STANDARD SPECIFICATIONS FOR WATER LINE CONSTRUCTION

DIVISION 2

LA PLATA ARCHULETA WATER DISTRICT
REVISED JUNE 9, 2020

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TECHNICAL SPECIFICATIONS

TABLE OF CONTENTS

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DIVISION 2

UNDERGROUND & SITE WORK

SECTION 02100
CLEARING AND GRUBBING

PART 1: GENERAL

1.01 SCOPE

a. This section includes grubbing, stripping and otherwise clearing of the construction site in accordance with the drawings and as specified herein or ordered.

b. This work includes the removing and disposal of all trees, roots, stumps, vegetation and debris as necessary to accommodate new construction or to grade the site and the preservation of all vegetation and other objects designated to remain.

1.02 SUBMITTALS

a. Spoil Site Permit: When the material and debris resulting from the clearing and grubbing operations are disposed of at locations off the project, the Contractor shall obtain and submit written permission from the District of the property upon which the material and debris is to be placed. Contractor shall provide executed copy of permit to dispose of waste materials from appropriate jurisdictions.

1.03 PROTECTION

a. The Contractor shall provide the necessary protection to prevent damage, injury or loss of property at the site or adjacent thereto, including wetland areas, trees, shrubs, lawns, walks, pavements, roadways, monuments, structures and utilities not designated for removal, relocation or replacement in the course of construction.

PART 2: PRODUCTS

2.01 MATERIALS

a. Paint required for cut or scarred surfaces of trees or shrubs designated to remain shall be a suitable product designed for the specific application.

PART 3: EXECUTION

3.01 GENERAL

a. Information on the drawings showing existing conditions does not constitute a guarantee that other items may not be found or encountered. All such items not shown on the drawings or specified to remain that may interfere with the project shall be removed, upon approval of the Owner, as a part of this contract at the expense of the Contractor.

b. Verify actual field conditions. Inspect related work and adjacent surfaces. Report all conditions which prevent proper execution of this work to the Owner/Engineer.

c. All materials and work shall conform to the requirements of the Building Code and other agencies of the governing body having jurisdiction over the work.

d. Contractor shall obtain permits and inspections and pay all fees required for this work.

e. All companies or authorities owning conduits, wires or pipes running over or under property shall be notified so that arrangements can be made for the removal of any utilities and the capping of any pipes that are to be abandoned, if so required. Record Location of caps and abandoned lines shall be recorded in the as-builts.

f. Existing trees to remain, as noted on plans. Do not disturb or dig into root system.

3.02 CLEARING AND GRUBBING

a. All environmental plans, permits, practices, and laws shall be considered and adhered to prior to execution of any items in this Section.

b. Only those trees and shrubs shall be removed that are in actual interference with excavation or grading work and such removal shall be subject to approval by the Owner or Engineer 9if so assigned). The Owner or Engineer (if so assigned) reserves the right to order additional trees or shrubs removed at no additional cost to the Owner if, in his opinion, they cannot be maintained or have been damaged by the Contractor's operations.

c. All trees, stumps, vegetation and debris not designated to remain shall be cleared and/or grubbed, except for special treatment in non-engineered fills as follows:

1) In locations to be seeded, stumps, roots and other protruding obstructions shall be removed to a minimum of 6-inches below the final ground surface.

2) Undisturbed stumps, roots and non-biodegradable solid objects which will be at least 3 feet below the subgrade or embankment surfaces will not require removing, providing they do not extend more than 6-inches above the existing ground surface.

d. Clear area within work limits of all surface vegetation, including trees, stumps, down timber, brush, roots, weeds, grasses and deleterious matter.

e. Clear and remove all internal fences from the site. Perimeter property line fences to remain in place unless otherwise shown or directed.

f. All timber shall become the property of the Contractor unless otherwise specified.

g. Tree branches which extend into the work areas within 8 feet vertically from finish grade shall be clean-cut off next to the trunk and the cuts shall be treated with an approved tree sealant.

h. Remove no trees, shrubbery or other vegetation outside of designated clearing limits. Trees and shrubs not designated for removal to be protected from damage

during clearing and grubbing operations. Roots shall be neatly cut where removal is required.

i. Protect existing facilities, adjacent properties and survey monuments from damage.

j. Comply with safety requirements per Federal, State and local codes.

k. Cleanup adjacent work areas of all litter and debris resulting from the Contractor's operations under this section.

l. The clearing and grubbing shall extend 5 feet beyond the top of the backslope and/or toe of embankment, unless otherwise shown or directed.

m. At all times, the Contractor shall remain within the property lines and/or easement areas.

n. Except in areas to be excavated, all holes resulting from the clearing and grubbing operations shall be backfilled and compacted in accordance with applicable sections contained herein.

3.03 STRIPPING

a. Areas of excavation or embankment shall be stripped a minimum of six-inches of roots, sod, grass, crop residue, decayed vegetable matters and other organic materials, unless otherwise shown or directed.

3.04 DISPOSAL OF DEBRIS

a. Debris resulting from the clearing and grubbing operations shall be disposed of at spoil sites in a legal manner, in full compliance with applicable codes and ordinances. Stumps, branches, roots, etc. shall not be disposed of within the project limits.

PART 4: SPECIAL PROVISIONS

4.01 MEASUREMENT AND PAYMENT

a. When not listed in the bid, all "CLEARING AND GRUBBING" costs will be considered incidental work for which no separate payment will be made.

END OF SECTION

SECTION 02200
EARTHWORK

PART 1: GENERAL

1.01 SCOPE

a. This section includes unclassified excavation, embankment fill, and common fill. All work to be completed in accordance with the drawings and as specified herein or ordered. This section does not include trench excavation and backfill.

1.02 SUBMITTALS

a. Spoil Site Permit: When the material and debris resulting from the excavation operations are disposed of at locations off the project, the Contractor shall obtain and submit written permission from the Owner of the property upon which the material and debris is to be placed. Contractor shall provide executed copy of permit to dispose of waste materials from appropriate jurisdictions.

1.03 PROTECTION

a. The Contractor shall provide the necessary protection to prevent damage, injury or loss of property at the site or adjacent thereto, including wetland areas, trees, shrubs, lawns, walks, pavements, roadways, monuments, structures and utilities not designated for removal, relocation or replacement in the course of construction.

1.04 RELATED WORK

a. Clearing and Grubbing is included in Section 02100.

b. Trench Excavation and Backfill is included in Section 02226.

c. Sedimentation and Erosion Control is included in Section 02270.

1.05 TESTING

a. Compaction testing will be conducted on all fill material. Owner shall retain the services of a geotechnical engineering firm to provide all testing at Owner's expense for first test. Any tests that fail to meet the requirements of these Specifications shall be retested at Contractor's expense.

PART 2: PRODUCTS

(NOT USED)

PART 3: EXECUTION

3.01 GENERAL

a. Information on the drawings showing existing conditions does not constitute a guarantee that other items may not be found or encountered. All such items not shown on the drawings or specified to remain that may interfere with the project shall be removed, upon approval of the owner, as a part of this contract at the expense of the Contractor.

b. Verify actual field conditions. Inspect related work and adjacent surfaces. Report all conditions which prevent proper execution of this work to the Owner/Engineer.

c. All materials and work shall conform to the requirements of the Building Code and other agencies of the governing body having jurisdiction over the work.

d. Contractor shall obtain permits and inspections and pay all fees required for this work.

e. All companies or authorities owning conduits, wires or pipes running over or under property shall be notified so that arrangements can be made for the removal of any utilities and the capping of any pipes that are to be abandoned, if so required. Record location of caps and abandoned lines.

3.02 UNCLASSIFIED EXCAVATION

a. Excavation shall be made to the lines and grades shown on the Plans. Owner will provide survey staking for the excavation and fill on a one-time basis. Any additional survey will be at the expense of the Contractor.

b. Contractor shall provide dust control for all excavation.

c. Comply with safety requirements per Federal, State and local codes.

d. Cleanup adjacent work areas of all litter and debris resulting from the Contractor's operations under this section.

3.03 COMMON FILL

a. Prior to beginning fill operations, the area shall be cleared and grubbed as specified in Section 02100.

b. Fill material shall be placed in lifts to suit the specified compaction requirements to the lines and grades required, making allowances for settlement and placement of cover materials (i.e. topsoil, sod, etc.). Soft spots or uncompacted areas shall be corrected.

c. Fill material shall not be placed on frozen surfaces, or surfaces covered by snow or ice. Fill material shall be free of snow, ice, and frozen earth.

d. Fill material shall not be placed and compacted when the materials are too wet or too dry to properly compact. The in-place moisture content shall be no more than 3%

above optimum nor less than 2% below optimum as determined by the laboratory test of the moisture-density relation appropriate to the specified compaction requirements. Fill material shall be compacted to 95% of modified proctor value.

3.04 DISPOSAL OF UNSUITABLE, WASTE, OR SURPLUS EXCAVATED MATERIAL

a. Unsuitable, waste, or surplus excavated material shall be removed and disposed of off-site. Materials may be temporarily stockpiled in an area within the limits of construction that does not disrupt construction activities, create any nuisances or safety hazards, or otherwise restrict access to the work site.

PART 4: SPECIAL PROVISIONS

4.01 MEASUREMENT AND PAYMENT

a. When not listed in the bid, all "EARTHWORK" costs will be considered incidental work for which no separate payment will be made.

END OF SECTION

SECTION 02213
ROCK AND BOULDER EXCAVATION

PART 1: GENERAL

1.01 SCOPE OF WORK

a. Furnish all labor, materials, equipment, and incidentals required and excavate and dispose of rock and boulders as shown on the Drawings and as specified herein.

b. If blasting is required to loosen rock and boulders for excavation; CONTRACTOR must obtain the necessary local and regional permits. CONTRACTOR is responsible for coordination with and obtaining approval from La Plata County for all aspects of the Utility Permit including all blasting requirements and restrictions including submittals outlined in this Section. If blasting is performed, provide the services of a licensed professional engineer, registered in the State of Colorado, to prepare blasting plans and supervise blasting operations.

c. Payment for rock excavation shall be made in accordance with the unit price schedule in the Bid Form. CONTRACTOR will assist ENGINEER in making measurements of rock excavation quantities in the field using methods specified.

1.02 RELATED WORK

a. Earthwork for pipe installation and backfilling is included in Section 02226.

1.03 SUBMITTALS

a. Submit to the ENGINEER, in accordance with Section 01306, the proposed methods of excavation for the various portions of the work; such Submittals shall be for information only. CONTRACTOR will remain responsible for means, methods and techniques, as well as all safety considerations. Submit for approval means, methods, and procedures for verifying measurement and payment for rock excavation quantities.

b. Submit three copies of the pre-blast survey, including three sets of photographs and/or video recordings, as specified herein. Do not submit blasting plans unless requested by ENGINEER (such submittals will be for information purposes only).

c. Blasting plans shall be prepared and signed by a licensed professional engineer, registered in the State of Colorado, having a minimum of 5 years of professional experience in blasting operations. Submit an original and three copies of the licensed professional engineer certification, stating that blasting plans have been prepared by the professional engineer, and that the professional engineer will be responsible for their execution.

d. Submit three copies of blasting permits required by local agencies and authorities. Original permits shall be prominently displayed on the site prior to initiating blasting operations.

e. Submit three copies of blasting records as specified herein.

1.04 DELIVERY, STORAGE, AND HANDLING

a. The delivery, storage and handling of explosives shall be performed only by qualified persons licensed to use explosives in the State of Colorado and shall be in full conformance with all laws, regulations, ordinances, and practices. Extreme care shall be taken to avoid injury or damage to persons or property.

b. Storage, transportation and handling of explosive materials requires full compliance with the rules and regulations of OSHA. Storage of explosives onsite will not be allowed.

1.05 DEFINITIONS

a. Rock: Reference DEFINITIONS in Section 02226-1.06 a-2 for more specific classification of Rock Excavation – Where discrepancies exist, 02226 shall govern.

The removal of solid rock or rock fragments of such hardness and texture which cannot be loosened, broken up or removed by ripping in a single pass by a rock ripping bucket equipped with a stepped-tooth face of standard manufacturer's design adequately sized for use with and powered by a late model crawler-type hydraulic excavator (Caterpillar 325B L or equivalent). Removal methods require systematic drilling and blasting, chemical expanders, or jack (air or hydraulic) hammers. All boulders or detached pieces of solid rock more than 2.0 cubic yards in volume will be classified as rock excavation.

PART 2: PRODUCTS

(NOT USED)

PART 3: EXECUTION

3.01 PREPARATION FOR BLASTING

a. Perform a pre-blast survey for all structures and roadways within the influence range of blasting operations, or within 200-feet of the blast area, whichever is greater. The pre-blast survey shall consist of a close visual inspection, fully supported by photographs or video recordings, performed by, or under the supervision of, a licensed professional engineer experienced in such surveys. Insurance underwriter shall be present during such surveys.

b. Any damage noted after completion of blasting operations which cannot be determined from the pre-blast survey to be a pre-existing condition shall be presumed to have been caused by blasting operations. Such damage shall be repaired promptly and completely to the property owner's satisfaction to restore the condition of the property to that existing prior to blasting.

c. Maintain pre-blast survey records for a period of not less than 3 years following final completion and acceptance of work.

3.02 BLASTING PLANS

a. Prior to initiating blasting operations, a blasting plan shall be prepared by a licensed professional engineer. The plan shall include sketches to show blast locations; proximity to, and methods for protection of, existing structures and utilities; drill hole patterns, amount of charges, firing sequence and times; calculations of ground velocities, energy ratio, acceleration and displacement; and any other pertinent information required. Field monitoring methods and techniques shall also be addressed.

b. If required by local or state regulations, blasting plans shall be reviewed by the appropriate agency or authority and revised as required to meet with their approval.

3.03 BLASTING

a. Blasting operations shall be performed under the direct supervision of a licensed professional engineer, by qualified blasting technicians licensed in the State of Colorado. Blasting operations shall be in full compliance with applicable state and local laws, regulation, ordinances and practices.

b. Blast locations shall be heavily matted to contain potential flying debris.

3.04 DISPOSAL OF ROCK AND BOULDERS

a. Fragmented rock with dimensions not exceeding 6-inches in any direction may be mixed with common fill and used as common fill in accordance with Section 02226.

b. Rock and boulders may be crushed and screened for reuse in the work, provided that the resultant materials meet the requirements for gravel, crushed stone, or structural fill.

c. Unused rock and boulders shall be removed and disposed of off-site at the CONTRACTOR'S expense.

PART 4: SPECIAL PROVISIONS

4.01 MEASUREMENT AND PAYMENT

a. All "ROCK AND BOULDER EXCAVATION" costs will be paid for as indicated below:

1) Rock excavation will be paid for on a cubic yard basis and or at the prices named in the bid. Measurement will be as outlined below.

a) The length will be the entire horizontal distance measured along the centerline of the trench.

b) The width for measurement purposes shall be 12 inches greater than the maximum outside diameter of the pipe.

c) The measurement for depth will be the vertical distance from the top of the rock to the depth shown on the plan. The depth will be measured at intervals of 25 feet along the centerline of the trench and the average depth between measuring points will be the depth used for computing the depth of rock.

b. Measurement and payment for rock excavation will be in addition to the payment for trench excavation and backfill. Payment for rock excavation shall include full compensation for all work necessary to excavate the rock material. Price indicated also includes the cost for embedment and pipe zone materials.

END OF SECTION

SECTION 02226
TRENCH EXCAVATION AND BACKFILL

PART 1: GENERAL

1.01 SCOPE

a. This section includes all trench excavation, backfill and related work for the construction of the designated pipelines and other incidental work.

b. Cooperation with Utilities

1) In accordance with C.R.S. 9-1.5-103 et seq. (Excavation Requirements – Plans and Specifications), the Owner and Engineer will certify in the project plans and specifications which Quality Level (A-D) the depicted existing known utilities are, pursuant to the most recent version of the ASCE Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data

2) (CI/ASCE 38-02). The Contractor shall not be relieved of its responsibility to comply with the requirements set forth therein and shall not rely solely on the Owner's or Engineer's plans and specifications when completing its work with respect to existing buried utilities. The Contract will indicate those utility items which are to be relocated or adjusted by the utility owner or which are to be relocated or adjusted by the Contractor. The Contractor shall consider in the bid proposal all of the permanent and temporary utility facilities in their present or relocated positions as shown in the Contract and as revealed by site investigation. Utility delays due to changes which are the responsibility of the Contractor will be considered nonexcusable delays. Utility delays beyond the Contractor's control and not due to the fault or negligence of the Contractor shall be documented by the Contractor and tied to the project's critical path schedule Delays will be determined to be compensable or non-compensable. The Contractor and the Engineer shall meet with the utility owners as often as necessary to coordinate and schedule relocations or adjustments. Additional compensation will not be allowed for foreseeable coordination, inconvenience, or damage sustained due to interference from the utility facilities or the removal or relocation operations as indicated in the Contract.

3) If utility facilities or appurtenances are found that are neither identified in the Contract, nor revealed by location services or site investigation, the Engineer will determine whether adjustment or relocation of the utility is necessary. The Engineer will make arrangements with either the utility owner or the Contractor to accomplish necessary adjustments or relocations

when not otherwise provided for in the Contract. Extra work will be considered for payment in accordance with the Schedule of Values or by approval of the Owner.

4) Where the Contractor's operations are adjacent to properties of railroad, telegraph, telephone, power, or other utility companies, to which damage might result in considerable expense, loss, or inconvenience, work shall not commence until arrangements for the protection of the utilities have been made.

5) If utility services are interrupted, the Contractor shall promptly notify the utility owner and shall cooperate in the restoration of service. Repair work shall be continuous until the service is restored. Work shall not be undertaken around fire hydrants until provisions for continued service have been approved by the local fire authority.

c) Trench Excavation and Backfill:

1) Work of making all necessary trench excavations for the construction of all contract work.

2) It is the Contractor's sole responsibility to ensure strict adherence to local, State and Federal safety guidelines, best practices, regulations, and laws related to trench safety. This includes but is not limited to OSHA regulations and due respect for required cover over pipe and trench depth; soil type and conditions; local area conditions (e.g. vibration, traffic, moisture); resulting trench sloping, benching, and trench safety equipment (e.g. shoring, sheeting, piling); and proper personnel protection equipment and practices (e.g. PPE, safe egress, overhead equipment, etc.). It is the Contractor's responsibility to determine when and where engineered trench safety is needed and to separately obtain such engineering in accordance with law and regulations. As trenching safety is specific to soil types encountered during excavation, the Owner, Owner's Engineer, or their agents make no claim to the need or absence of need for site-specific trenching safety requirements in the Plans or scope of the Work. The Owner, Owner's Engineer, or their agents shall in no way be responsible for un-safe trenching acts or omissions by the Contractor, or any resulting damage, injury, or death due to the Contractor's trenching activities.

3) Furnishing, placing and use of sheeting, shoring and sheet piling necessary in excavating for and protecting the work and workmen.

4) Performing all pumping and fluming necessary to keep the trenches free from water.

5) Providing for uninterrupted flow of existing drains and sewers and the temporary disposal of water from other sources during the progress of the work.

6) Supporting and protecting all structures, pipes, conduits, culverts, posts, poles, wires, fences, buildings and other public and private property adjacent to the work.

7) Removing and replacing existing sewers, culverts, pipelines and bulkheads where necessary.

8) Removing all surplus excavated material.

9) Performing all backfilling, grading and compaction to the limits specified or ordered in the Plans or by the Engineer.

10) Restoring all property damaged as a result of the work included under this section.

11) Maintaining proper wastewater disposal with respect to local environmental conditions.

6) The Work includes obtaining and transporting suitable fill material from off-site when onsite material is not available.

7) The Work includes transporting surplus excavated material, including all removed pavement and road base, not needed for backfill at the location where the excavation is made, to other parts of the work where filling is required, or disposal of all surplus on other sites provided by the Contractor or as directed by the Owner

1.02 LABORATORY SERVICES

a. Where testing is required by the local governing authority, i.e. County/City Road Department or CDOT, or at direction of the Owner, Owner will provide for the backfill compaction testing services as described below.

b. For General Conditions:

1) Sieve Analysis (ASTM C - 136) : One test for each select material source and type:

a) Selected bedding and pipe zone backfill material.
b) Crushed rock aggregate base course material.
c) Pit run aggregate material.

2) Backfill Compaction :

a) One moisture density curve (AASHTO T-180) for each size and type of material used for backfill. The maximum dry weight and optimum moisture content shall be indicated. The cost of all retests

required due to any unauthorized change in backfill material shall be borne by the Contractor.

b) Test consolidated backfill material in trenches around pipes for conformance with specified "Compaction Requirements," contained herein:

(1) Where tests indicate insufficient values, perform additional tests as required by the Owner's Representative. Testing shall continue until specified values have been attained by additional compaction effort.

(2) Retests shall be referenced to the corresponding failing test. The cost of all retests shall be borne by the Contractor.

c. For conditions within CDOT ROW, in or impacting roads:

1) for work within CDOT ROW that is within the four (4) feet of the road's 45-degree load prism, compaction and testing requirements are as follows (see CDOT standards for full requirements):

b) Structure Backfill (Class 1) shall be compacted to a density of at least 95 percent of maximum dry density determined in accordance with AASHTO T 180 as modified by CP 23. Backfill shall be compacted at ± 2 percent of Optimum Moisture Content (OMC).

c) Structure Backfill (Class 2 and 3) shall be compacted to a density of at least 95 percent of maximum dry density. The maximum dry density and OMC for A-1, A-2-4. A-2-5 and A-3 materials will be determined in accordance with AASHTO T 180 as modified by CP 23. The maximum dry density and OMC for all other materials will be determined in accordance with AASHTO T 99 as modified by CP 23. Materials shall be compacted at ± 2percent of Optimum Moisture Content (OMC). Materials having greater than 35 percent passing the 75 μm (No. 200) sieve shall be compacted at 0 to 3 percent above OMC.

1.03 CONSTRUCTION WITHIN ROADWAY AND RAILROAD RIGHT-OF-WAYS

a. Permits : The Contractor shall be responsible for ensuring that all permits required for construction are obtained.

b. Traffic Control Plans: The Contractor will be responsible for developing and executing approved traffic control and safety plans as required by CDOT, La Plata County (LPC) or other local governing authority. Such plans to be submitted and approved prior to work in subject areas commencing.

c. Contractor shall be responsible for acquisition, placement, and removal of all traffic protection barriers (e.g. Concrete K-rails / Jersey blocks, water barrels, etc.), as well as any other traffic control materials, devices, flagging, signage or other needs, as part of the Work.

d. Contractor shall provide bonds and insurance as required by affected agency prior to proceeding with any work.

e. Notification : The Contractor shall give written notice to appropriate officials of the affected Federal or State Highway Department, City, County or railroad at least five days, not including weekends and holidays, before starting construction within highway or railroad rights-of-way and as required under other roadways.

f. Flowable Fill: Where trench excavation is within 4 feet of the edge of roadway, flowable fill (Controlled Low-Strength Material-CLSM) self-leveling backfill may be required. CLSM shall be low permeability and easily excavated as specific qualities.

g. Road work within CDOT ROW shall conform to CDOT standards and specifications for backfill, compaction, testing and paving.

h. Road work within LPC ROW shall conform to LPC standards and specifications for backfill, compaction, testing and paving.

1.04 SUBMITTALS

a. Submittals shall be in accordance with the requirements of these Contract Documents and shall include:

1) When excess excavated material is disposed of at locations off the project site, the Contractor shall obtain and submit written permission from the Owner of the property upon which the material is to be placed.

2) Executed copy of permit(s) to dispose of material specified under this section.

3) Flowable Fill mix design where applicable.

1.05 PROTECTION

a. Test Pits: The Contractor shall dig such exploratory test pits as may be necessary in advance of excavation to determine the exact location and elevation of subsurface structures, pipelines and conduits which are likely to be encountered and shall make acceptable provision for their protection, support, and maintenance in operation.

b. Sheeting, Shoring, and Bracing:

1) The Contractor shall furnish and install adequate sheeting, shoring, and bracing to maintain safe working conditions, and to protect newly built work and all adjacent and neighboring structures from damage by settlement.

2) Bracing and sheeting shall conform to the recommendations in the Occupational Safety and Health Administration Standards for Construction (OSHA). A trench box may be used in lieu of sheeting and bracing as permitted by OSHA. Unless otherwise approved, all trench support materials shall be removed in a manner that will prevent caving of the sides and movement or damage to the pipe.

3) Bracing shall be arranged so as not to place a strain on portions of completed work until the construction has proceeded far enough to provide ample strength. Sheeting and bracing may be withdrawn and removed at the time of backfilling, but the Contractor shall be responsible for all damage to newly built work and adjacent and neighboring structures.

4) Unless engineered solutions are required by conditions and regulations, all sheeting, shoring, and bracing shall be of Contractor's design. If engineered solutions are required, it is the Contractor's responsibility to obtain them. In all cases, such sheeting, shoring and bracing shall be in accordance with all Federal, State and Local codes and requirements.

c. Removal of Water:

1) The Contractor shall at all times during construction provide and maintain ample means and devices with which to remove promptly and dispose of properly all water entering the excavations or other parts of the work and shall keep said excavations dry until the pipelines to be placed therein are completed. In water bearing soil, well points and/or sheeting shall be supplied, together with pumps and other appurtenances of ample capacity to keep the excavation dry.

2) The Contractor shall dispose of water from the work in a suitable manner without damage to adjacent areas of environmental concern, property or structures.

3) Contractor shall provide silt fences, straw bales, and/or sedimentation basins as required to clarify waters prior to discharge in accordance with Federal, State and Local requirements.

1.06 DEFINITIONS

a. Classification of Excavated Materials

1) Unclassified Native Material shall be defined as all material not classified as rock excavation or unsuitable material that is removed from the trench by required excavation.

2) Rock Excavation shall be defined as follows:

a) "Rock excavation shall consist only of that solid bedrock or ledge rock and boulders over two (2) cubic yards in volume which cannot be removed by a D8K (or approved equal) with four barrel hydraulics and dual rippers or 90,000 pound class Excavator (P.C. 400 Komatsu or 235 Caterpillar or approved equal) with single shank ripper on back of bucket, which shall not be more than thirty-six inches (36") in width, but which requires systematic drilling, blasting or the use of rock splitters, pneumatic hammers and wedges. All D8K's and 90,000-pound class Excavators shall be in excellent operating condition and operated by personnel competent to operate like machinery."

b) "Removal of existing concrete and asphaltic surfaces does not qualify as rock excavation."

3) Unsuitable Materials

a) Unsuitable material shall be defined as all material that is either too wet, contains grass, roots, brush or other vegetation, large rocks or is classified under ASTM D 2487 as Pt. OH, CH, MH or OL and materials which cannot be compacted to achieve the required percentage of maximum density for the intended use shall not be used in the work.

b. Trench Backfill Zones

1) Pipe Embedment Zone - The area from 4-inches under the pipe to 1/6 the outside pipe diameter distance above the bottom of pipe for the width of the trench.

2) Pipe Zone - The area from the top of the pipe embedment zone to 6-inches above the pipe for the width of the trench.

3) Trench Backfill Zone - The area from 6-inches above the pipe to bottom line of surface restoration for the width of the trench.

c. Trench Classifications

1) Class I Trench - Class I trench shall have select granular material in all three zones for backfill material. For use under paved or graveled roadways, road shoulders, gravel, and paved driveways, or as directed by the Engineer. The type of material required for each backfill zone shall be as follows:

Zone	Material
Pipe Embedment Zone	Class 3
Pipe Zone	Class 3
Trench Backfill Zone	Class 3 (Top 12" may be CLSM (flow fill))

2) Class II Trench - Class II trench shall have select granular material in the pipe embedment and pipe zones and suitable native excavated material in the trench backfill zone to 6-inches below finish grade. The top 6-inches shall be select aggregate base course material as specified. For use under gravel roads, driveways, road shoulders and future or current paved areas, or as directed by the Engineer.

Pipe Embedment Zone	Class 3
Pipe Zone	Class 3
Trench Backfill Zone	Class 2 or 3

3) Class III Trench - Class III trench shall have select granular material in the pipe embedment zone and native excavated material in the pipe zone and trench backfill zone. For use under unimproved open areas or under gravel roads, road shoulders and driveways or future paved areas with the top surface of select aggregate base course material to the depth specified or shown on the drawings or as directed by the Engineer.

Pipe Embedment Zone -	Class 3
Pipe Zone -	Class 2
Trench Backfill Zone -	Class 2 or 3

4) Class IV Trench - Class IV trench shall have unclassified native excavated material in the pipe embedment and pipe zones and unclassified native excavated material in the backfill zone for backfill material. For use under unimproved open rural area or as directed by the Engineer.

Pipe Embedment Zone -	Class 2
Pipe Zone -	Class 2
Trench Backfill Zone -	Class 2

PART 2: PRODUCTS

2.01 SELECTED GRANULAR BACKFILL MATERIAL REQUIREMENTS

a. Selected backfill material shall consist of well graded pit run, sand or crushed rock or screenings, meeting the following requirements:

(a) Class 1 structure backfill shall meet the following gradation requirements:

Sieve size	Mass Percent Passing – Square Mesh sieves
50 mm (2 inch)	100 %
4.75 mm (No.4)	30-100
0.30 mm (no. 50)	10-60
0.075 mm (no. 200)	5-20

In addition, this material shall have a liquid limit not exceeding 35 and a plasticity index of not over six when determined in conformity with AASHTO T 89 and T 90 respectively.

(b) Class 2 structure backfill shall be composed of suitable materials developed on the project. To be suitable for use under this classification, backfill shall be free of frozen lumps, wood, or other organic material. If the material contains rock fragments that, in the opinion of the Engineer, will be injurious to the structure, the native material shall not be used for backfilling and the Contractor shall furnish Class 1 structure backfill material at the contract unit price. If contract unit price does not exist for Class 1 structure backfill, it will be paid for in accordance with subsection 104.03.

(c) Class 3 structure backfill shall be a sandy gravel and meet the following gradation:

Sieve size	Mass percent Passing – Square Mesh sieves
9.5 mm (3/8 inch)	90-100 %
4.75 mm (No.4)	45-80
0.075 mm (no. 200)	5-12

1) General Condition CLSM: All flowable fill (CLSM) for this project shall be excavatable with a maximum 28-day strength of 150 psi. Flowable fill will consist of a mixture of Portland cement, fly ash, fine aggregate, air entraining admixture, and water. Flowable fill is intended to contain a low cementitious content for reduced strength development.

2) CDOT Structure Backfill (Flow-Fill) shall conform to CDOT standards

2.02 UNCLASSIFIED NATIVE MATERIAL

a. Excavated material free of vegetable matter, large rocks and debris.

b. Excavated material approved by the Engineer for use as backfill in designated trench zones.

c. Individual particles no larger than 8 inches in diameter.

2.03 FOUNDATION STABILIZATION

a. Gravel or crushed aggregate with 100% passing the 1.5-inch sieve size or Engineer approved clean, well graded granular material.

b. Excavation Below Grade: Where the excavation is carried beyond or below the lines and grades shown on the plans or staked, the Contractor shall, at his own expense, refill all such excavated space with required pipe bedding material.

c. Unstable Trench Bottom Where the excavation is found to consist of muck, organic matter or any other material that the Engineer determines to be unsuitable for supporting the pipe, an additional depth shall be excavated as directed by the Engineer and replaced with an approved granular stabilization material. Payment shall be made on the unit price provided in the bidding schedule, or upon the Owner's approval. Regardless of revised depth, trench safety (including but not limited to sloping, benching and shoring methods) shall remain the Contractor's responsibility

PART 3: EXECUTION

3.01 PREPARATION

a. The site of an open cut excavation shall be first cleared of all obstructions preparatory to excavation. Wherever paved or surfaced streets are cut, saw wheel or approved cutting devices shall be used. Width of pavement cut shall not be less than 6-inches greater than trench width. All cut or broken pavement shall be removed from site during excavation.

b. The Contractor shall maintain street traffic at all times and erect and maintain barricades, warning signs, traffic cones, and other safety devices during construction in accordance with Manual of Uniform Traffic Control Devices (MUTCD) to protect the traveling public. Provide flagmen as required during active work in roadway areas. With respect to work in CDOT ROW, Contractor shall adhere to the Contractor-developed and CDOT-approved Traffic Control Plan; such controls may be required to extend beyond the CDOT ROW.

c. Intent of specifications is that all streets, structures, and utilities be left in condition equal to or better than original condition. Where damage occurs and cannot be repaired or replaced, Contractor shall purchase and install new material which is satisfactory to the District and Property Owner. Plans and/or specifications cover and govern replacement and restoration of foreseeable damage.

d. The operations shall be confined to the work limits provided. Avoid encroachment on, or damage to, private property or existing utilities unless prior arrangements have been made with copy of said arrangement submitted to Engineer.

3.02 TRENCHING

a. Excavation for trenches in which pipelines are to be installed shall provide adequate space for workmen to safely place and joint the pipe properly, but in every case the trench shall be kept to a minimum width. Where shown, the width of trench at the top of the pipe shall not exceed the limits specified or as shown on the drawings.

b. The width of the trench at the top of any trench segment is subject to the Contractor's determination of soil type, specified pipe cover, and resulting safe trenching requirements, including sloping, benching or other Contractor-determined safe trenching methods. Plans may show specific limits on trench width and type in specific areas, which shall be adhered to and with respect to the abov-mentioned safety requirements.

c. Excavation shall be to the depth necessary for placing of appropriate Pipe Embedment Zone bedding material under the pipe as shown on the drawings. If over digging occurs, the trench bottom shall be filled to grade with compacted granular bedding material.

d. Unless otherwise permitted by the Engineer, trenching operations shall not be performed beyond the distance which will be backfilled and compacted the same day.

e. In general, backfilling and compaction shall begin as soon as the conduit is in approved condition to receive it and shall be carried to completion as rapidly as possible. New trenching shall not be started when earlier trenches need backfilling, or the surfaces of streets or other areas need to be restored to a safe and proper condition.

f. Where the excavation activities require the removal of portions of an abandoned pipeline, 2,500 psi concrete plugs shall be installed in the open ends of the pipe. Concrete plugs to be a minimum one and one-half (1-1/2) times the diameter of the pipe. Such plugs shall be located in the As-built drawings.

3.03 EXCAVATION OF UNSUITABLE MATERIALS

a. Unsuitable materials existing below the Contract bottom limits for excavation shall be removed as directed by the Engineer. Such excavation shall be conducted at a time when the Engineer or Owner's representative is present and shall not exceed the vertical and lateral limits as prescribed by the Engineer.

b. Where soft subgrade is encountered in which satisfactory pipe stability cannot be obtained by moisture control and compaction, the unstable material shall be excavated to the depth required by the Engineer.

c. Backfill with foundation stabilization material compacted in layers not exceeding 12-inches depth to required density and compaction.

3.04 DISPOSAL OF UNSUITABLE AND SURPLUS MATERIAL

a. All excavated materials which are unsuitable for use in backfilling trenches or around structures, and materials excavated that are in excess of that required for backfilling and for constructing fills and embankments, whether or not shown on the drawings, shall be disposed of by the Contractor at own expense and at disposal sites provided by him as may be required.

b. Surplus excavated material shall be disposed of at designated spoil sites in a legal manner, in full compliance with applicable codes and ordinances.

3.5 ROCK EXCAVATION

a. Where the bottom of the trench encounters ledge rock and/or boulders and large stones which meet the definition of "rock" as described herein, said rock shall be removed to provide 6-inches of clearance to each side and below all pipe and accessories.

b. Excavations below subgrade in rock shall be backfilled to subgrade with approved bedding material and thoroughly compacted.

c. Contractor is to excavate and remove the overburden exposing the rock surface, allowing the Engineer to profile the excavated trench for rock measurement. The profiling of the exposed rock surface shall be done prior to commencement of rock removal activities.

d. The Contractor shall comply with the requirements for the use and security of explosives as specified in the special conditions.

3.06 REMOVAL OF CONCRETE CURBS & SIDEWALKS

a. Where trench excavation requires removal of concrete curbs and/or sidewalks, the curbs and/or sidewalks shall be sawcut as required and removed at a tooled joint unless otherwise authorized by the Engineer.

b. The intention of this requirement is to facilitate the replacement of curbs and sidewalks to the joint pattern of the existing and surrounding curbs and/or sidewalks. The sawcut lines for concrete sidewalk and curb cuts shown on the drawings are schematic and not intended to show the exact alignment of such cuts.

3.08 BACKFILL AND COMPACTION

a. General

1) Backfill Immediately: All trenches and excavations shall be backfilled immediately after pipe is laid therein, unless otherwise directed by the Engineer. Under no circumstances shall water be permitted to rise in un-backfilled trenches after pipe has been placed.

2) Backfilling With Excavated Material: Where specified or directed, material excavated in connection with the work shall be used for backfilling, in accordance with the type of trench classification shown on the contract drawings. No material shall be used for backfilling that contains stones, rock, or pieces of masonry or asphalt greater than 8-inches, frozen earth, debris, earth with an exceptionally high void content, organic material, or marl.

3) In no case shall backfill material deposited by machinery be allowed to fall directly on the pipe and in all cases the bucket shall be lowered so that the shock of the falling backfill material will not cause damage.

4) All backfill material shall be placed with moisture-density control in accordance with the typical trench detail shown on the Standard Detail Sheets and/or in compliance with the Specifications. All approved backfill material for general work shall be adjusted to within three percent (3%) of the optimum moisture content prior to its placement in the trench. Jetting or water soaking trenches to achieve compaction of the backfill will not be permitted except when the backfill consists of gravel or other granular material having less than twenty percent (20%) by weight passing a No. 200 sieve.

5) All backfill in CDOT ROWs and within four (4) feet of the 45-degree load prism of a CDOT road shall comply with CDOT Standards for type, lifts, compaction and testing.

6) During initial backfilling, the Contractor shall take all necessary precautions to prevent movement or distortion of the pipe or structure being backfilled. Pipe Zone material shall be placed and compacted in even lifts on both sides of the pipe to above the top of the pipe. Above the pipe bedding and pipe zone the earth backfill material shall be placed full width in uniform layers not more than twelve (12) inches thick. Each layer shall be compacted to the required density with approved mechanical or hand tamping equipment. Special care shall be taken to compact the haunches of the pipe, including elimination of any voids.

7) Unless otherwise shown in the plans, the maximum layer thickness for flow-fill shall be 3 feet. Additional layers shall not be placed until the flow-fill has lost sufficient moisture to be walked on without indenting more than 2 inches. Damage resulting from placing flow-fill in layers that are too thick

or from not allowing sufficient time between placement of layers shall be repaired at the Contractor's expense. Mix designs and variations thereof shall be submitted for approval.

8) In CDOT ROW and within four (4) feet of the 45-degree load prism of a CDOT road, flow-fill mix shall conform with CDOT Class I or II Structure Fill (Flow-Fill) requirements.

b. Embedment Zone

1) Pipe embedment material shall be placed in the trench, compacted and shaped to provide continuous support for the pipe between joints or fittings.

2) Holes shall be provided for all joints or fittings as required to permit assembly.

3) Pipe shall be laid directly on the embedment materials.

c. Pipe Zone

1) Backfill shall be placed in uniform layers on both sides of the pipe. Each layer shall be placed, then carefully and uniformly tamped to the specified density so as to eliminate the possibility of lateral displacement of the pipe.

2) Care shall be taken to ensure that the material under the haunches of the pipe is sufficiently compacted.

d. Trench Zone

1) After the backfill has been placed and compacted around the pipe and structures to a height of 6-inches over the top as specified above, the remainder of the trench may be backfilled by machine.

2) The backfill material shall be deposited in horizontal layers not exceeding 12-inches thick, and each layer shall be thoroughly compacted to the specified density by approved methods before the succeeding layer is placed.

3) General Work Flowable fill (Flowfill) will consist of CSLM and shall be an alternate to 95% compaction of backfill within 4' of the edge of roadway within the roadway prism. The Contractor will have the option to achieve 95% compaction of a modified proctor for all backfill within the Trench Backfill Zone or to place flowfill up to within 8" of the top of the trench. Flow Fill will have a slump of 7 to 10 inches, when tested in accordance with ASTM C143.

4) Flowable Fill in CDOT ROW and within four (4) feet of the 45-degree load prism of a CDOT road shall conform to CDOT Class I or II Structure Fill (Flow-Fill) standards

e. Backfilling Under Existing Conduits

1) Where it is necessary to undercut or replace existing utility conduits and/or service lines, the excavation beneath such lines shall be backfilled the entire length with granular bedding material tamped in place in 6-inch layers to the required density. The granular bedding shall extend outward from the spring line of the conduit a distance of 2 feet on either side and thence downward at its natural slope.

f. Backfilling Under Pavement and Walks

1) Where any pavement, driveway, parking lot, curb and gutter, or walk is to be placed over a backfill area, granular material shall be used. The material shall be placed and compacted to the required density in accordance with the specification contained herein.

2) Where pavement or traveled road surface carries standard vehicle loads (e.g. HS-20), flowable fill requirements will be an allowable alternative. Flowable fill will be placed within the road prism beneath surfaced roads or shoulders and any trenching within 4 feet of 45-degree load prism the edge of the road.

3) Backfilling within CDOT ROW pavement shall conform to CDOT standards for Class I or II Structure Fill and/or Class I or II Structure Fill (Flow-Fill).

3.09 COMPACTION REQUIREMENTS

a. Compaction requirements for Type I, Type II and Type III trench shall be as follows:

1) Compaction of the pipe embedment and pipe zone shall be achieved by mechanical compaction in horizontal lifts or other approved method to ninety-two percent (92%) of the maximum dry density per AASHTO T-99 test method.

2) Compaction of the trench zone shall be achieved by mechanical compaction in horizontal lifts or other approved method to ninety-five percent (95%) of the maximum dry density per AASHTO T-99 test method.

b. Compaction requirements for Type IV trench shall be as follows except under gravel roads, driveways, road shoulders or future or current paved areas which shall be compacted in accordance with paragraphs "a.-1 and 2 above".

1) Compaction of the pipe embedment and pipe zone shall be achieved by mechanical compaction in horizontal lifts or other approved method to eighty percent (80%) of the maximum dry density per AASHTO T-99 test method.

2) Compaction of the trench zone shall be achieved by mechanical compaction in horizontal lifts or other approved method to eighty-five percent (85%) of the maximum dry density per AASHTO T-99 test method.

c. Compaction requirements for Trenches and backfill in CDOT ROW and within four (4) feet of the 45-degree load prism of a CDOT road shall conform to CDOT Standards.

1) Backfill shall consist of approved materials uniformly distributed in layers brought up equally on all sides of the structure or pipe. Each layer of backfill shall not exceed 12 inches and shall be compacted to the required density before successive layers are placed.

2) Structure Backfill (Class 1) shall be compacted to a density of at least 95 percent of maximum dry density determined in accordance with AASHTO T 180 as modified by CP 23. Backfill shall be compacted at ± 2 percent of Optimum Moisture Content (OMC).

3) Structure Backfill (Class 2) shall be compacted to a density of at least 95 percent of maximum dry density. The maximum dry density and OMC for A-1, A-2-4. A-2-5 and A-3 materials will be determined in accordance with AASHTO T 180 as modified by CP 23. The maximum dry density and OMC for all other materials will be determined in accordance with AASHTO T 99 as modified by CP 23. Materials shall be compacted at ± 2percent of Optimum Moisture Content (OMC). Materials having greater than 35 percent passing the 75 μm (No. 200) sieve shall be compacted at 0 to 3 percent above OMC.

4) Structure Backfill (Flow-Fill) shall not be compacted.

3.10 COMPACTION TESTS

a. Trenches shall be backfilled and consolidated in layers, as specified, to the existing ground surface. Where required by the local governing authority or at direction of the Owner all backfill shall be frequently tested to ensure that the required density is being attained. Contractor shall contact governing agency to determine their requirements for compaction testing, however, the minimum requirements for compaction testing shall be as follows:

1) General Work: For every 300 lineal feet of trench and each branch or section of trench less than 300 feet in length, at least one compaction test shall be performed for each two-foot vertical lift of backfill material placed. The first test shall be taken approximately two feet above the top of pipe and the last test shall be at the pavement subgrade or 6 inches below the ground surface in unpaved areas. Compaction tests shall be taken at random locations along the trench and wherever poor compaction is suspected. If any portion of the backfill placed fails to meet the

minimum density specified, the area shall be defined by additional tests if necessary and the material in the designated area shall be removed and replaced to the required density at the Contractors expense.

2) Work within CDOT ROW Under Pavement, General: For every 200 lineal feet of trench and each branch or section of trench less than 200 feet in length, at least one compaction test shall be performed for each two-foot vertical lift of backfill material placed. The first test shall be taken approximately two feet above the top of pipe and the last test shall be at the pavement subgrade or 6 inches below the ground surface in unpaved areas. Compaction tests shall be taken at random locations along the trench and wherever poor compaction is suspected. If any portion of the backfill placed fails to meet the minimum density specified, the area shall be defined by additional tests if necessary and the material in the designated area shall be removed and replaced to the required density at the Contractors expense.

3) **Special Conditions – Compaction Testing within the Gem Village Frontage Road**: The compaction testing within the Gem Village Frontage road (if trenching and backfilling are used in lieu of boring), shall require 1 test per every 100 CY of material at the vertical dimensions stated in 2), above.

4) All compaction testing shall be performed by a certified testing laboratory. The cost of the testing shall be borne by the Owner. It shall be the Contractor's responsibility to assist in coordinating the testing and to make necessary excavations in order to accommodate compaction tests at all locations designated.

b. The initial test series for each type of backfill material shall be continued until the method of consolidation employed has proven to attain the required compaction. Any change in the proven method of consolidation will not be permitted unless approved by the Owner's Representative.

c. Subsequent tests or series of tests shall be in locations and at depths ordered by the Engineer.

d. The cost of all retests shall be borne by the Contractor.

3.11 SURFACE RESTORATION AND CLEAN UP

a. Surface restoration shall conform to these Contract Documents where applicable. Restore ground surfaces to original conditions and elevations unless otherwise specified or directed.

b. Clean up and remove all excess materials, construction materials, debris from construction, etc. Replace or repair any fences, mailboxes, signs, landscaping, or other facilities removed or damaged during construction. Replace all lawns, topsoil, shrubbery, flowers, etc., damaged or removed during construction. Contractor to be responsible for seeing that lawns, shrubs, etc. remain alive. Leave premises in condition equal to or better than original condition before construction.

c. Immediately after any section of a completed pipeline has been tested and approved by the Owner or Engineer, the Contractor shall replace all paved surfaces removed or damaged by his operation. All pavement replacement shall be in accordance with the typical trench detail shown on the standard detail sheets, and in accordance with any permit requirements impose by the City,
County or State.

d. Unless otherwise approved, all asphalt pavements removed shall be replaced with hot mixed bituminous pavement and all aggregate base course material shall be Colorado Department of Transportation, Class 6 Aggregate Base Course. Paved surfaces shall be restored to their original line and grade and finished to match adjacent undisturbed surfaces. If Contractor is unable to replace asphalt pavement with hot mixed bituminous pavement, then temporary cold asphalt pavement shall be used. Contractor will be responsible for maintaining the cold asphalt pavement until it can be replaced with hot mixed bituminous pavement. All costs for temporary pavement, maintaining temporary pavement, and replacing asphalt pavement with hot mixed bituminous pavement shall be included in the bid price for pavement replacement.

e. All curbs, gutters, sidewalks, gutter pans, driveways, and other concrete street hardware within the right-of-way shall be replaced by a licensed Cement Contractor with a permit issued by the permitting authority. All concrete shall be Colorado Department of Transportation, Class B.

PART 4: SPECIAL PROVISIONS

4.01 MEASUREMENT AND PAYMENT

a. When not listed in the bid, all trench excavation and backfill costs will be considered incidental work for which no separate payment will be made.

b. When listed in the Bid, payment for work specified under this section will be made at the prices listed in the Bid and as outlined below. Quantities to be computed by the Engineer from measurement of actual work completed and accepted.

c. Common Excavation

1) Paid for on a linear foot basis for each size and classification of trench at the prices named in the Bid. Length will be measured horizontally along pipe actually installed without deducting for fittings and appurtenances.

d. Foundation Stabilization

1) Paid for on a cubic yard basis at the prices named in the Bid. Length and width will be measured horizontally along foundation stabilization material actually installed.

2) Depth measured to be actual depth installed below bottom of bedding. The average depth will be used with measurement intervals of 25 feet along centerline of trench.

3) No payment will be made for unauthorized foundation stabilization.

e. Rock Excavation

1) Payment for unforeseen rock conditions shall be made after negotiations to determine a unit price based on the best and safest method selected and approved by the Engineer for the rock removal.

2) Rock excavation will be paid for on a cubic yard basis and or at the prices named in the Bid. Measurement will be as outlined below.

a) The length will be the entire horizontal distance measured along the centerline of the trench.

b) The width for measurement purposes shall be 12 inches greater than the maximum outside diameter of the pipe.

c) The measurement for depth will be the vertical distance from the top of the rock to the depth shown on the plan. The depth will be measured at intervals of 25 feet along the centerline of the trench and the average depth between measuring points will be the depth used for computing the depth of rock.

f. Measurement and payment for rock excavation will be in addition to the payment for trench excavation and backfill at the unit cost stated in the Schedule of Values. Payment for rock excavation shall include full compensation for all work necessary to excavate and dispose of the rock material. Price indicated also includes the cost for embedment, pipe zone, and backfill materials.

g. AC Pavement Cuts

1) When not listed in the bid, all pavement cuts to be considered incidental to work for which no separate payment will be made.

2) When listed in the Bid, payment for work specified under this section will be made at the prices listed in the Bid Schedule of Values. Quantities are to be computed by the Owner's Representative for measurement of actual work completed and accepted.

h. Payment indicated shall include complete compensation for all labor, equipment, materials and incidentals involved in the work specified herein. No additional compensation will be considered unless allowed and submitted in accordance with sections VIII and XIII of the General Conditions.

END OF SECTION

SECTION 02270
SEDIMENTATION AND EROSION CONTROL

PART 1: GENERAL

1.01 SCOPE

a. Furnish labor, materials, equipment, and incidentals necessary to perform all installation, maintenance, removal, and area cleanup related to sedimentation control work as shown on the Drawings and as specified herein. The work shall include, but not necessarily be limited to, installation of temporary access ways and staging areas, silt fences, stone filter boxes, stone filter berms, sediment removal and disposal, device maintenance, removal of temporary devices, temporary mulching, excelsior matting, and final cleanup.

1.02 RELATED WORK

a. Trenching, Backfilling, and Compaction are included in Section 02226 of the Standard Specifications.

b. Surface Restoration is included in Section 02501 of the Standard Specifications.

1.03 STATUTORY REQUIREMENTS

a. Contractor is required to obtain an NPDES Stormwater Permit from the Colorado Department of Public Health and Environment.

b. Adequacy of sedimentation and erosion control practices will be at sole discretion of Owner and Engineer whether identified in the contract documents or not. If such measures are termed inadequate, additional measures may be ordered by Engineer at Contractor's expense.

1.04 SUBMITTALS

a. Submit sedimentation and erosion control plan and technical product literature for all commercial products to be used for sedimentation and erosion control in accordance with Section 01306 of the Standard Specifications. Submit certification of weed free status for straw and mulch used on the project.

1.05 QUALITY ASSURANCE

a. Install and maintain all sedimentation control devices necessary to prevent the movement of sediment from the construction site to off-site areas or into the stream system via surface runoff or underground drainage systems. Measures in addition to those shown on the Drawings necessary to prevent the movement of sediment off site shall be installed, maintained, removed, replaced, if necessary, following

each precipitation or snowmelt event that results in runoff. No additional charges to the Owner will be considered.

PART 2: PRODUCTS

1.01 MATERIALS

a. Crushed stone for sediment filtration devices shall consist of sound, durable stone, free of any foreign material, angular in shape, free from structural defects and comparatively free of chemical decay. The stone shall be maximum size of 2-in and a minimum size of ½-in.

b. Silt Fence

1) Steel posts shall be a minimum of 5-ft in length, 2 ½-in by 2 ½-in by ¼-in angle post with self-fastening tabs and a 5-in by 4-in (nominal) steel anchor plate at bottom.

2) Welded wire fabric shall be 4-in by 4-in mesh of 12 gauge by 12 gauge steel wire.

3) Silt fence fabric shall be a woven, polypropylene, ultraviolet resistant material such as Mirafi 100X as manufactured by Mirafi, Inc., Charlotte, North Carolina or equal.

4) Tie wires for securing silt fence fabric to wire mesh shall be light gauge metal clips (hog rings), or 1/32-in diameter soft aluminum wire.

5) Prefabricated commercial silt fence may be substituted for built-in-field fence. Pre-fabricated silt fence shall be "Envirofence" as manufactured by Mirafi Inc. or equal.

c. One quarter inch woven wire mesh shall be galvanized steel or hardware cloth.

d. Straw mulch shall be utilized on all newly graded areas to protect areas against washouts and erosion. Straw mulch shall be comprised of threshed straw of oats, wheat, barley, or rye that is certified weed free, and free of mold or other objectionable material. The straw mulch shall contain at least 50 percent by weight of material to be 10-inch or longer. Straw shall be in an air-dry condition and suitable for placement with blower equipment.

PART 3: EXECUTION

2.01 INSTALLATION

a. Silt Fence Installation

1) Silt fences shall be positioned as necessary to prevent off site movement of sediment produced by construction activities or as directed by the Engineer.

2) Dig trench approximately 6-in wide and 6-in deep along proposed fence lines.

3) Drive metal stakes, 8-ft on center (maximum) at back edge of trenches. Stakes shall be driven 2-ft (minimum) into ground.

4) Hang 4 x 4 woven wire mesh on posts, setting bottom of wire in bottom of trench. Secure wire to posts with self-fastening tabs.

5) Hang filter fabric on wire carrying to bottom of trench with about 4-inch of fabric laid across bottom of trench. Stretch fabric reasonably taut along fence length and secure with tie wires 12-in on center both ways.

6) Backfill trench with excavated material and tamp.

7) Install pre-fabricated silt fence according to manufacturer's instructions.

b. Construct filter boxes from ¼-in woven wire mesh or hardware cloth and wood. Fill with crushed stone and place around drainage channels, spoil piles, and storm drain inlets. An alternate method is to ring each inlet with a silt fence.

c. Staging areas and non-paved access ways shall be surfaced with a minimum depth of 4-in of crushed stone.

3.02 MAINTENANCE AND INSPECTION

a. Inspections

1) Visually inspect all sedimentation control devices once per week and promptly after every rainstorm. If such inspection reveals that additional measures are needed to prevent movement of sediment to offsite areas, Contractor shall promptly install additional devices as needed. Maintain sediment controls promptly, whenever needed.

a. Device Maintenance

1) Silt Fences- Remove accumulated sediment once it builds up to one-half the height of the fabric. Replace damaged fabric, or patch with a 2-ft minimum overlap. Make other repairs as necessary to ensure that the fence is filtering all runoff directed to the fence.

2) Filter Boxes- Replace crushed stone when it becomes saturated with silt.

3) Add crushed stone to access ways and staging area as necessary to maintain a firm surface free of ruts and mud-holes.

3.03 REMOVAL AND FINAL CLEANUP

a. Once site has been fully stabilized against erosion, remove sediment control devices and all accumulated silt. Dispose of silt and waste materials in proper manner. Re-grade all areas disturbed during this process and stabilize against erosion.

PART 4: SPECIAL PROVISIONS

4.01 MEASUREMENT AND PAYMENT

a. When not listed in the bid, all "SEDIMENTATION AND EROSION CONTROL" costs will be considered incidental work for which no separate payment will be made.

END OF SECTION

SECTION 02277
RIVER CROSSINGS

PART 1: GENERAL

1.01 SCOPE

a. This section includes furnishing and installing concrete encased pipework in creeks or rivers, including excavation, backfill, pipework, grading, shaping and restoring banks, furnishing and placing riprap, dewatering or diverting water as required, as well as procuring and conforming to all applicable permits.

1.02 SUBMITTALS

a. Submittals shall be in accordance with the requirements of these Contract Documents and shall include:

1) For the Engineer's review:

a) Certification that material conforms to the requirements contained herein.

b) Dewatering or diversion design shall be stamped by an engineer licensed in the state in which the work is being done.

PART 2: PRODUCTS

2.01 CONCRETE

a. Concrete shall conform with the requirements of CDOT Class B concrete except as modified herein.

b. Concrete to have a compressive strength of not less than 3300 psi at 28 days.

2.02 EXCAVATION

a. Unless otherwise specified or shown on the drawing, all excavations shall be classified as common excavation (unclassified).

PART 3: EXECUTION

3.01 GENERAL

a. All creek and river crossing work shall be completed during low flow conditions in the river or creek.

b. All scour pads shall be poured in such a manner to prevent fresh concrete from coming in contact with the creek or river water. Pipe trench shall be dewatered prior to pouring concrete and shall be maintained dry until after pour is completed.

c. Dewatering shall be the Contractor's design.

d. All concrete shall be allowed to cure for 24 hours in "dry" trench prior to backfilling or be covered with 5 mil visqueen and protected from flow during initial cure.

e. Contractor shall notify the Colorado Department of Fish and Wildlife's office a minimum of two (2) working days prior to installing creek or river crossings.

f. Confine work to the limits shown on drawings.

g. All sheet piling coffer dams and other temporary structures shall be completely removed upon completion of the work unless otherwise approved in writing by the Engineer.

PART 4: SPECIAL PROVISIONS

4.01 MEASUREMENT AND PAYMENT

a. When not listed in the bid, all "RIVER CROSSINGS" costs will be considered incidental work for which no separate payment will be made.

END OF SECTION

SECTION 02501
TRENCH SURFACE RESTORATION

PART 1: GENERAL

1.01 SCOPE

a. This section includes all surface restoration and related work for the construction of the designated pipelines and other work as required for the completion of the project.

b. Surface restoration includes, but is not limited to, the following:

1) Restoration of all surfaces disturbed during construction including A.C. pavement, concrete, gravel, lawns, topsoil, trees, shrubbery, flowers, fences, mailboxes, signs, landscaping, etc.

2) Surfaces shall be restored in-kind unless otherwise shown on the drawings or directed by the Engineer.

3) Surfaces, including pavement, within CDOT ROW shall comply with CDOT standards and are subject to CDOT inspection approval and warranty requirements.

4) Maintenance of all surfaces until final surface restoration is completed. Temporary AC pavement cold patching may be required for all street crossings which are not permanently restored within seven (7) days of excavation depending on the permit requirements of governing agency.

5) Depth, type and compaction of materials shall be equal to original surfaces unless otherwise specified herein or shown on the drawings.

1.02 CLASSIFICATIONS

a. Class A: Asphalt concrete pavement restoration for State Highway, County Roads or City Streets, whichever is the governing agency in the area of the work. Also asphalt concrete driveways.

b. Class B: Gravel Road restoration.

c. Class C: Gravel shoulder restoration including graveled driveways.

d. Class D: Concrete driveways, sidewalks, curbs, and gutter restoration.

e. Class E: Unimproved or open areas restoration.

PART 2: PRODUCTS

2.01 AGGREGATE BASE COURSE MATERIAL (ROAD BASE)

a. Aggregate Base Course Material or Road Base used for surface restoration shall be material meeting the requirements of the Colorado Department of Transportation (CDOT), La Plata County or the City, whichever is the governing agency in the area of the work.

2.02 TOPSOIL

a. Native topsoil shall be removed and stockpiled to be used for topsoil replacement when possible. Where imported topsoil is required, it shall be clean sandy loam, free from sulfates or alkali.

b. Depth of topsoil shall be determined by actual existing field conditions or as directed by the Engineer.

2.03 A.C. PAVEMENT

a. A.C. pavement shall conform to the requirements of CDOT, La Plata County or the Town or City, whichever is the governing agency in the area of the work.

2.04 PORTLAND CEMENT CONCRETE

a. All concrete shall conform to the requirements of CDOT, La Plata County or the Town or City, whichever is the governing agency in the area of the work.

2.05 GRASS SEED AND MULCH

a. Grass seed and mulch shall conform to the requirements of CDOT, La Plata County or the Town or City, whichever is the governing agency in the area of the planting, except as modified herein.

b. Seed mixtures shall be compatible with the immediately surrounding vegetation.

c. Seed mix to be approved by the Engineer prior to application.

2.06 GRASS SOD

a. Grass sod shall be certified nursery grade cultivated grass sod with a strong fibrous root system, free of stones and burned or bare spots, and compatible with the immediately surrounding grass.

PART 3: EXECUTION

3.01 GENERAL

a. The intent of this specification is that cleanup activities and surface restoration work immediately follow the installation of pipe, construction of structures, etc. This is imperative so as to minimize the impact activities to the property owner, or other users.

b. Trench backfill and subgrade shall meet compaction requirements as set forth in the applicable sections contained herein prior to proceeding with surface restoration work.

c. All workmanship for A.C. pavement surface restoration shall conform to the standard requirements of CDOT, La Plata County or the City, whichever is the governing agency and in accordance with the project permit requirements for Asphalt Concrete Pavement replacement and patching.

d. The Contractor shall notify the Engineer a minimum of 24 hours in advance of performing any A.C. pavement surface restoration work. No A.C. pavement surface restoration work shall be performed when weather conditions, in the Engineers opinion, are not suitable for placement of A.C. pavement.

e. All workmanship for concrete restoration shall conform to the standard requirements of CDOT, La Plata County or the City, whichever is the governing agency.

f. In areas designated for Class E surface restoration, topsoil shall be removed and stored at an approved location prior to excavation.

3.02 PROTECTION

a. No heavy construction vehicle shall operate on any pavement, curbing or walk.

b. Concrete Curbing and Walks:

1) No concrete shall be mixed, transported, placed or finished when the temperature of the base, subgrade or air is below 40°F or whenever, in the opinion of the Engineer, the temperature may fall below 40°F within twenty four (24) hours after the concrete has been placed.

2) The Contractor shall take such precautions as are necessary to protect newly placed concrete from rain.

3) The Contractor shall protect newly placed concrete from freezing for no less than seven (7) days.

3.03 CLASS A SURFACE RESTORATION - Asphalt Concrete Pavement and Driveways

a. Asphalt concrete pavement restoration shall conform to all standards and requirements of the Colorado Department of Highways (CDOT), La Plata County or City, whichever is the governing agency in the area of the work.

b. The wearing course shall match the existing pavement in thickness, line, profile and grade but in no case shall the pavement thickness be less than three (3) inches placed in two (2) lifts.

3.04 CLASS B SURFACE RESTORATION - Gravel Roads

a. Surface restoration shall conform to all standards and requirements of La Plata County or City, whichever is the governing agency in the area of the work.

b. The wearing course shall match the existing road surface in thickness, line and grade, but in no case shall the gravel thickness be less than four (4) inches.

3.05 CLASS C SURFACE RESTORATION - Gravel Shoulders and Driveways

a. Gravel shoulder restoration shall conform to all standards and requirements of the Colorado Department of Highways (CDOT), La Plata County or City, whichever is the governing agency in the area of the work.

b. Gravel driveway restoration shall conform to the same requirements as gravel shoulder restoration or as directed by the Engineer. The gravel thickness shall not be less than six (6) inches.

c. Gravel shoulders and driveways shall be compacted by mechanical means to ninety five percent (95%) of the maximum dry density per AASHTO T-180 unless otherwise directed by the Engineer.

3.06 CLASS D SURFACE RESTORATION - Concrete Driveways, Walks, Curb and Gutter

a. Concrete driveways, sidewalks, curb and gutter restoration shall conform to all standards or requirements of the Colorado Department of Highways (CDOT), La Plata County or City, whichever is the governing agency in the area of the work.

b. Concrete surface restoration shall also conform to drawing details and specifications, Paragraph 3.08, contained herein. Where there is a difference between the agencies requirements and these specifications, the most stringent requirement shall take precedence.

c. The supporting aggregate base course shall be not less than six (6) inches thick and shall be compacted by means of mechanical compaction to ninety five percent (95%) of the maximum dry density per AASHTO T-180.

3.07 CLASS E SURFACE RESTORATION - Unimproved or open areas

a. Surface restoration shall conform to all standards and requirements of the governing agency.

b. Surface restoration shall also conform to drawing details and specifications contained herein.

c. Compact to density of existing in place materials by mechanical means unless otherwise directed by the Engineer.

d. Contractor shall replace trees, shrubbery, flowers, ground cover in kind to match existing as approved by the Engineer.

e. Reseeding :

1) All areas to be seeded shall be made substantially clear and free of weeds, briars, sticks, loose stones greater than 1-inch, and all other debris detrimental or toxic to the growth of grass.

2) The surface soil in all areas to be seeded shall be in a condition favorable for the germination and growth of grass seed. A minimum of 1/2-inch and maximum of 1-1/2 inches of surface soil shall be in a loose condition.

3) Soil preparation operations shall be directional along the contours of the areas involved.

4) Seed shall be applied at a time approved by the Engineer when conditions are favorable for germination.

f. Resodding:

1) Provide a finish grade such that the top of installed and fresh-cut mature grass will be level with all adjoining sidewalks and curbs. Add or remove topsoil as necessary to achieve proper finish grade.

2) All areas to be sodded shall be made substantially clear and free of weeds, briars, sticks, loose stones greater than 1-inch, and all other debris detrimental or toxic to the growth of grass.

3) The surface soil in all areas to be sodded shall be in a condition favorable for the growth of grass. A minimum of 1/2-inch and maximum of 1-1/2 inches of surface soil shall be in a loose condition.

4) Lay sod perpendicular to direction of slope with alternating joints. Fit sod pieces tightly together: no joints and overlapping; hand tamp firmly and evenly.

5) Top-dress lightly with topsoil to fill depressions and joints between strips; leave finished sodding smooth and free of lumps and depressions.

6) Roll sod to ensure the root system is bound to the soil.

7) Sod shall be applied at a time approved by the Engineer when conditions are favorable for growth.

3.08 CONCRETE CURBING, WALKS AND DRIVEWAYS

a. All soil subgrade under driveways, curbs, curb and gutter and walks shall be compacted in accordance with the requirements of the applicable sections contained herein.

b. All curbs, sidewalks and driveways shall conform to the lines, grades and thicknesses of existing structures, but in no case shall the thickness be less than

sixteen (16) inches for Type "C" curbs, four (4) inches for sidewalks, and six (6) inches for driveways and driveway aprons.

c. A minimum 6-inches of 3/4-inch aggregate base course leveling course shall be provided under all curbs, sidewalks and driveways.

d. Unless otherwise authorized by the Engineer, sidewalks and/or curbs shall be constructed to match the joint pattern of the existing and surrounding sidewalks and/or curbs.

PART 4: SPECIAL PROVISIONS

4.01 MEASUREMENT AND PAYMENT

a. When not listed in the bid, all "SURFACE RESTORATION" costs will be considered incidental work for which no separate payment will be made.

b. When listed in the Bid, payment for work specified under this section to be made at the units and prices named in the Bid for each class of surface restoration, complete and acceptable to the Engineer.

c. Length to be measured horizontally along center line of the trench to the nearest foot without deducting for structures, valves, etc.

d. Restoration of concrete curbing and walks shall be considered incidental to the restoration of the street to which it is adjacent.

e. Cutting Of AC Pavement

1) AC pavement sawcutting to be paid for on a linear foot of trench basis at the unit prices named in the Bid Schedule of Values.

2) In no case will payment be made for duplicate cuts where over-excavation, inadequate backfill compaction or less than prompt repaving results in the need for new cuts.

f. Payment indicated to include complete compensation for all labor, equipment, materials and incidentals required for completion of the work. No additional compensation to be allowed.

END OF SECTION

SECTION 02634
CARRIER PIPE AND BORED CASING

PART 1: GENERAL

2.01 SCOPE

a. This section includes all work necessary to install all railroad and highway bored crossing or longitudinal (parallel to road or structure) bored placements and all related work for the construction of the designated pipeline and other incidental work.

b. Work shall include, but is not limited to, the following:

1) Obtain all necessary permits, bonds and insurance required by Union Pacific Railroad, CDOT, La Plata County and/or other regulating authorities.

2) Furnish and install casing for bored crossing as shown on the drawings.

3) Installation of carrier pipe and appurtenances in casing.

4) Coordinate with railroad, CDOT, La Plata County, and other regulating authorities.

5) Furnish any and all protective fencing, berms and/or guard rails as required by the regulating authority.

2.02 SUBMITTALS

a. Submittals shall conform to the requirements of these Contract Documents and shall include:

1) As-built location of the casing.

2) Proof of insurance.

3) Copies of applicable permits.

PART 2: PRODUCTS

2.01 EXCAVATION AND BACKFILL

a. Conform to requirements of applicable sections contained herein.

b. Backfill with same material as that used for carrier pipe.

2.02 CASING PIPE

a. Contractor shall provide casing of a size to permit proper construction of the carrier pipe to the required lines and grades. Casing shall be welded smooth steel pipe conforming to the requirements of ASTM A-53 or approved equal.

b. Minimum casing wall thickness shall be as outlined below.

1) Casing Pipe - Minimum Size and Thickness

Carrier Pipe Diameter (Inches)	**Minimum Casing Pipe Diameter (Inches)**	**Casing Minimum Wall Thickness (Inches)**
<6	8	0.188 (3/16)
6	10	0.281 (9/32)
8	14	0.281 (9/32)
10	16	0.313 (5/16)
12	18	0.344 (11/32)
14	22	0.375 (3/8)
16	24	0.406 (13/32)
18	26	0.438 (7/16)
20	28	0.469 (15/32)

c. Casing pipe shall have a minimum yield strength of 35,000 psi.

d. The class of casing specified is based upon the superimposed loads and not upon the stresses resulting from jacking or boring operations. Any increase in casing strength to withstand jacking or boring operations shall be the responsibility of the Contractor, supplied at no additional cost to the Owner.

2.03 CARRIER PIPE

a. Carrier pipe shall conform to the plan requirements and specifications contained herein.

2.04 SKIDS

a. Skids shall be either Calpico Model PX casing insulators with four (4) skids per band, or Wooden skids made of sound Douglas fir, pressure treated with an approved preservative, and beveled on both ends for ease of installation. Field cut edges shall be given a heavy coat of preservative. Straps shall be Type 316 stainless steel, or approved equal, and shall be installed at spacing shown on the Drawings.

b. A minimum of three (3) bands per 20' length of pipe shall be required.

2.05 SAND

a. When called for on the Drawings, sand for filling the annular space between the carrier pipe and casing pipe shall be clean, well graded sand, acceptable to the Engineer.

PART 3: EXECUTION

3.01 GENERAL

a. Construction in all cases shall conform to the requirements of regulating authority. A minimum of seven (7) days' notice to the regulating authority is required prior to entry of right-of-way for construction of bored crossing.

b. Before the start of work, Contractor shall submit satisfactory evidence to the Engineer that he has complied with all permit and insurance requirements.

c. Temporary fencing and warning barricades shall be installed around the boring pit(s) in accordance with all Federal, State, local and regulating authority requirements.

3.02 EXCAVATION

a. Excavation shall be unclassified and shall include whatever materials are encountered to the depths shown or required. Contractor shall provide shoring and dewatering as required. Shoring and dewatering systems shall be of Contractor's design.

3.03 I NSTALLATION OF CASING PIPE

a. Casing pipe shall not deviate from established line or grade at either end by more than the following:

Line	±1.0 feet
Grade	±0.5 feet

b. Sections of casing pipe shall be joined by welding joints with a continuous weld around the circumference of the pipe. It shall be the Contractor's responsibility to provide joints capable of resisting boring or jacking forces without failure.

c. Boring pits shall be braced and shored as required by Federal, State or local laws and regulations. A safe and satisfactory means of removing boring material from the pit shall be provided.

d. The boring shall be no larger than the outside diameter of the casing.

3.04 PIPE INSTALLATION IN CASING

a. General

1) Casing insulators shall be placed on the carrier pipe as shown on the drawings or specified herein so that pipe is supported continuously by the skids and is not supported by the bells.

2) Carrier pipe and skids shall be gently pulled through casing to avoid damage to pipes and couplings.

3) Contractor shall provide a means of pulling the toning wire through the casing when the use of non-metallic carrier pipe is specified.

4) All carrier pipe joints within the casing pipe shall be restrained or harnessed.

b. PVC Pressure Pipe

1) PVC Pressure Pipe used in casing shall be Certa-Lok C900 as manufactured by Certainteed Corporation.

3.05 CLOSURE OF CASING AFTER CARRIER PIPE INSTALLATION

a. Ends of the casing shall be closed with sacking, booting, or similar material following the placement of spacers, skids, or fill in the casing, but shall not be tightly sealed.

3.06 PLACING FILL IN CASING

a. When required, the Contractor shall completely fill the annular space between the pipe and the casing with approved sand to prevent pipe flotation.

b. The Contractor shall accomplish the filling by pouring or pumping from the two ends as necessary.

3.07 RESTORATION OF TRENCH LINES

a. Where pipe must be laid across the bore pit, the pit shall be filled with compacted granular material to the pipe spring line.

b. Trench backfill and surface restoration shall conform to the specification contained herein.

PART 4: SPECIAL PROVISIONS

4.01 MEASUREMENT AND PAYMENT

a. When not listed in the bid, all "CARRIER PIPE AND BORED CASING" costs will be considered incidental work for which no separate payment will be made.

b. When listed in the Bid, payment for work specified under this section will be made at the prices named in the Bid Schedule of Values and as outlined below, complete and acceptable to the Engineer.

1) Payment for bored installation is to be made at the unit cost price named in the Bid installed complete, tested, disinfected and acceptable to the Engineer.

c. Payment to include complete compensation for all labor, materials, equipment and incidentals necessary to install bored crossing to the pay limits shown on plans. Payment includes complete compensation for all bore pits, backfill, casing, carrier pipe and temporary fencing, berms and/or guardrails. No additional compensation to be allowed.

d. No payment to be made for pipe or valves which have not passed a hydrostatic leakage test.

END OF SECTION

SECTION 02635
DIRECTIONAL DRILLING

PART 1: GENERAL

1.01 SCOPE

a. This section includes all work necessary to install all directionally drilled crossings or longitudinal runs and all related work for the construction of the designated pipeline and other incidental work.

b. Work shall include, but is not limited to, the following:

1) Obtain all necessary permits, bonds and insurance required by regulating authorities.

2) Furnish and install pipe crossing as shown on the drawings.

3) Coordinate with regulating authorities.

4) Furnish any and all protective fencing, berms and/or guard rails as required by the regulating authority.

5) Providing temporary traffic control as required by the regulating authority and by Section 01505 of these Specifications.

1.02 SUBMITTALS

a. Submittals shall conform to the requirements of these Contract Documents and shall include:

1) Proof of insurance.
2) Copies of applicable permits.

PART 2: PRODUCTS

2.01 EXCAVATION AND BACKFILL

a. Conform to requirements of applicable sections contained herein.

b. Backfill with same material as that used for carrier pipe.

2.02 CARRIER PIPE

a. Carrier pipe shall conform to the plan requirements and specifications contained herein.

PART 3: EXECUTION

3.01 GENERAL

a. Construction in all cases shall conform to the requirements of regulating authority. A minimum of two (7) days' notice to the regulating authority is required prior to entry of right-of-way for construction.

b. Before the start of work, Contractor shall submit satisfactory evidence to the Owner that he has complied with all permit and insurance requirements.

c. Temporary fencing and warning barricades shall be installed around the drilling machine in accordance with all Federal, State, local and regulating authority requirements.

3.02 EXCAVATION

a. Excavation shall be unclassified and shall include whatever materials are encountered to the depths shown or required. Contractor shall provide safe shoring and dewatering as required. Shoring and dewatering systems shall be of Contractor's responsibility.

3.03 INSTALLATION OF CARRIER PIPE

a. Carrier pipe shall not deviate from established line or grade at either end by more than the following:

Line	±1.0 feet
Grade	±0.5 feet

b. The Contractor shall first drill a pilot hole (diameter as determined by Contractor) in the alignment of the new pipeline. A reamer of sufficient size to accommodate the new pipeline shall be pulled back to pre-ream the hole. The carrier pipe shall then be pulled back to the extents shown on the drawings.

c. PVC Pressure Pipe

1) Where the drawings indicate the use of PVC pipe, Certa-Loc C900 shall be used with restrained couplings.

2) Pipe pull loads shall not exceed manufacturer's specifications.

3) Deflection of the pipe shall be no greater than 75% of the manufacturer's recommended deflection (bend radius).

d. HDPE Pressure Pipe

1) Where the drawings indicate the use of HDPE pipe, the joints of pipe shall be butt-fusion welded together in accordance with manufacturers recommendations. The ends of the pipe shall have a flange fitting welded where the drawings indicate it shall be attached to pipe of other materials.
2) HDPE pipe shall only be used with permission of Owner or Engineer.

3.04 RESTORATION OF TRENCH LINES

a. Trench backfill and surface restoration shall conform to the specification contained herein.

PART 4: SPECIAL PROVISIONS

4.01 MEASUREMENT AND PAYMENT

a. When not listed in the bid, all "CARRIER PIPE " costs will be considered incidental work for which no separate payment will be made.

b. When listed in the Bid, payment for work specified under this section will be made at the prices named in the Bid and as outlined below, complete and acceptable to the Engineer.

c. Payment to include complete compensation for all labor, materials, equipment, insurance and incidentals necessary to install directionally drilled crossings or longitudinal runs to the pay limits shown on plans at the unit cost value stated in the Bid. Payment includes complete compensation for all bore pits, backfill, casing, carrier pipe and temporary fencing, berms and/or guardrails. No additional compensation to be allowed.

d. No payment to be made for pipe or valves which have not passed a hydrostatic leakage test.

END OF SECTION

SECTION 02667
WATER DISTRIBUTION SYSTEM

PART 1: GENERAL

1.01 SCOPE

a. This section includes the construction of buried water distribution pressure piping from 2-inches in diameter and larger and appurtenances as shown on the drawings or as required to complete the work.

b. Work under this section shall include, but not be limited to the following:

1) Installation of all buried pipe, fittings, joint restraints, valves, fire hydrant assemblies and service connection assemblies.

2) Installing connections to all existing and/or new facilities and provide temporary services as required.

3) Pressure testing of new pipe lines and appurtenances.

4) Disinfecting new pipelines and appurtenances dechlorination and flushing for a complete and operable system.

1.02 QUALITY CONTROL

a. Laboratory Services: The Owner will retain the services of a certified Laboratory to provide testing services as listed in this Section.

b. Field Inspection:

1) All new water distribution pressure piping installations shall be inspected by a Representative of the La Plata Archuleta Water District. Inspection shall begin at the beginning of construction and continue through the testing disinfection and flushing operations. Any defective work discovered after installation shall be removed and correctly replaced in a manner satisfactory to the Engineer, or La Plata Archuleta Water Districts Representative at the Contractor's expense.

2) All defective materials shall be suitably marked and removed from the job site before the end of the following day.

c. Final Inspection and Acceptance: The acceptance of all pipelines by the La Plata Archuleta Water District will be based on the following:

1) Submittal of satisfactory results of required test (such as pressure test, leakage tests, disinfection tests, compaction tests, etc.) certified by an Engineer or approved by a certified testing laboratory.

2) Passing a final inspection of the work by the La Plata Archuleta Water District.

3) Submittal of "As-Built" construction drawings on a copy of the original construction plans.

4) Restoration of all non-public surface disturbance.

5) Restoration of all surface disturbance within the public right-of-way to the satisfaction of the City, County or State; or governing agency.

6) Contractor shall warrant the work, in its entirety, for a period of three years from the date of acceptance against defects in material and workmanship.

1.03 SUBMITTALS

a. Submittals shall be in accordance with the requirements of these Contract Documents and shall include the following:

1) Material and pressure class schedule of all pipe fittings and appurtenances.

2) Special joint details and any special provisions required for assembly.

3) Manufacture's literature for each size and type of pipe, fittings, valve and structure used.

4) A certificate from the pipe, valves and fittings manufacturer stating that the materials have been sampled and tested in accordance with the provisions of and meet the requirements of the designated specification.

PART 2: PRODUCTS

2.01 PIPE

a. General

1) Pipe buried underground, unless otherwise specified or shown, shall be bell and spigot with rubber gasket (push-on) type joints in straight runs and mechanical joints each way from bends. The spigot end of each pipe shall be marked to indicate when the pipe is properly inserted in the bell.

2) All gaskets shall be a single molded rubber ring fitted into a specially shaped recess and forming a pressure tight seal.

3) All ductile iron pipe and fittings shall be polyethylene encased conforming to AWWA C-105.

b. Ductile Iron (DI) Pipe

1) All ductile iron pipe shall be centrifugally cast in conformance to AWWA C-151 unless otherwise specified.

2) All ductile iron pipe shall be minimum Class 52 thickness, unless otherwise shown or specified.

3) Ductile iron pipe shall be cement lined per AWWA C-104.

4) Restrained Joint Pipe

a) All ductile iron pipe and fittings where shown on the Drawings to be restrained shall be positively restrained push-on joint pipe capable of being deflected after assembly and conforming to specifications contained herein.

5) All pipe shall be as manufactured by Pacific States, US Pipe, Tyler Pipe, or approved equal.

c. PVC Pressure Pipe

1) 2-inch Through 3-inch Pipe Schedule 40 PVC

a) Unless otherwise shown on the drawings, PVC pressure pipe 2inches through 3-inches in diameter shall be Schedule 40, socket type solvent weld joints.

b) Solvent weld glue and primer shall be "Wet & Dry" for all solvent weld joints.

2) 4-inch Through 12-inch (AWWA C-900 or AWWA C-909)

a) Unless otherwise shown on the drawings, PVC pressure pipe 4-inches through 12-inches in diameter shall conform to the requirements of AWWA C-900 or AWWA C-909 (design stress of 4000 psi), NSF approved, with cast iron pipe equivalent (CI) outside diameter dimensions and conforming to the following:

(1) Shall be minimum Class 150 pipe with wall thickness equivalent to a standard dimension ratio (SDR) of 18.

3) 14-inch Through 24-inch Pipe (AWWA C-905)

a) Unless otherwise shown on the drawings, PVC pressure pipe 14inches through 24-inches in diameter shall conform to the requirements of AWWA C-905, NSF approved, with cast iron pipe equivalent (CI) outside diameter dimensions and conforming to the following:

(1) Shall be minimum Class 165 pipe with wall thickness equivalent to a standard dimension ratio (SDR) of 25.

4) All pipe shall be as manufactured by J-M Pipe and P-W Pipe, or approved equal.

d. HDPE (Polyethylene) Pressure Pipe

1) Unless otherwise shown on the Drawings, PE pressure pipe 4-inch and larger in diameter shall conform to the requirements of AWWA C-906, NSF approved, and shall be a minimum of Pressure Class 150 pipe.

2) HDPE pipe shall only be used where approved in writing by La Plata Archuleta Water's Engineer.

2.02 PIPE JOINTS a. General

1) Gaskets and glands shall be provided by the manufacturer of the fitting on which they are to be used and shall be specifically designed for the pipe OD equivalent used.

2) Where required a non-toxic vegetable soap lubricant shall be supplied with the pipe or fittings in sufficient quantities for installing the pipe.

3) All MJ bolts shall be Cor-Blue bolts or approved equal.

4) All flange bolts shall be stainless steel. All stainless steel bolts shall receive a coating of "anti-seize" on the threads prior to installation.

b. Ductile Iron Pipe Joints 1) Push-On Joints

a) All push-on joints shall be single rubber gasket push-on joints conforming with the requirements of AWWA C-111 unless otherwise specified. Gaskets and lubricant shall be provided by the manufacturer of the pipe on which they are to be used.

b) Restrained Push-On Joints

(1) Restrained joint ductile iron pipe and fittings shall have a flexible, positively restrained push-on joint system capable of being deflected after assembly.

(2) Unless otherwise specified, all restrained joint ductile iron pipe and fittings shall be "TR-Flex" as manufactured by U.S. Pipe or approved equal.

2) Mechanical Joints

a) All components of mechanical joints shall be in conformance with AWWA C-111.

b) Retainer Glands

(1) Retainer glands shall be used at locations shown on the drawings.

(2) The use of retainer glands in lieu of concrete for thrust restraint is limited to applications specified herein or shown on the drawings.

(3) Retainer glands shall be "Mega-Lug" as manufactured by EBAA Iron Inc., or approved equal.

3) Flanged Joints

a) Flanged joints for ductile iron pipe shall conform with the requirements of AWWA C-115. Unless otherwise shown or specified, flanged spools shall be minimum Class 53 thickness. Gaskets shall be 1/8-inch thick rubber, full face, conforming to the pipe manufacturer's requirements and AWWA C-111.

b) Adapter Flanges

(1) Where shown on the drawings or approved by Engineer, adapter flanges for use in making custom ductile iron spools shall be Uni-Flange Series 200 for pipe 4-inches through 12inches in diameter, and Uni-Flange Series 400 for pipe greater than 12-inches in diameter, as manufactured by Uni-Flange Corporation, or approved equal.

(2) Gaskets shall conform with AWWA C-111 and shall be provided by the manufacturer of the adapter flange.

(3) Set screws shall be square head design. A listing of the manufacturer's torque installation requirements for all pipe thicknesses shall be included with the adapter flange.

c. PVC PIPE JOINTS

1) Push-On Joints

a) All push-on joints shall be single rubber gasket push-on joints conforming with the requirements of AWWA C-111 unless otherwise specified. Gaskets and lubricant shall be provided by the manufacturer of the pipe on which they are to be used.

2) Mechanical Joints

a) All components of mechanical joints shall be in conformance with AWWA C-111.

3) Restrained Joints

a) Joint restraints shall be used at locations shown on the plans or specified herein

b) The use of joint restraints in lieu of concrete for thrust restraint is limited to applications specified in the Contract Documents or approved by the Engineer. Joint restraints shall be specifically designed for use on PVC pipe.

c) Joint restraints shall be Mega-Lug Series 2000, 2200 or 220SV, as manufactured by EBAA Iron Inc. or approved equal.

4) Adapter Flanges

a) Where shown on the drawings or approved by Engineer, adapter flanges for use in connecting PVC pipe to flanged fittings shall be Uni-Flange Series 900 as manufactured by Uni-Flange Corporation, or approved equal.

b) Gaskets shall conform with AWWA C-111 and shall be provided by the manufacturer of the adapter flange.

d. HDPE (POLYETHYLENE) PIPE JOINTS

1) All joints between Polyethylene pipe and Polyethylene fittings shall be made by thermal butt-fusion. Thermal butt-fusion shall be conducted only by persons who have received training in the use of the fusion equipment according to the recommendations of the pipe supplier or the equipment supplier. When different polyethylene piping materials must be joined, both pipe manufacturers shall be consulted to determine the appropriate fusion procedures.

2) When Polyethylene pipe is being joined to pipe of other materials a polyethylene flange assembly consisting of a metal back-up flange or ring and a polyethylene stub-end or flange adapter shall be used.

3) When approved by the Engineer a mechanical joint type weld-on fitting may be used to connect to ductile iron fittings.

2.03 DUCTILE IRON (DI) FITTINGS

a. General

1) All fittings shall be mechanical joint unless otherwise specified or shown on the drawings.

a) All tees with valves connected to them shall be flanged with a Flanged by MJ valve bolted directly to the tee.

b) If size 2" and 3" pipe line is installed off a tee, use IP tapped companion flange, stainless steel nipple (4" minimum length) and IP threaded gate valve.

2) Unless otherwise shown or specified, all fittings shall be as manufactured by Mueller, Tyler, US Pipe or approved equal.

b. Mechanical Joint Fitting s

1) All MJ tees, crosses, elbows, reducers, adapters, combinations thereof, and other miscellaneous fittings 4-inches through 16-inches in diameter shall be ductile iron compact fittings in conformance with AWWA C-153.

2) All MJ tees, crosses, elbows, reducers, adapters, combinations thereof, and other miscellaneous fittings greater than 16-inches in diameter shall be ductile iron fittings in conformance with AWWA C-110.

3) Unless other specified, the minimum working pressure for all MJ or ductile iron fittings 4-inches through 16-inch in diameter shall be 350 psi.

4) Unless otherwise specified, the minimum working pressure for all MJ or ductile iron fittings greater than 16-inches in diameter shall be 250 psi.

c. Flanged Fittings

1) All flanged tees, crosses, elbows, reducers, adapters, combinations thereof, and other miscellaneous fittings 4-inches through 48-inches in diameter shall be ductile iron fittings in conformance with AWWA C-110.

2) Unless otherwise specified, the minimum working pressure for all flanged ductile iron fittings shall be 250 psi.

2.04 DUCTILE IRON (DI) COATINGS AND LININGS

a. All pipe and fittings, with the exception of solid sleeve couplings, shall be cement-mortar lined and seal coated in accordance with AWWA C-104.

b. Pipe or fittings which have a damaged cement lining, or no cement, lining will be rejected at the job site. Cement linings that are installed or repaired by the distributor/supplier shall be completed in strict accordance with AWWA C-104. Cement linings shall not be repaired at the job site.

c. All DI pipe and fittings buried underground shall be coated on the outside with a standard coating of black bituminous paint a minimum of 1 mil thick unless otherwise specified. The finished coating shall be continuous, smooth, neither brittle when cold nor sticky when exposed to the sun and shall be strongly adhered to the pipe.

d. Unless otherwise specified, DI pipe used within buildings and structures and which is to receive field coats of paint shall not be coated with any black bituminous paint. Such pipe, after proper cleaning, shall be painted with one coat of primer paint that is compatible with the field coats. Painting specifications shall be followed for cleaning and painting.

2.05 Couplings and Adapters

a. Mechanical joint couplings and adapters shall be limited in their application to connection of new pipe work to existing waterlines, temporary installations, and where specifically called for in the Contract Documents or approved by Engineer.

b. Mechanical joint couplings and adapters shall be solid sleeve type couplings consisting of a ductile iron sleeve, ductile iron follower rings, rubber gaskets, and corrosion-resistant bolts and hex nuts (Cor-Blue or approved equal).

c. Mechanical joint couplings and adapters shall have minimum pressure ratings that will accommodate maximum pressures which will be experienced during hydrostatic and leakage testing.

d. Mechanical joint couplings and adapters shall be as manufactured by Romac, Smith Blair, Dresser, Rockwell or approved equal.

2.06 VALVES a. General

1) All valves and appurtenances shall have the name, monogram, or initials of the manufacturer cast thereon. They shall be built and equipped for the type of operation as specified herein or as shown on the drawings.

2) Where requested by the Contractor and approved by the Engineer, additional valves may be installed by the Contractor to facilitate installation, testing, or connection to existing pipe work. Unless otherwise specified in writing by the Engineer, such valves requested by the Contractor shall be provided at no additional cost to the Owner.

3) All buried valves shall be supplied with a 2-inch square operating nut. Operating nut shall be 1-5/16 -inch square at the top, 2-inch square at the base and 1-3/4 - inches high.

a) Where shown on the drawings extension stems shall be provided for buried valves when the operating nut is four (4) feet or more below finished grade. Extension stem shall extend to within twelve (12) inches of the ground surface and shall be provided with spacers which will center the stem in the valve box.

4) Unless otherwise specified, all valves shall have a minimum pressure rating that will accommodate maximum pressure which will be experienced during hydrostatic leakage testing.

b. Valve Boxes (VB)

1) A cast iron valve box and lid shall be provided for each underground valve. Valve boxes shall be slip type sized for the type of valve and depth of bury. The lid shall have the word "water" permanently cast on the top. All buried valves shall be provided with valve boxes. Valve boxes shall be 564A, with formed top to receive insert type traffic cover or approved equal.

2) All parts of valve boxes, bases, and covers shall be coated by dipping in bituminous varnish.

c. Gate Valves (GV)

1) Unless otherwise specified or shown on the drawings, all gate valves shall be resilient seat wedge gate valves, cast iron body, fully bronze mounted with non-rising stem. The stem and all wearing surfaces shall be bronze or other approved non-corrosive material.

2) Except as modified herein, gate valves and appurtenances shall conform to the requirements of AWWA C-509 covering iron-body, resilient seat non-rising stem gate valves 3-inches through 12-inches diameter.

3) All packing box bolts shall be stainless steel.

4) All gate valves shall open left (counter clockwise).

d. Tapping Valves

1) Tapping valves shall be furnished with flanged inlet end connections having a machined projection on the flange to mate with a machined recess on the outlet flange of the tapping tee. The outlet ends shall conform in dimensions to the AWWA Standards for hub or mechanical joint conditions, except that the outside of the hub shall have a large flange for attaching a drilling machine. The seat opening of the valves shall be larger than normal size to permit full diameter cuts. Tapping tees shall be of the same manufacture as the tapping valve.

e. Butterfly Valves (BFV)

1) All butterfly valves shall conform to AWWA C-504, except as herein modified.

2) Unless otherwise specified or shown on the drawings, valves shall be flanged end, short body type AWWA Class 150-B, with totally enclosed, geared, manual operator. Flanges shall be 125-pound, full faced, drilled per ANSI B16.1.

3) Valves shall be rated by the manufacturer at 350 psi.

4) All bolts shall be stainless steel.

f. Air Release Valves (ARV)

1) Air release valves shall be sized as shown on the Drawings and manufactured by APCO or approved equal.

2) Air release valves shall be installed at the locations and in accordance with the details shown on the drawings.

2.07 SERVICE PIPE FITTINGS AND TAPPING SADDLES

a. All water service lines shall be seamless Type K copper pipe, conforming to AWWA C-800, 160 psi rated.

b. Unless otherwise shown on the drawings, service pipe shall be 3/4-inch.

c. Each individual residential water service connection shall be equipped with a locking meter stop at the inlet to the meter. All meter stops shall be bronze with copper pipe connector and outlet for meter coupling.

d. All water service connections shall be provided with a corporation stop. All corporation stops shall be bronze with full-way bore with inlets for AWWA iron pipe threads and straight flared or compression outlets to adapt to copper pipe. Corporation stops shall be Mueller Type 300 Ball Valve (B-25025 or B-25028) or approved equal.

e. All services shall be saddle tapped using bronze saddles with bronze or stainless-steel bolts and clamps. Service Saddles shall be Mueller Series H-16000 Double Strap with AWWA taper thread or approved equal.

f. All services on PVC water lines shall be saddle tapped using bronze saddles specifically designed for use with PVC pipe with IPS threads and bronze or stainless-steel bolts. Tapping saddles for PVC pipe shall be Ford Model 202B with stainless steel band, Clow Brass Service Saddle Style 3407 or 3408, Mueller Series H-1600 double strap or approved equal.

2.08 WATER METERS

a. All meter pits, yokes and water meters shall be provided by the La Plata Archuleta Water District

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b. Where connecting to existing water meters, Contractor shall supply all required fittings to make connection.

2.09 FIRE HYDRANTS

a. All fire hydrants shall conform to local fire district requirements.

b. Unless otherwise required by local fire district requirements, all fire hydrants shall conform to the following:

1) All fire hydrants shall be improved, dry-barrel type and shall conform to requirements of AWWA C-502. The standard hydrant shall have a six-inch connection, a 5-1/4-inch main valve opening, two (2) 2-1/2-inch hose ports and one (1) 4-1/2-inch pumper port. The hydrant barrel shall be marked with a circumferential rib to denote the intended ground line. The centers of the hose nozzles and pumper nozzle shall be at least 14-inches above the ground grade line.

Hydrants shall be of the "traffic" or "breakaway" design, having easily replaceable breaking devices for the grade-line flange and operating stem that prevents damage to the barrel sections upon impact.

The operating nut and port cap wrench nuts shall be 1-3/8-inch pentagon, measured from point to opposite flat side at the base. The height of the nut shall not be less than one inch.

The nozzle caps shall be removed, and the operating nut opened by turning to the left (counter-clockwise). Nozzle caps shall be securely chained to the upper barrel section.

The 2-1/2-inch hose nozzles shall be National Standard fire hose thread.

The pumper port shall be Mueller 4-512 or equal with the following requirements:

a) Outside diameter of male thread is 5.282 inches.
b) Diameter of root male thread is 4.932 inches.
c) Number of threads per inch is 4.
d) Pitch diameter is 5.12 inches.

2) PAINTING: Fire hydrants shall be painted “Safety Red”.

3) Fire hydrants shall be oriented so as to optimize access to ports, or as directed by the Engineer.

4) Fire hydrants shall be Mueller Centurian, Clow Medalion, or as approved by the La Plata Archuleta Water District.

2.10 TAPPING TEES

a. Tapping tees used for making connections to existing, in-service lines shall have Class 125 outlet flanges.

b. In all cases, the tapping tee shall be designed for use with the existing pipe materials and OD equivalent.

c. Unless otherwise specified or approved by the Engineer, all tapping tees shall be furnished with a fusion bonded epoxy coating conforming to the requirements of AWWA C-550.

d. The tapping tees shall be as manufactured by Mueller or approved equal.

2.11 BACKFILL AND BEDDING MATERIAL

a. Unless otherwise shown on the drawings or specified herein, all pipe bedding materials shall be in conformance with the applicable excavation and backfill specifications contained herein.

2.12 CONCRETE

a. Concrete for thrust blocks shall be Portland Cement concrete with minimum compressive strength at 28 days of 3000 psi.

b. Reinforcing steel shall be deformed bars conforming to ASTM A-615, Grade 60.

2.13 TONING WIRE

a. A continuous insulated 10-gauge solid copper toning wire shall be supplied with non-metallic pipe. Insulation shall be direct burial type, or appropriately pulled in the case of directional boring or casing.

b. Additional wire shall be installed as necessary to allow the toning wire to be looped up at all valve boxes and hydrants on all lines.

PART 3: EXECUTION

3.01 PRODUCT HANDLING

a. Care shall be taken in handling and transporting to avoid damaging pipe and appurtenances. Loading and unloading shall be accomplished with the material under control at all times and under no circumstances shall the material be dropped. Material shall be securely wedged and restrained during transportation and supported on blocks when stored in the shop or field. Manufacturer's recommendations shall be carefully followed during material handling and storage.

b. Store all pipe on a flat surface so that the blocking will support the barrel evenly. It is not recommended that pipe be stacked higher than four (4) feet. Plastic pipe, if stored outside for long periods of time shall be covered with an opaque material to protect it from sunlight.

c. Lower all pipe and fittings into trench in a manner to prevent damage to pipe or fittings. Heavy impact may cause a slight longitudinal indentation in the outside of PVC pipe and a crack on the inside. This may result in a split as soon as the pipe is

placed under pressure. Any pipe that has been impacted shall be examined closely for this type of damage.

3.02 PREPARATION OF TRENCH

a. Trench excavation shall conform to requirements of applicable sections contained herein.

b. Unless otherwise specified or shown on the drawings, the width of the trench at the top of the pipe shall not exceed the values outlined below. Trench widths are based on the width of the pipe plus the distance from each side of the pipe to the face of the trench (or the back of the sheeting, if used).

1) For pipe twenty-four (24)-inches in diameter or less, trench width shall not exceed width of the pipe plus nine (9) inches on each side.

2) For pipe greater than twenty-four (24)-inches in diameter, trench width shall not exceed width of the pipe plus fifteen (15) inches on each side.

c. Unless otherwise directed or called for on the drawings, all pipe trenches shall be excavated below the proposed pipe invert as required to accommodate the depths of pipe bedding material as scheduled on the drawings.

3.03 GRADE AND ALIGNMENT

a. All waterlines shall be installed with a minimum depth of bury of 48-inches measured from the top of pipe to finish grade unless specifically approved by the Engineer. A greater depth may be necessary to avoid underground obstructions. A minimum of six (6) inches of clearance shall be maintained between the pipe and obstructions.

b. In CDOT ROW's, pipe shall be installed with a minimum bury depth of 54-inches.

c. When waterlines are designed to be laid in a straight line and/or at a specific grade, the deviation from line and grade shall not be in excess of 0.2 feet horizontally for line and 0.1 feet vertically for grade.

3.04 UTILITY CONFLICTS

a. The Contractor shall be responsible for exposing potential utility conflicts far enough ahead of pipeline construction to make necessary adjustments in grade and alignment of the new work within the recommended limits of pipe and fitting deflection and/or the lines and grades stated in the Contract Documents.

b. The Contractor shall be responsible for informing the Engineer of the need for a grade and/or alignment adjustment.

c. The Contractor shall not deviate from the design line and grade stated in these Contract Documents without the approval of the Engineer.

3.1 SANITARY SEWER SEPARATION

a. Horizontal Spacing: The physical relationship between water lines and sanitary sewers shall conform to requirements of the Colorado State Department of Health. The minimum horizontal spacing between sewer lines and water lines shall be ten (10) feet measured edge to edge.

1) When it is impossible to obtain the minimum 10-foot horizontal separation distance the following methods of installation may be used:

a. Exceptions to the horizontal separation distance are allowed, provided that the water main is laid in a separate trench or on an undisturbed earth shelf located on the "uphill" side of the sewer at such an elevation that the bottom of the water main is at least 18 inches above the top of the sewer. The sewer materials must be water works grade 150 psi (1.0 Mpa) pressure rated pipe meeting AWWA standards or similar and must be pressure tested to ensure water tightness

b. Crossings: Water mains crossing gravity sanitary or storm sewers, raw surface water pipes, reclaimed water pipes, and liquid petroleum pipes must be laid to provide a minimum vertical distance of 18 inches between the outside of the water main and the outside of the gravity sanitary or storm sewer. This must be the case where the water main is either above or below the sewer with preference to the water main being located above the sewer. Minimum protection shall be as follows:

1) Water mains crossing gravity sanitary or storm sewers, raw surface water pipes, reclaimed water pipes, and liquid petroleum pipes must be laid to provide a minimum vertical distance of 18 inches between the outside of the water main and the outside of the gravity sanitary or storm sewer. This must be the case where the water main is either above or below the sewer with preference to the water main being located above the sewer.

2) At crossings, one full length of water pipe must be located so both joints will be as far from the sewer as possible. Special structural support for the water and sewer pipes may be required. Special structural support of the water and sewer pipes may be required.

3) When it is impossible to obtain the minimum 18-inch vertical separation distance, the following methods of installation may be used:

a. If the sewer pipe will cross less than 18 inches above or under the water main, either the water main or sewer pipe must be installed with secondary containment. Acceptable options include a pipe casing extending no less than 9-feet each side of the crossing. The pipe casing must be of watertight material with no joints. The casing pipe materials may be steel, ductile iron, fiberglass, fiberglass reinforced polymer mortar

(FRPM), or polyvinylchloride (PVC) with suitable carrier pipe supports and casing pipe end seals. The design must include a means to support the sewer pipe to prevent settlement and permit maintenance of the water main without damage to the sewer pipe or water main. Alternatively, concrete or controlled low strength material (e.g., flowable fill) encasement of either pipe extending no less than 10-feet each side of the crossing may be used.

b. In all cases, suitable backfill or other structural protection shall be provided to preclude settling and/or failure of the sewer or water piping, especially the higher pipe.

c. Contractor shall contact Engineer when sewer lines are found within the above described zone. Engineer may field verify the need for encasement of sewer lines. Contractor shall install ductile iron sewer lines only after direction from the Engineer.

3.06 OPERATION OF EXISTING VALVES

a. The Owner will operate or supervise the operation of all existing valves during the course of the work. The Contractor shall not operate any existing valve unless specifically instructed to do so by the Engineer or the Owner.

b. The Contractor shall be responsible for coordination of the work with the Owner to provide for the timely operation of existing valves.

c. The Contractor shall coordinate and perform the work so as not to require the Owner's personnel to operate any valves outside of the Owner's normal work hours.

3.07 SANITARY PRACTICES DURING INSTALLATION

a. Pipe shall not be laid in standing water. Precautions shall be taken to prevent dirt, debris, or other foreign materials from entering the pipe during all phases of construction. Tools, rags, and other materials shall be kept out of the pipe at all times.

b. At the end of each day, or at other times when the trench site is left unattended, the open ends of the pipe shall be sealed with a water-tight plug to prevent trench water and foreign materials from entering the pipe. If water is in the trench, the seal shall remain in place as long as water is able to enter the pipe

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3.08 PIPE INSTALLATION

a. Pipe shall be laid and joined one length at a time to the required line and grade. Pipe shall be placed with the bell end facing the direction of laying unless otherwise specified.

b. Where pipe is laid on grades in excess of fifteen percent (15%), the bells shall face upgrade. Where pipe is laid on grades in excess of twenty percent (20%), pipe anchorage systems shall be required.

c. The outside of the spigot and the inside of the bell shall be clean before the pipe or fittings are installed. If the pipe contains dirt or other foreign matter, the interior of the pipe shall be cleaned as necessary to remove the material prior to installation.

d. As the pipe is placed in the trench, bell holes shall be dug and the pipe supported on bedding materials the full length of the barrel.

e. Where required, lubricate the outer surface of the rubber gaskets and the spigot end of the pipe using approved lubricant.

f. Assemble the pipe in accordance with the manufacturer's recommendations, including conformance to insertion limits. Regardless of the method used to assemble the pipe, the pipe shall be kept in alignment during installation of the spigot into the bell end or the fitting.

g. After each length of pipe is installed in the trench, the pipe shall be secured in place with approved backfill material tamped under and along sides to prevent movement. Additional backfill material shall be placed and compacted in 12-inch layers to the height shown on the plans and details or as directed. The remainder of the trench shall be backfilled as specified and called for in these Contract Documents.

h. Pipe ends shall be kept clear of backfill at all times.

i. Wherever piping passes through walls, a wall casting pipe or sleeve shall be installed unless otherwise shown on the drawings.

3.09 FITTING INSTALLATION

a. All connections shall be made in strict accordance with manufacturer's recommendations.

b. The connection of pipe with plain ends of the same diameter in new construction shall be accomplished with ductile iron, mechanical joint sleeve couplings unless otherwise approved by the Engineer.

c. Contractor shall use the correct rubber ring with the ductile iron bell or fitting, (e.g., Tyton ring with Tyton bell; MJ ring with MJ fitting) and specifically designed for the pipe OD equivalent used.

3.10 CUTTING PIPE a. General

1) Where new or existing pipe requires cutting in the field it shall be done in a manner to leave a smooth end at right angles to the pipe centerline. The pipe shall be marked around its entire circumference prior to cutting.

2) After cutting and dressing or beveling, the insertion limit reference mark on the spigot shall be accurately relocated and marked at the proper distance from the end as recommended by the manufacturer. The reference mark may be located by using a factory marked end of the same size as a guide.

b. Ductile Iron Pipe

1) Ductile iron pipe shall not be flame cut.

2) The cut end of the pipe shall be ground smooth as required. For push-on joint connections, the cut end shall be beveled as necessary to remove sharp edges which may damage the gasket. The width and general appearance of the bevel shall closely resemble the bevel on an original pipe end.

3) Any lining or coating damaged during the cutting process, as determined by the Engineer, shall be cause for removing the damaged section by re-cutting the pipe or for rejecting the pipe altogether.

c. PVC Pipe

1) For push-on joint connections, the cut end shall be beveled per manufacturer's recommendations.

2) Factory finished beveled end may be used as a guide to determine the angle and length of taper. The end may be beveled using a plastic pipe beveling tools which will cut the correct taper automatically. A portable type sander or abrasive disc may also be used to bevel the pipe end. Any equivalent tool or equipment which will produce a smooth bevel surface may be substituted.

3.11 CONNECTION TO EXISTING, IN-SERVICE MAINS

a. The Contractor must provide at least 3 business days notice to the District prior to connecting to existing mains so that the District can notify customers of a planned outage.

b. Immediately prior to installation, all fittings, valves and appurtenances, including tool surfaces which will come in contact with potable water, shall be thoroughly cleaned by washing with potable water and then swabbed or sprayed with a one percent (1%) hypochlorite solution in accordance with the requirements of AWWA C-651.

c. Cut-In Connections

1) All valves shall be operated by or under the supervision of a La Plata Archuleta Water District Representative. Care shall be taken to open all valves slowly to prevent water hammer.

2) Prior to taking any waterline out of service, the Contractor shall assemble all personnel, equipment, and materials necessary to complete the work, completely assemble all fitting assemblies and check components for compatibility with the existing waterline, and accomplish all excavation that is required to make the connection in as short of time possible or within a time period approved by the La Plata Archuleta Water Representative.

3) Existing valves may leak. The Contractor shall be prepared to make required connections in situations where there is still a partial flow of water after the isolation valves have been closed.

4) In situations where an existing pipe joint is found adjacent to a proposed connection and the Engineer determines that construction operations may compromise the joint, the Contractor shall remove the existing pipe between the joint and the new work as directed by the Engineer and replace that section with new materials.

d. Tapping Tees

1) Contractor shall fully support the weight of the tapping tee, associated valve and the existing pipeline. Under no circumstances shall the weight of the tapping unit be supported by the existing pipe. Pipe which is damaged due to failure of the Contractor to follow this requirement shall be replaced at no additional cost to the Owner.

3.12 STANDARD MAIN BLOW-OFFS

a. At all permanent dead-ends on new waterlines and at other locations specified or shown on the drawings, a 2-inch blow-off assembly shall be installed as specified herein and in accordance with drawing details.

b. Valve boxes or meter boxes shall be provided for all blow-offs and shall be installed flush with finished grade and be kept free of rocks and debris.

3.13 PIPE ANCHORAGE

a. Pipe anchorage systems shall be installed as shown on the drawings or as specified herein.

b. All plugs, caps, tees, and bends of 11-1/4° or more on waterlines that are 4-inches in diameter or larger shall be securely anchored by concrete thrust blocking or

restrained joints as approved by the Engineer. The use of threaded tie back rods for thrust restraint shall not be used unless specifically shown on the drawings or directed by the Engineer.

c. Thrust blocks shall be installed where specified herein, shown on the drawings, or as directed by the Engineer. Installation shall be in conformance with drawing details and the following:

1) All concrete thrust blocks shall be placed using forms as necessary to allow access to the bolt circles after the placement of the thrust blocking concrete. The bearing surface shall be placed so that the pipe and fitting joints will be accessible for repair. Concrete shall in no case extend around more than one-half the circumference of the fitting at any point.

2) A plastic sheet or other similar protection shall be placed between the concrete and any portions of the valve, fitting, or nuts and bolts with which the concrete comes in contact. Do not encase pipe joints, valve mechanics, or cover bolt circles with concrete.

3) Concrete thrust blocking shall be placed between undisturbed earth and the fittings to be anchored. If, in the opinion of the Engineer, the undisturbed earth against which the bearing surface will be established is compromised by adjacent trenches or excavations, the Contractor shall excavate additional material as required to establish a new bearing surface that is consistent with the size, configuration, and location of the piping.

3.14 SERVICE TAPS

a. Service pipe and fittings shall conform to plan details. Installation shall be in accordance with pipe manufacturer's recommendations.

b. All service on DI and PVC pipe shall be saddle tapped.

3.15 FIRE HYDRANTS

a. Installation of hydrants to conform to plan details. Installation shall be in accordance with AWWA C-600 and set where indicated on plans or directed by the Engineer.

b. Hydrants shall be installed true and plumb.

c. Hydrants shall be set a minimum of three (3) feet behind the curb/sidewalk or within the utility corridor right-of-way unless otherwise shown or directed.

d. Hydrants shall set so that the center of the safety breakaway flange is located a minimum of 2 inches and a maximum of 6 inches above finished curb, sidewalk or finished grade.

e. Where utility conflicts may require changes in grade, Contractor shall pothole existing utilities far enough in advance to allow the proper height hydrants to be on hand.

f. Hydrants set too high shall be removed and replaced with an appropriate hydrant by the Contractor at no additional cost to the Owner. Extensions required for hydrants set too low shall be supplied and installed by the Contractor at no additional cost to the Owner.

3.16 VALVE AND VALVE BOX INSTALLATION

a. Valve installation shall be in accordance with AWWA C-600 and applicable sections contained herein. A valve box shall be supplied for each valve, conforming to plan requirements and at locations shown on plans or staked in field.

b. Valve boxes shall be centered over the valve and installed plumb, with the cover flush with the finished grade. Valve boxes shall be set so they do not transmit shock or stress to the valves.

c. Backfill shall be placed around the valve boxes and thoroughly compacted in conformance with the compaction requirements for the adjacent backfill, and in a manner that will not damage or displace the valve box from proper alignment or grade. Misaligned valve boxes shall be excavated, plumbed and backfilled at Contractor's expense.

d. Toning wire, where required, shall be looped up at all valve boxes.

e. Valve boxes shall be kept free of rocks and debris at all times.

3.17 INSTALLATION OF TONING WIRE

a. Toning wire shall be placed on top of the pipe and taped to the top of the pipe using duct tape at about 8-foot intervals.

b. When splicing wire to connect a new roll of wire or to connect wire from lateral water lines the wire shall be tied together in an overhand knot, the end of the insulation strip off to expose at least 3/4” of bare wire, the wire twisted together , and then a silicone filled wire nut screwed over the end to completely cover and seal the exposed wire.

c. Wire shall be looped up into at least one valve box at all valve clusters and at all fire hydrants.

d. Contractor, at his expense, will be responsible for testing the toning wire to ensure that there is complete continuity of signal. Each valve box shall be visually inspected to verify that the toning wire has been properly placed. The continuity of the toning wire shall be tested in each direction from a valve box or fire hydrant with an electronic locator. Any areas that do not show continuity will be fixed at the Contractor’s expense.

3.18 CLEANING POTABLE WATER MAINS

a. All water mains shall be cleaned in accordance with AWWA C-650.

b. Minimum blowoff size for water mains shall be as shown in the following table:

Water Line Size	Minimum Blowoff Size
4”	1”
6” – 12”	2”
14”- 16”	4”
18” – 20”	6”

c. Prior to completion of pressure and leakage testing and prior to being placed into service, all new water mains and repaired portions or extensions of existing mains shall be disinfected by chlorination by the Contractor in accordance with AWWA Standard C 651 except as may be modified herein.

3.19 DISINFECTING POTABLE WATER MAINS

a. All water mains shall be disinfected in accordance with the requirements of AWWA C-651 except as modified herein.

b. The use of chlorine tablets glued into the pipe with Permatex will not be allowed. All new water lines shall be disinfected by introducing chlorinated water from a water truck or other means, approved by the Engineer, into the new line. Chlorine residual shall not be less than 50 ppm

1) Dry chlorine powder, that has 68% Calcium Hypochlorite as the active ingredient, or liquid chlorine bleach, that has 5% by weight chlorine, shall be used at the rate as set forth:

a) Dry chlorine powder shall be mixed at the rate of 0.62 pounds of powder per 1000 gallons of water.

b) Liquid chlorine bleach shall be mixed at the rate of one gallon per 1000 gallons.

c) The amount of chlorinated water required for various sizes of water lines is shown in the following table:

CHLORINATED WATER REQUIRED FOR DISINFECTION

Pipe Diameter (in)	X-sectional Area (ft^2)	Volume per 100 feet of pipe (gallons)
2	0.02	16
3	0.05	37
4	0.09	66
6	0.20	147
8	0.35	261
10	0.55	408
12	0.79	588
14	1.07	800
16	1.40	1045
18	1.77	1322
20	2.18	1632
24	3.14	2350
30	4.91	3672

2) Powdered chlorine or liquid chlorine bleach shall be thoroughly mixed with clean water in a water truck or other storage container. After mixing the solution shall be tested to ensure that it is at least a 50-ppm chlorine residual. If there is not at least a 50-ppm residual more powdered chlorine or liquid chlorine bleach shall be added to bring the residual up to 50-ppm. The chlorine residual shall be tested using a commercially available chlorine residual tester that measures concentrations above 10-ppm.

3) After the water line has been completed and before making connections to services or other water mains, except those shown on the drawings, water line shall be slowly loaded with chlorinated water from the water truck or tank until all air has been expelled. Air shall be bled from all service lines and fire hydrant laterals to insure adequate disinfection of all lines.

c. The dosage of chlorinating agent shall be of the amount to produce a minimum chlorine residual of 50 mg/L of free chlorine at all points in the line. Tests with the DPD method shall be made at selected points to determine the residual.

d. Where the Contractor chooses to use other methods for disinfecting the water line he shall submit a detailed plan to the Engineer, for Engineer's approval, indicating methods of introducing chlorine to the water line, methods for flushing the line and the means by which heavily chlorinated water will be disposed of.

e. Chlorinated water shall be retained in the lines for sufficient time to accomplish the desired disinfection but not less than 24 hours. All valves and hydrants in the line shall be operated during the retention period. At the end of this 24-hour period, the treated water in all portions of the main shall have a residual of not less than 25 mg/L free chlorine.

f. Valves shall be manipulated, Under Owner supervision and with care to operate slowly as to prevent water hammer, so that the strong chlorine solution in the line being treated will not flow back into lines adjoining the new line. Check valves may be used if desired.

g. The Contractor shall furnish required materials and apparatus and perform the work of disinfection. If additional taps and open trenches at points of connection are required, the Contractor shall bear the responsibility of making taps and maintaining open trenches until a satisfactory analysis has been obtained.

3.20 CLEARING THE MAIN OF HEAVILY CHLORINATED WATER

a. Following chlorination, all heavily chlorinated water shall be flushed into a water truck from the lines at their extremities until the replacement water throughout the lines shall, upon test, have a chlorine residual of no more than that of the existing system to which the new line is connected.

b. Heavily chlorinated water that is in the water truck shall be disposed of in accordance with all Federal, State and Local laws and regulations. The environment into which the chlorinated water is to be discharged shall be inspected. If there is any possibility that the chlorinated discharge will enter any stream, storm drain, or any drainage feature, then a neutralizing chemical shall be applied to the chlorinated water prior to discharge from the water truck. The table below shows the neutralizing chemicals that can be used and their respective dosages, in pounds, per 1000 gallons of water:

CHEMICAL REQUIRED FOR DECLORINATING WATER

Residual Chlorine (ppm)	Sulfur Dioxide (SO_2)	Sodium Bisulfite ($NaHSO_3$)	Sodium Sulfite (Na_2SO_3)	Sodium Thiosulfate ($Na_2S_2O_3$-$5H_2O$)
1	0.008	0.012	0.014	0.012
2	0.017	0.025	0.029	0.024
5	0.042	0.063	0.073	0.060
10	0.083	0.125	0.146	0.120
25	0.21	0.313	0.365	0.30
50	0.42	0.625	0.73	0.60

3.21 FLUSHING AND CLEANING

a. After all of the heavily chlorinated water has been removed from the new water line, fire hydrants and service lines; the main shall be flushed to remove all dirt and debris that may be in the line. Contractor shall flush the line to obtain a minimum velocity of at least 2.5 fps in the line.

b. Upon completion of flushing the District will take bacteria samples and provide the laboratory analysis. Should the initial treatment prove ineffective, the chlorination shall be repeated as set forth in Paragraph 3.19 at no additional cost to the District until confirmed tests show acceptable results.

3.22 PRESSURE AND LEAKAGE TESTS FOR PRESSURE PIPE

a. The Contractor shall furnish the pump, pipe connections, taps, gauges, auxiliary water container, bulkheads, plugs and other necessary equipment and perform pressure and leakage tests on all lines unless otherwise directed by the Engineer. All equipment and material that will come in contact with water entering the distribution system shall be clean and disinfected prior to use. Water shall be potable water that has only been stored in clean disinfected containers.

b. Tests shall be conducted on all pipelines or valved sections thereof. Tests on lines anchored or blocked by concrete shall not be conducted until the concrete has taken permanent set.

c. Hydrostatic leakage testing shall be performed in conformance to the applicable sections of AWWA C-600 or local jurisdiction requirements, whichever is more stringent, except as modified below. Unless otherwise authorized by the District,

all hydrostatic leakage tests shall be witnessed by the Engineer or the Districts field Representative.

d. The test pressure shall be 150 lbs./sq. in., or 50 percent (50%) above the normal operating pressure, whichever is greater. Hydrostatic pressure shall be applied by pumping water from an auxiliary supply. The Contractor shall accurately determine the amount of water required to reach the initial test pressure and the amount required to re-pressurize the pipe structure at the completion of the test period.

e. The test pressure shall be maintained for a minimum of four (4) hours and additional time as required for thorough inspection to find any leaks or defects in the water main and appurtenances. Should the pipe section fail to pass the tests, the Contractor shall find and correct failures and repeat the tests until satisfactory results are obtained at no additional cost to the Owner.

f. Where test pressure is 250 psi or less, the hydrostatic test shall be performed with the hydrant line valves open.

g. Air Removal - Before applying the specified test pressure, air shall be expelled completely from the pipe, valves, and hydrants. If permanent air vents are not located at all high points, the Contractor shall install corporation cocks at such points so that the air can be expelled as the line is filled with water. After all the air has been expelled, the corporation cocks shall be closed and the test pressure applied. At the conclusion of the pressure test, the corporation cocks shall be removed and plugged or left in place at the discretion of the Owner.

h. Allowable Leakage

1) No pipe installation will be accepted if the leakage is greater than that determined by the formula outlined below or local jurisdiction requirements, whichever is more stringent.

$$L = \frac{SD\sqrt{P}}{133{,}200}$$

Where:

L = allowable leakage, in gallons per hour

S = length of pipe tested, in feet

D = nominal diameter of the pipe, in inches

P = average test pressure during the leakage test, in pounds per square inch (gauge)

NOTE: This formula is based on an allowable leakage of 11.65 gpd/mi./in. of nominal diameter at a pressure of 150 psi.

2) The allowable leakage in gallons per hour at various pressures and pipe sizes is shown below. In the event of discrepancies between formulas and table values, the more stringent shall apply.

ALLOWABLE LEAKAGE PER 1,000 FEET OF PIPELINE - *gph*

AVG. TEST PRESSURE ***psi***	**NOMINAL PIPE DIAMETER - *in.***									
	3	**4**	**6**	**8**	**10**	**12**	**14**	**16**	**18**	**20**
250	0.36	0.47	0.71	0.95	1.19	1.42	1.66	1.90	2.14	2.37
225	0.34	0.45	0.68	0.90	1.13	1.35	1.58	1.80	2.03	2.25
200	0.32	0.43	0.64	0.85	1.06	1.28	1.48	1.70	1.91	2.12
175	0.30	0.40	0.59	0.80	0.99	1.19	1.39	1.59	1.79	1.98
150	0.28	0.37	0.55	0.74	0.92	1.10	1.29	1.47	1.66	1.84
125	0.25	0.34	0.50	0.67	0.84	1.01	1.18	1.34	1.51	1.68
100	0.23	0.30	0.45	0.60	0.75	0.90	1.05	1.20	1.35	1.50

3) If the pipe structure under test contains sections of various diameters, the allowable leakage shall be the sum of the computed leakage for each size. No additional leakage allowance will be given for fire hydrant assemblies.

3.23 CLEANUP

a. Cleanup and surface restoration shall conform to the requirements contained herein and shall closely follow pipe laying activities.

b. Contractor shall remove all excess materials, broken pavement, construction equipment, etc., within three (3) days after pipe is laid in any area.

c. Contractor shall level and re-sod lawn areas, grade and gravel shoulder or parking areas, and replace any signs, mailboxes, etc. which were removed or damaged.

PART 4: SPECIAL PROVISIONS

4.01 MEASUREMENT AND PAYMENT

a. When not listed in the Bid, all "WATER DISTRIBUTION SYSTEM" costs will be considered incidental work for which no separate payment will be made.

b. When listed in the Bid, payment for work specified under this section will be made at the prices named in the Bid for the following items installed, tested, disinfected and acceptable to the Engineer.

1) Mainline pipe to be paid for at the unit prices named in the Bid for each size and type of pipe. Length to be measured horizontally along centerline of pipe without deducting for valves and fittings. Unless otherwise listed in the Bid, cost of mainline pipe fittings and appurtenances shall be included in the unit price for mainline pipe.

2) Unless otherwise listed in the Bid, valves are to be paid for at the unit price named in the Bid for each size and type of valve complete with valve box and cover.

3) Each fire hydrant assembly to be paid for at the unit price named in the Bid. Payment for each fire hydrant assembly shall include hydrant, spool piece, gate valve, fittings, mainline tee, thrust blocking and all appurtenances, as well as excavation, backfill, compaction and surface restoration.

4) All mainline connections named in the Bid to be paid for at the lump sum prices named in the Bid. Unless otherwise listed in the Bid, payment for each mainline connection shall include fittings, pipe thrust restraint and all appurtenances inclusive of valves, as well as excavation, backfill, compaction and surface restoration outside of the specified trench pay limits.

5) Each air release valve assembly to be paid for at the unit prices named in the Bid. Unless otherwise listed in the Bid, payment for each air release valve assembly to include fittings, pipe, valves, manhole, drain line and all appurtenances, as well as excavation, backfill, compaction and surface restoration.

6) All near and far side water service to be paid for at the unit prices named in the Bid. Payment for each service to include fittings, pipe and all appurtenances, as well as saw-cutting, excavation, backfill, compaction and surface restoration.

c. No payment to be made for pipe or valves which have not passed a hydro-static leakage test.

d. Quantities to be computed by the Engineer from measurement of actual work completed and accepted.

e. Installation of pipe anchorage and thrust restraint systems to be considered incidental work for which no separate payment will be made.

f. Payment indicated to include complete compensation for all labor, equipment, materials, and incidentals involved in the work as listed in the Bid and as specified under this section. No additional compensation to be allowed.

END OF SECTION