, taken fully on each side of joint, every 200 lineal feet. RICE values shall be used in calculating Relative Compaction according to AASHTO T166.

3.10 FIELD QUALITY CONTROL

A. 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, for QA purposes only. Refer to 1.12 and 1.13 in Section 01400: Quality Control for designation of QA vs QC responsibilities.

B. 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 schedule with the Owner so to provide the testing agency contractually required, 24-hour, one business day, advance notification to schedule tests. Refer to City's General Contract

Conditions – VII.66: Inspection of Work and City's Standard Specifications for Road and Bridge Construction – Quality Control and Quality Assurance.

C. Testing Agency will test in-place pavement for density and thickness.

D. Asphalt density testing:
   1. Every one-hundred fifty (150) lineal feet per driving lane.
   2. Every 2,000 square feet of parking lot
   3. Densities shall be between ninety-two percent (92%) and ninety-six percent (96%) of the RICE unit weight

E. Contractor to verify final surfaces are of uniform texture, conforming to required grades and cross sections

F. The Contractor will core the pavement as required by the testing agency for field density tests in accordance with AASHTO T 230, Method B, or for field calibration of nuclear density equipment in accordance with ASTM D 2950.
   1. Testing agency will take not less than 4-inch diameter pavement specimens
   2. At the testing agency's discretion, cores may be required at the beginning of placement of each pavement layer or change of mixture materials or gradation.
   3. Untested areas during placement will require cores to be taken to verify compaction
   4. Contractor to repair holes from test specimens

G. For each completed course or from locations directed by the testing agency, and at a minimum, a representative asphalt pavement sample shall be taken from the first one thousand (1,000) tons, and all mix properties shall be verified. The percent voids filled with asphalt cement, Hveem stability, and Lottman shall be verified at a minimum of every ten-thousand (10,000) tons. Asphalt testing shall comply with ASTM D1559. Two copies of all test reports shall be submitted directly to the Engineer.

H. Acceptable density of in-place course materials is between 92 and 96 percent of the recorded laboratory RICE unit weight. Immediately re-compact asphaltic concrete not conforming to acceptable density. Remove and replace all sections not in conformance density requirements

I. Thickness: Variations from drawings
   1. Base course: 1/4-inch +
   2. Remove and replace paving less than minimum thickness

J. Grade Tolerance: ±0.1 feet

K. Surface Smoothness
   1. Test using a 10-foot straight edge applied parallel to direction of drainage
   2. Advance straight edge five feet, maximum 1/4-inch per foot from nearest point of contact
   3. Do not permit pockets or depressions where water may pool
   4. Remove and replace areas, deficient in smoothness. Overlay corrections may be permitted only if acceptable to Engineer

L. Inspection: The work of this section is subject to the inspection and approval of the engineer and/or owner. The following inspections are required:
   1. Protection of adjacent property
   2. Staking and establishment of elevations
   3. Establishment and compaction of subgrade
   4. Placement and compaction of bituminous base course and wearing surface
   5. Final inspection
   6. Obtain approval of each element of work listed above in sequence of its completion before proceeding with the next item

3.11 CLEANING

A. After completion of paving operations, clean surfaces of excess or spilled asphalt materials to the satisfaction of Engineer

3.12 PROTECTION OF FINISHED WORK

A. After final rolling, do not permit vehicular traffic on asphalt concrete pavement until it has cooled and hardened and in no case sooner than 6 hours

B. Provide barricades and warning devices as required to protect pavement and the general public

3.13 WARRANTY

A. Provide installer's 2-year written warranty endorsed by the contractor warranting the pavement from creeping, shoring, cracking, softening, settling, ponding and other defects due to improper placing or defective materials. Replace defective materials upon notification by the owner in accordance with the requirements of the original work.

3.14 SCHEDULE OF MIX PLACEMENT

A. Refer to Drawings for asphalt thickness and subgrade requirements.

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

F. City of Grand Junction Standard Specifications of Road and Bridge Construction Section 212: Seeding, Fertiliser & Sodding

G. Rocksol Consulting Group Geotechnical Investigation Report Kannah Creek Flowline Upper 3 Miles (dated Dec. 20, 2022)

H. RockSol Consulting Group Geotechnical Memorandum (dated March 16, 2021)

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 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 the City of Grand Junction and Mesa County.

B. Provide certificate 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 See City of Grand Junction specification section 212 of the Road and Bridge Construction chapter for approved seed mixes.

2.3 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

2.4 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

3.4 SEEDING METHODS

A. All seeding shall be installed by broadcasting, drilling method, or hydroseed. Small areas of restoration may be broadcast seeded if directed by Engineer.

B. 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

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 revegetation seed has germinated

D. 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

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