

GRAND COUNTY
WATER AND SANITATION
DISTRICT NO. 1

ENGINEERING
AND
CONSTRUCTION
STANDARDS

February 1, 2021

**GRAND COUNTY WATER AND SANITATION DISTRICT NO. 1
ENGINEERING & CONSTRUCTION STANDARDS
TABLE OF CONTENTS**

DIVISION 01 00 00 – GENERAL REQUIREMENTS

01 42 10 Other Relevant Documents

Part 1 – General

- 1.1 Grand County Water and Sanitation District No. 1 Rules and Regulations
- 1.2 Colorado Utility Notification Center
- 1.3 Colorado Department of Public Health and Environment
- 1.4 Colorado Department of Transportation
- 1.5 Construction Specification Institute
- 1.6 Denver Water Department Construction Information and Requirements
- 1.7 Grand County Erosion and Sediment Control Handbook
- 1.8 Town of Winter Park Standards and Specifications for Design and Construction
- 1.9 Town of Winter Park Earthworks Specifications
- 1.10 Town of Winter Park Right-of-Way Use Permit Application
- 1.11 Town of Winter Park Requirements for Submittal of Digital Final Plat
- 1.12 Town of Winter Park Building Permits and Codes
- 1.13 Union Pacific Railroad Construction Requirements
- 1.14 United States Forest Service Special Use Authorization Regulations (36 C.F.R. Part 251)

01 14 00 Work Restrictions

Part 1 – General

- 1.1 Private and Public Land
- 1.2 Facility Locations
- 1.3 Open Excavations
- 1.4 Test Pits
- 1.5 Care and Protection of Property
- 1.6 Protection and Relocation of Existing Structures and Utilities
- 1.7 Protection of Archaeological Sites and Artifacts

01 33 00 Submittals

Part 1 – General

- 1.1 Scope
- 1.2 Responsibilities

Part 2 – Submittal Materials

- 2.1 Construction Drawings
- 2.2 Project Schedule
- 2.3 Construction Schedule
- 2.4 Manufacturer’s or Product Data
- 2.5 Testing and Test Reports
- 2.6 Shop Drawings
- 2.7 Engineered Products
- 2.8 Operation and Maintenance Manuals
- 2.9 Record Manuals
- 2.10 Warranties

Part 3 – Execution

- 3.1 Submittals
- 3.2 Transmittal Procedure
- 3.3 Deviation from Contract
- 3.4 Submittal Completeness
- 3.5 Review Procedure
- 3.6 Effect of Review of Contractor’s Submittals
- 3.7 Project and Construction Schedules
- 3.8 Project Status Update

Form 01330-A: Submittal Transmittal

Form 01330-B: Professional Engineer Certification Form

01 35 43 Environmental Protection Procedures

Part 1 – General

- 1.1 Scope of Work
- 1.2 Applicable Regulations
- 1.3 Notifications
- 1.4 Chemicals
- 1.5 Petroleum-Based Products and Spills
- 1.6 References
- 1.7 Submittals

Part 2 – Part 2 – Products

- 2.1 Erosion Control
- 2.2 Trash Control

Part 3 – Execution

- 3.1 Erosion Control
- 3.2 Protection of Streams

- 3.3 Protection of Land Resources
- 3.4 Protection of Air Quality
- 3.5 Rubbish Control
- 3.6 Maintenance of Existing Facilities During Construction
- 3.7 Noise Control
- 3.8 Noxious Weed Controls

DIVISION 02 00 00 – EXISTING CONDITIONS

02 21 00 Surveys

Part 1 – General

- 1.1 Scope of work
- 1.2 Description
- 1.3 Quality Assurance
- 1.4 Submittals

Part 2 – Products (not used)

Part 3 – Execution

- 3.1 General

DIVISION 03 00 00 – CONCRETE

03 41 00 Concrete Manholes and Precast Structures

Part 1 – General

- 1.1 Scope of Work
- 1.2 Submittals
- 1.3 Reference Standards
- 1.4 Quality Assurance

Part 2 – Products

- 2.1 General
- 2.2 Precast Concrete Manhole Sections
- 2.3 Precast Concrete Structures
- 2.4 Manhole Frame and Cover
- 2.5 Jointing Precast Manhole Sections and Structures
- 2.6 Corrosion Resistant Coating
- 2.7 Pipe Connections to Manhole
- 2.8 Damp-Proofing
- 2.9 Steps
- 2.10 Seam Sealer

Part 3 – Execution

- 3.1 Installation
- 3.2 Leakage Tests
- 3.3 Cleaning

DIVISION 31 00 00 – EARTHWORK

31 23 19 Dewatering and Drainage

Part 1 – General

- 1.1 Scope of Work
- 1.2 Design and Performance Responsibility
- 1.3 Submittals

Part 2 – Products

- 2.1 Materials

Part 3 – Execution

- 3.1 General
- 3.2 Surface Water Control

- 3.3 Excavation Dewatering
- 3.4 Dewatering Structure
- 3.5 Concrete Washout Pit

31 23 33 Trenching and Backfilling

Part 1 – General

- 1.1 Scope
- 1.2 Tunneling and Boring
- 1.3 Reference Standards
- 1.4 Related Work
- 1.5 Submittals
- 1.6 Quality Assurance

Part 2 – Products

- 2.1 Bedding and Backfill Material Requirements
- 2.2 Unsuitable Material
- 2.3 Water
- 2.4 Blasting Materials and Equipment

Part 3 – Execution

- 3.1 Structure Excavation
- 3.2 Pipeline Trench Excavation
- 3.3 Excavation in Landscaped and Unimproved Areas
- 3.4 Disposal of Excess Clean Excavated Material
- 3.5 Disposal of Pavement Material
- 3.6 Backfill – General
- 3.7 Compaction
- 3.8 Pipe Trench Backfill
- 3.9 Lean Mix Concrete
- 3.10 Blasting

DIVISION 32 00 00 – EXTERIOR IMPROVEMENTS

32 92 19 Seeding

Part 1 – General

- 1.1 Scope of Work
- 1.2 Submittals

Part 2 – Products

- 2.1 General
- 2.2 Seed Mixtures

- 2.3 Topsoil
- 2.4 Fertilizer

Part 3 – Execution

- 3.1 General
- 3.2 Topsoil Removal, Storage, and Placement
- 3.3 Fertilization
- 3.4 Seeding

DIVISION 33 00 00 – UTILITIES

33 14 13 Water Distribution Pipe and Fittings

Part 1 – General

- 1.1 Scope of Work
- 1.2 References
- 1.3 Definitions
- 1.4 Submittals
- 1.5 Quality Assurance
- 1.6 Delivery, Storage, and Handling
- 1.7 System Design Requirements

Part 2 – Products

- 2.1 General
- 2.2 Pipe Anchors
- 2.3 Couplings for Metallic Piping
- 2.4 Service Lines
- 2.5 Slab, Floor, Wall, and Roof Penetrations
- 2.6 Piping Support Systems
- 2.7 Concrete
- 2.8 Trench Excavation, Pipe Bedding, and Backfill
- 2.9 Pipe Marking Tape

Part 3 – Execution

- 3.1 Examination
- 3.2 Preparation
- 3.3 Piping Installation
- 3.4 Flexible Couplings, Flanged Coupling Adapters, Grooved Joint Couplings, and Service Saddles
- 3.5 Piping Support Systems
- 3.6 Slab, Floor, Wall, and Roof Penetrations
- 3.7 Trench Excavation and Backfill
- 3.8 Buried Pipe Placement
- 3.9 Flexible Sleeve Couplings

- 3.10 Connecting Dissimilar Pipe
- 3.11 Flexible Joints at Concrete Structures, Walls, Backfill or Encasement
- 3.12 Closures
- 3.13 Thrust Restraint
- 3.14 Marking Tape and Tracer Wire
- 3.15 Exposed Piping Installation
- 3.16 Corrosion Protection
- 3.17 Disinfection
- 3.18 Pipe Leak Testing
- 3.19 Hydrostatic Leak Testing

33 14 14 Water Distribution Valves and Hydrants

Part 1 – General

- 1.1 Scope
- 1.2 References
- 1.3 Contractor Submittals
- 1.4 Quality Assurance

Part 2 – Products

- 2.1 General – Valves
- 2.2 Gate Valves
- 2.3 Butterfly Valves
- 2.4 Hydrants

Part 3 – Execution

- 3.1 Cleaning
- 3.2 General Installation
- 3.3 Gate Valves and Boxes
- 3.4 Fire Hydrants
- 3.5 Testing and Disinfection

33 14 20 Pressure Reducing Valves and Vault

Part 1 – General

- 1.1 Scope
- 1.2 References
- 1.3 Contractor Submittals
- 1.4 Quality Assurance

Part 2 – Products

- 2.1 Pressure Reducing Valves
- 2.2 Pre-Fabricated Vault

2.3 Other Valves

Part 3 – Execution

- 3.1 Cleaning
- 3.2 General Installation
- 3.3 Testing and Disinfection

33 31 11 Gravity Sewer Pipe

Part 1 – General

- 1.1 Scope of Work
- 1.2 Submittals
- 1.3 Reference Standards
- 1.4 Quality Assurance
- 1.5 System Description
- 1.6 Delivery, Storage, and Handling

Part 2 – Products

- 2.1 Polyvinyl Chloride (PVC) Pipe and Fittings
- 2.2 Backfill Materials

Part 3 – Execution

- 3.1 Installation of PVC Pipe and Fittings
- 3.2 Jointing PVC Pipe (push-on type)
- 3.3 Joining Polyvinyl Chloride (PVC) Sewer Pipe and Fittings
- 3.4 Testing of Sewers
- 3.5 Final Cleaning

WATER DETAILS

- W-1 WATER MAIN NOTES
- W-2 FIRE HYDRANT ASSEMBLY
- W-3 CONCRETE THRUSTBLOCKS
- W-4 POLYETHYLENE WRAP
- W-5 OPEN CUT CROSSING BENEATH CONDUIT
- W-6 GATE VALVE
- W-7 SERVICE LINE, STOP BOX AND INSIDE METER INSTALLATION FOR UP TO 2-
INCH DIAMETER SERVICE LINES
- W-8 TYPICAL SERVICE LINE STUB-OUT DETAIL
- W-9 TYPICAL SERVICE LINE TRENCH DETAIL
- W-10 TYPICAL WATER MAIN TRENCH DETAIL
- W-11 TRENCH PLUG

SANITARY SEWER DETAILS

- S-1 SANITARY SEWER NOTES
- S-2 PRECAST MANHOLE
- S-3 MANHOLE BASE SHAPED INVERTS
- S-4 TYPICAL SEWER MAIN TRENCH DETAIL
- S-5 SERVICE CONNECTION TO NEW CONSTRUCTION (PVC PIPE)
- S-6 TRENCH PLUGSECTION 01 14 00

SECTION 01 42 19

RELEVANT DOCUMENTS

PART 1 – GENERAL

Comply with all of the following documents as applicable to a particular project.

- 1.1 Grand County Water and Sanitation District No. 1 (District) Rules and Regulations
- 1.2 Colorado Utility Notification Center (call 811)
- 1.3 Colorado Department of Public Health and Environment (CDPHE)
- 1.4 Colorado Department of Transportation (CDOT)
- 1.5 Construction Specification Institute (CSI)
- 1.6 Denver Water Department Construction Information and Requirements
- 1.7 Grand County (County) Erosion and Sediment Control Handbook
- 1.8 Town of Winter Park (Town) Standards and Specifications for Design and Construction
- 1.9 Earthworks Specifications
- 1.10 Town Right-of-Way Use Permit Application
- 1.11 Town Requirements for Submittal of Digital Final Plat
- 1.12 Town Building Permits and Codes
- 1.13 Union Pacific Railroad Construction Requirements
- 1.14 United States Forest Service (USFS) Special Use Authorization Regulations (36 C.F.R. Part 251)

END OF SECTION

SECTION 01 14 00

WORK RESTRICTIONS

PART 1 – GENERAL

PRIVATE AND PUBLIC LAND

- A. Do not enter or occupy private or public lands outside of easements and rights-of-way, except by written permission of the landowner or controlling authority. Provide a copy of written authorization to the District if such entry is specifically for construction of facilities that will be transferred to the District.
- B. Construction within public and private lands may be restricted by additional conditions. See Section 01 00 00. It is the responsibility of the Contractor to be aware of and strictly follow any restrictions and/or permit conditions imposed by these entities and their respective requirements and regulations.

1.2 FACILITY LOCATIONS

- A. When in public roadways and rights-of-way within the Town limits, meet the requirements of the Town's Standards and Specifications for Design and Construction for location of new utilities. Outside Town limits, meet the requirements of the appropriate jurisdictional authority.
- B. Locate proposed utilities and facilities as indicated on the approved Drawings, including plans and specifications as more particularly described in the District's Rules and Regulations, unless directed otherwise by the District. The District reserves the right to make modifications in locations as may be necessary or desirable to avoid interference with existing structures or for other reasons.

1.3 OPEN EXCAVATIONS

- A. Meet the requirements of the Town's Standards and Specifications for Design and Construction and, for excavations within the Town's limits, meet the Town's Earthwork Specifications.
- B. Adequately safeguard all open excavations by providing temporary barricades, caution signs, lights and other means to prevent accidents to persons and damage to property. Provide suitable and safe bridges and other crossings for accommodating travel by pedestrians and workers. Bridges provided for access during construction shall be removed when no longer required.

- C. Take precautions to prevent injury to the public due to open trenches. All trenches, excavated material, equipment, or other obstacles that could be dangerous to the public shall be well lighted at night.
- D. When within boundaries of other agencies or landowners who have jurisdictional control, meet all requirements of those jurisdictions.

1.4 TEST PITS

- A. Excavate and backfill test pits for the purpose of locating underground utilities or structures in advance of construction at the direction of the District. Backfill test pits immediately after their purpose has been satisfied. Restore and maintain the surface in a manner satisfactory to the District and the Town.
- B. All backfill shall meet the Town's Earthwork Specifications.

1.5 CARE AND PROTECTION OF PROPERTY

- A. Protect all public and private property and use every precaution necessary to prevent damage thereto. If any direct, or indirect, damage is done to public or private property by or on account of any act, omission, neglect, or misconduct in the execution of the work on the part of the Contractor, restore such property to a condition similar or equal to that existing before the damage was done, or make good the damage in other manner acceptable to the District and the Town at the sole expense of the Contractor.

1.6 PROTECTION AND RELOCATION OF EXISTING STRUCTURES AND UTILITIES

- A. Contractor shall assume full responsibility for the protection of all buildings, structures, and utilities, public or private, including but not limited to poles, signs, building services, utilities in the street, gas pipes, water pipes, hydrants, sewers, drains, electric lines, telephone lines, and any other cables. Contractor is responsible for all damage done to such utilities.
- B. The Contractor shall bear responsibility for obtaining locations of underground structures and utilities including existing water and sewer services, telephone lines, and other utilities. The Contractor is responsible for scheduling utility locates through the Colorado Utility Notification Center. Call 811 to arrange utility locates prior to commencing construction.
- C. The District will provide assistance to the Contractor in determining the location of existing water and sewer lines related to the project.
- D. Notify utility owner(s) (both above ground and underground facilities) prior to proceeding with excavations whenever such work is within 20 feet of any existing utility.

- E. Notify utility owner if utility is damaged by the Contractor's operations. Repair damaged utility only with written authorization. Provide District a copy of every written authorization.
- F. Use approved granular bedding material to rebed utilities exposed below mid-diameter. Extend granular bedding material to the limits of the trench excavation and a minimum of two feet beyond each side of the exposed utility.

1.7 PROTECTION OF ARCHAEOLOGICAL SITES AND ARTIFACTS

- A. Should the Contractor identify any archaeological sites or should the Contractor locate any artifacts, the Contractor shall immediately stop all activity in the area of the site or artifact. The Contractor shall immediately notify the District, the Town and the Colorado Historical Society.

END OF SECTION

SECTION 01 33 00

SUBMITTALS

PART 1 – GENERAL

1.1 SCOPE

- A. Submittals covered by these requirements include, when applicable, project and construction schedules, manufacturers' information, shop drawings, test procedures, test results, samples, requests for substitutions, operation and maintenance manuals, record drawings, and miscellaneous work-related submittals.
- B. Submittals shall also include construction drawings, reinforcing steel details, right-of-way documentation, survey documentation, water demand and Single Family Equivalent (SFE) documentation as applicable to the project.

1.2 RESPONSIBILITIES

- A. The Contractor shall be responsible for the accuracy and completeness of the information contained in each submittal and shall assure that the material, equipment or method of work shall be as described in the submittal. The Contractor shall verify that all features of all products conform to the specified requirements. Submittal documents shall be clearly edited to indicate only those items, models, or series of equipment, which are being submitted for review. All extraneous materials shall be crossed out or otherwise obliterated.
- B. The Contractor shall coordinate the scheduling of submittals to avoid work delays.
- C. When applicable, the Contractor shall provide submittal copies to other appropriate agencies as is required by those agencies.

PART 2 – SUBMITTAL MATERIALS

2.1 CONSTRUCTION DRAWINGS

- A. Construction drawings shall be provided to the District for all proposed improvements that shall become the property of the District upon completion. Construction drawings shall also include right-of-way and/or easement documentation, equipment schedules, lists, calculations for water demand and other items as appropriate.

- B. Construction drawings must be reviewed and approved, and all necessary right-of-way and/or easement provisions must be in place to the District's satisfaction before construction can commence.

2.2 PROJECT SCHEDULE

- A. A project schedule shall be submitted with construction plans and shall include the overall schedule for permitting, easement acquisition, and a general time frame anticipated for construction.
- B. The Contractor shall update this schedule as conditions warrant.

2.3 CONSTRUCTION SCHEDULE

- A. A detailed construction schedule shall be submitted 5 working days prior to the start of construction and maintained in accordance with this section.
- B. The Contractor shall provide a graphic construction schedule prepared by the critical path method or other approved method. The schedule shall be prepared from estimates of the required duration and sequence for each item of work.
- C. The project schedule shall depict all significant construction activities and all items of work listed in the bid. The dependencies between activities shall be indicated so that it may be established what effect the progress of any one activity has on the schedule.
- D. Time for completion, specific dates for construction activities, and sequencing requirements shall be shown on the schedule. Activities making up the critical path shall be identified.
- E. The schedule duration of each activity shall be based on the work being performed during the normal 40-hour work week with allowances made for legal holidays and normal weather conditions, unless otherwise agreed upon with the District.

2.4 MANUFACTURER'S OR PRODUCT DATA

- A. Manufacturer's data shall include, but not be limited to, cut sheets, brochures, model number identification, and standard published manufacturer's material specifying the quality, make-up, application and materials of fabrication for the specified products.
- B. This data shall also include product or material samples when specified or when deemed appropriate by the Contractor and/or the District.

2.5 Testing and test reports

- A. The Contractor shall notify the District not less than 7 working days prior to the date that the equipment installation(s) and/or other materials or portions of the Work will be ready for inspection and testing.
- B. Test certification shall be provided, and signed by the responsible party, to the satisfaction of the District at the completion of the test. It shall include the following:
 - 1. Date of report, name, address, telephone number and signatures of individuals performing the test or inspection and of individuals issuing the report.
 - 2. Project name and contract number, when appropriate.
 - 3. Dates, times, temperature, weather conditions, and locations of tests and inspections.
 - 4. Identify the work or product by specification section and test or inspection method.
 - 5. Complete inspection or test data, results of test, interpretation of test results, compliance with any contractual requirements and recommendations regarding re-testing.
 - 6. Backfill compaction and concrete testing is to be completed by a District approved laboratory at the sole expense of the Contractor. Testing shall be completed on a timely basis so as to not delay construction work. Results shall be tabulated and provided to the District in a timely manner.

2.6 SHOP DRAWINGS

- A. Shop drawings shall accompany product data submittals as required in the individual specification sections herein.
- B. Shop drawings shall adequately provide the dimensions and layout of equipment and shall include plan and elevation views, blow-up drawings to depict all key components and materials, sections to depict how parts fit together and function, and other details as required to provide full detail of the equipment and its component parts.
- C. Shop drawings may also be required, in detailed and/or schematic form, for equipment or other mechanical systems.
- D. For underground piping, shop drawings shall include a layout drawing showing all applicable fittings, valves, vaults, manholes, and other relevant appurtenances.

- E. Shop drawings shall not fulfill the requirements for record drawings but may be included with record drawings when applicable.

2.7 ENGINEERED PRODUCTS

- A. Products requiring professional engineering design and/or certification shall include Form 01330-B: Professional Engineer Certification Form and shall be stamped by a professional engineer with valid registration in the State of Colorado. Such stamp shall be consistent with the rules and regulations of the state governing professional engineering registration. The form is provided at the end of this section.

2.8 OPERATION AND MAINTENANCE MANUALS

- A. If applicable, a system operation and maintenance manual, or series of manuals, shall be developed which covers the overall system operations and each piece of mechanical equipment specified within this contract.
- B. The CONTRACTOR shall submit the manuals in three-ring or other District approved binders. Formatting shall be 8½" x 11" size, well indexed and including the following information:
 - 1. Contractor's' names, addresses, and telephone numbers.
 - 2. Alphabetical list of all system components with the name and address, email, and 24-hour phone number of the company responsible for servicing each item during the first year of operation.
 - 3. Guarantees and warranties of all equipment whenever applicable.
 - 4. All data applicable to the installed equipment including, but not limited to: shop drawings, installation instructions, lubrication instructions, wiring diagrams, operating instructions, start-up procedures, shut-down procedures, trouble-shooting and repair guides, emergency guidelines, spare part and supply lists, vendors, and other relevant information.
- C. Operation and maintenance manuals shall be provided prior to project closeout and acceptance by the District.

2.9 RECORD DRAWINGS

- A. Record drawings (a/k/a "as-builts") are defined as a neatly and legibly marked set of construction drawings showing the final location of piping, manholes, mechanical equipment, electrical equipment, and other related systems. Record drawings shall also include additional documents such as equipment schedules, lists, drawings, and electrical and instrumentation diagrams.

- B. Unless otherwise specified, record drawings shall be full size and maintained in a clean, dry, and legible condition. Record documents shall not be used for construction purposes and shall be available for review by the District during normal working hours at the CONTRACTOR's field office. At the completion of the Work, all record drawings shall be submitted to the District.
- C. Record drawings shall depict all easements and properties transferred to the District as well as all existing easements and rights-of-way boundaries.
- D. Record drawings shall be provided for all water and sanitary sewer improvements that connect to, but are not part of, the District's systems.
- E. All record drawings shall be provided to the District prior to project closeout and acceptance by the District.
- F. Record drawings shall be prepared to be consistent with, and incorporated in, the Town's and the District's GIS database.

2.10 WARRANTIES

- A. All applicable warranty documents shall be assigned and delivered to the District after all terms for project closeout have been met.
- B. The Contractor shall provide a two-year materials and labor, in writing, warranty for all project improvements including, but not limited to all facilities, backfill, compaction, landscaping, and erosion control.
- C. All equipment and system warranties shall be presented to the District prior to project closeout and acceptance by the District. All warranties shall be in the District's name.

PART 3 – EXECUTION

3.1 SUBMITTALS

- A. The Contractor shall submit two copies of all submittals to the District for review and comment unless otherwise agreed upon with the District. When applicable, the District will consider electronic document submittals to be coordinated with the District staff and the District Engineer.
- B. Unless otherwise specified, Contractors shall use Form 01330-A: Submittal Transmittal attached at the end of this section, for all submittals for review and comment by the District.

3.2 TRANSMITTAL PROCEDURE

- A. Submittals, both electronic and hard copy/samples, shall be accompanied by Form 01330-A: Transmittal Submittal provided at the end of this section. A separate form shall be used for each specific item, class of material, equipment, or other items specified. All appropriate equipment numbers shall be identified on the submittal form. Submittals for various items shall be made with a single form when the items taken together constitute a manufacturer's package or are so functionally related that expediency indicates checking or review of the group or package as a whole.
- B. A unique number, sequentially assigned, shall be noted on the transmittal form accompanying each item submitted. Original submittal numbers shall have the following format: "XXX"; where "XXX" is the sequential number assigned by the CONTRACTOR. Re-submittals shall have the following format: "XXX-Y"; where "XXX" is the originally assigned submittal number and "Y" is a sequential letter assigned for re-submittals, i.e., A, B, or C being the 1st, 2nd, and 3rd re-submittals, respectively.

3.3 DEVIATION FROM CONTRACT

- A. If the Contractor proposes to provide material, equipment, or method of work which deviates from the Contract Documents, he shall indicate so under "deviations" on the transmittal form accompanying the submittal copies.

3.4 SUBMITTAL COMPLETENESS

- A. Submittals which do not have all the information required to be submitted, including deviations, are not acceptable and will be returned without review.

3.5 REVIEW PROCEDURE

- A. Submittals are specified for those features and characteristics of materials, equipment, and methods of operation which can be selected based on the Contractor's judgment of their conformance to the specified requirements. Other features and characteristics are specified in a manner which enables the Contractor to determine acceptable options without submittals. The review procedure is based on the Contractor's guarantee that all features and characteristics not requiring submittals conform as specified. Review shall not extend to means, methods, techniques, sequences or procedures of construction, or to verifying quantities, dimensions, weights or gages, or fabrication processes (except where specifically indicated or required by the Contract Documents) or to safety precautions or programs incident thereto. Review of a separate item, as such, will not indicate approval of the assembly in which the item functions.

3.6 EFFECT OF REVIEW OF CONTRACTOR'S SUBMITTALS

- A. Review of contract drawings, methods of work, or information regarding materials or equipment the Contractor proposes to provide, shall not relieve the Contractor of his responsibility for errors therein and shall not be regarded as an assumption of risks or liability by the District or its representatives, or by any officer or employee thereof, and the Contractor shall have no claim under the contract on account of the failure, or partial failure, of the method of work, material, or equipment so reviewed.
- B. A mark of "NO EXCEPTIONS TAKEN" or "MAKE CORRECTIONS NOTED" shall mean that the District and its representatives have no objection to the Contractor using the plan or method of work proposed, or providing the materials or equipment proposed. The District and its representatives, however, do not assume or create any risks or liability for the District and/or its representatives by these marks.

3.7 PROJECT AND CONSTRUCTION SCHEDULES

- A. The project schedule shall be submitted with the construction plans submittal and resubmitted if it is changed.
- B. The construction schedule shall be submitted 5 working days before construction begins and updated throughout the course of construction.

3.8 PROJECT STATUS UPDATE

- A. Project status meetings shall be held each week throughout the construction schedule, unless otherwise approved by the District.

FORM 01330-A: SUBMITTAL TRANSMITTAL

OWNER: Grand County Water and Sanitation District No. 1
ENGINEER:
CONTRACTOR:

Submittal No.: _____ **Description:** _____ **Section:** _____

Submittal Routing	Dated	Received
CONTRACTOR to ENGINEER		
ENGINEER to CONTRACTOR		

Routing via: Email Hard Copy

Note: This submittal has been reviewed with respect to the Contract Documents for the subject project and this review does not relieve the Contractor and its suppliers and subcontractors from their responsibility to comply with the Contract Documents.

Item	Copies	Date	Description	Review action	Reviewer initials	Review comments attached

Note: NET = No exceptions taken; MCN = Make corrections noted; A&R = Amend and resubmit; R = Rejected -- (Attach additional sheets if necessary.)

CONTRACTOR certifies that the material or equipment contained in this submittal meets all the requirements specified, including coordination with all related work, except for the following deviations.

Item	Deviation

Certified by: _____
Contractor's Signature

Date

FORM 01330-B: PROFESSIONAL ENGINEER CERTIFICATION FORM

The undersigned certifies that he/she is a professional engineer registered in the State of Colorado and that he/she has been employed by (name and address of CONTRACTOR)

to design _____ in accordance with Specification Section _____ for the _____ Project. The undersigned further certifies that he/she has performed the design of _____

and that said design is in conformance with all applicable local, state, and federal codes, rules, and regulations, and that his/her signature and P.E. stamp have been affixed to all calculations and drawings used in, and resulting from, the design. Also, affix stamp in space provided below.

The undersigned hereby agrees to make all original design drawings and calculations available to the District's Representative within seven days following written request.

P.E. Name

Signature

Address

Stamp

Contractor's Name

Date

Signature

Title

Address

END OF SECTION

SECTION 01 35 43

ENVIRONMENTAL PROTECTION PROCEDURES

PART 1 – GENERAL

1.1 SCOPE OF WORK

- A. Furnish all labor, materials and equipment and perform all work required for the prevention of environmental pollution in conformance with applicable laws and regulations, during and as the result of construction operations.
- B. For the purpose of this Specification, environmental pollution is defined as the presence of chemical, physical, or biological elements or agents which adversely affect human health or the environment; unfavorably alter ecological balances; affect other species; or degrade the utility of the environment for aesthetic and/or recreational purposes. Such pollution includes, but is not limited to, eroded soils, refuse, garbage, cement, concrete, sanitary waste, industrial waste, oil and other petroleum products, mineral salts and spirits, and thermal pollution.
- C. The control of environmental pollution requires consideration of air, water, and land, and involves management of noise and solid waste, as well as other pollutants.
- D. All phases of sedimentation and erosion control for construction within the Town limits shall comply with the Town's Standards and Specifications for Design and Construction and the Town's Earthwork Specifications and be subject to the approval of the Town. Construction within the National Forest shall meet U.S. Forest Service criteria. Construction outside of Town limits shall meet Grand County Requirements. Construction within State Highway rights of way shall meet Colorado Department of Transportation (CDOT) requirements.
- E. Provide erosion control measures such as diversion channels, sedimentation or filtration systems, berms, staked straw bales, straw wattles, silt fencing, seeding, mulching, or other special surface treatments as required to prevent erosion and runoff into existing waterways and storm water system. Place all erosion control measures in an area prior to any construction activity in that area.
- F. These Specifications are intended to ensure that construction is achieved with a minimum of disturbance to the environment. It is the Contractor's responsibility to determine the specific construction techniques to minimize such disturbance.

- G. Construction equipment shall be maintained and tuned at the manufacturers' recommended intervals and to the recommended specification to minimize exhaust emissions. Vehicles and equipment that show excessive emissions of exhaust gases shall not be operated until corrective measures, repairs or adjustments are made.
- H. Construction equipment idling will be minimized when not in use. No vehicle or piece of equipment shall be idled for more than 30 minutes.

1.2 APPLICABLE REGULATIONS

- A. Comply with all applicable Federal, State, and local laws and regulations concerning environmental pollution control and abatement.

1.3 NOTIFICATIONS

- A. Should the District, its representative, the Town's representative, the County's representative, or any State or Federal agency responsible for verification of certain aspects of the environmental protection requirements notify the Contractor of any non-compliance with requirements, the Contractor shall immediately take corrective action. Such notice, when delivered to the Contractor or its authorized representative at the site of the Work, shall be deemed sufficient for the purpose. If the Contractor fails or refuses to comply promptly, the District may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to any such stop orders shall be made the subject of a claim for extension of time or for excess costs or damages by the Contractor unless it is later determined that the Contractor was in compliance.

1.4 CHEMICALS

- A. All approved chemicals used during project construction or furnished for project operation, whether it is a disinfectant, a polymer, a reactant or of another classification, shall show approval of either the U.S. Environmental Protection Agency or the U.S. Department of Agriculture. Use of all such chemicals and disposal of residues shall be in strict accordance with the printed instructions of the manufacturer.
- B. Storage and handling of flammable and combustible materials, provisions for fire prevention, and control of dust shall be in accordance with the latest applicable OSHA requirements.
- C. The Contractor shall submit Material Safety Data Sheets (MSDS) for any hazardous material proposed to be utilized in the construction of the Work. The Contractor shall follow the information on the MSDS to assure safe use, handling, storage and environmentally acceptable disposal of the material used.

- D. All chemicals stored in drums or tanks on site shall be provided with secondary containment facilities meeting Federal, State and local laws, ordinances, regulations and permit conditions. All spigots shall be positioned so that secondary containment facilities catch any drips.

1.5 PETROLEUM BASED PRODUCTS AND SPILLS

- A. All waste petroleum based products shall be contained in sealed containers and disposed of at approved recycling facilities, and, if not recyclable, shall be disposed of at an approved dumpsite. Any spills shall be promptly cleaned up and waste, spillage, and contaminated materials disposed of at an approved dumpsite. Proof that a spill is cleaned up adequately shall be done to the satisfaction of the District and to the requirements of the appropriate regulatory authority. The Contractor shall comply with applicable Federal, State and local laws, orders, regulations, permit conditions, and water quality standards concerning the control and abatement of water pollution. When laws are inconsistent, the more stringent law shall apply. Violations of these applicable laws and regulations may result in the District stopping all work on site. All costs resulting from this work stoppage shall be the responsibility of the Contractor.
- B. All petroleum-based products stored in drums or tanks on site shall be provided with secondary containment facilities meeting Federal and local laws, ordinances, regulations and permit conditions. All spigots shall be positioned so that secondary containment facilities catch any drips.

1.6 REFERENCES

- A. Occupational Safety and Health Administration (OSHA)
 - 1. Safety and Health Standards for Construction
- B. Colorado State Division of Labor

1.7 SUBMITTALS

- A. Contractor shall submit to the District an environmental plan for dealing with hazardous materials and related items for approval.
- B. Contractor shall include erosion control plans, details, and notes, as required by the Town's Standards and Specifications for Design and Construction and the Town's Earthwork Specifications, with submitted construction plans.

PART 2 – PRODUCTS

2.1 EROSION CONTROL

- A. All natural products used for erosion control shall be certified weed-free.
- B. TRASH CONTROL
- C. Dumpsters shall be bear-proof.

PART 3 – EXECUTION

3.1 EROSION CONTROL

- A. Within Town limits, provide erosion control measures meeting the Town's Standards and Specifications for Design and Construction and the Town's Earthwork Specifications per approved construction drawings.
- B. Meet U.S. Forest Service, Grand County, and/or State requirements when applicable.

3.2 PROTECTION OF STREAMS

- A. Prevent damage to any stream from pollution by debris, sediment or other material, or from the manipulation of equipment and/or materials in or near such streams. Water that has been used for washing or processing, or that contains oils or sediments that will reduce the quality of the water in the stream, shall not be directly returned to the stream. Such waters shall be properly disposed of off-site or through a plan submitted and approved in writing by the District that meets all Federal, State, and local laws, ordinances, and requirements.
- B. Do not discharge water from dewatering operations directly into any live or intermittent stream, channel, wetlands, surface water, sanitary sewer, or storm sewer. Water from dewatering operations shall be treated by filtration, settling basins, or other approved method to reduce the amount of sediment contained in the water to allowable levels and disposed of by methods approved in writing by the District and the Town.

3.3 PROTECTION OF LAND RESOURCES

- A. Land resources within the project boundaries and outside the limits of the permanent Work improvements shall be restored to a condition, after the completion of construction, that will appear to be natural and not detract from the appearance of the project to the approval of the District and to the approval of the applicable Local, State, County, Federal, and/or private property owner. Confine all construction activities to areas shown on the Drawings.
- B. Outside of areas requiring earthwork for the construction of the new facilities, the Contractor shall not deface, injure, or destroy trees or shrubs, nor

remove or cut them without prior approval. No ropes, cables, or guys shall be fastened to or attached to any existing trees for anchorage.

- C. Where trees may possibly be defaced, bruised, injured, or otherwise damaged by the Contractor's equipment and operations, protect such trees by placing boards or similar protection around them. Monuments and markers shall be protected similarly before beginning operations near them.
- D. Any trees or other landscape feature scarred or damaged by the Contractor's equipment or operations shall be restored to its original condition.
 - 1. All trimming or pruning shall be performed in an approved manner by experienced professionals with saws or pruning shears. Tree trimming with axes will not be permitted.
 - 2. Climbing ropes shall be used where necessary for safety. Trees that are to remain within or outside the established clearing limits that are subsequently damaged by the Contractor and are beyond saving in the opinion of the Owner, shall be immediately removed and replaced.
 - 3. All tree stumps shall be cut below the ground surface or removed. Removed stumps shall be hauled away or mulched and used on site.
- E. Dispose of all debris and excess material to federal, state, and local standards and outside wetland or floodplain areas, in an environmentally sound manner.

3.4 PROTECTION OF AIR QUALITY

- A. Burning. The use of burning at the construction site for the disposal of refuse and debris will not be permitted.
- B. Wind erosion control shall be in accordance with the Town's Standards and Specifications for Design and Construction and the Town's Earthworks Specifications, and/or other applicable standards when outside Town limits, or in areas under multiple jurisdictions.

3.5 RUBBISH CONTROL

- A. During the progress of the Work, the Contractor shall keep the site of the Work and other areas used by it in a neat and clean condition, and free from any accumulation of rubbish. The Contractor should be aware that the site is in an area prone to high winds. The Contractor shall dispose of all rubbish and waste materials of any nature occurring at the Work site. Disposal of all rubbish and surplus materials shall be off the site of construction in accordance with local codes and ordinances governing loca-

tions and methods of disposal, and in conformance with all applicable safety laws.

- B. The construction site shall be cleaned up each night before leaving. Tools and equipment shall be securely stored and locked down. Materials should also be staked, stored, and secured in a tidy manner.

3.6 MAINTENANCE OF EXISTING FACILITIES DURING CONSTRUCTION

- A. During the work, maintain all facilities necessary for the proper operation of the existing water and wastewater systems to the approval of the District.
- B. Other facilities and utilities, including, but not limited to, electrical power service, roadways, trail systems, remote restrooms, and the like shall be maintained in their existing condition and remain accessible throughout performance of the Work.
- C. Down time for any portion of the existing water and wastewater facilities shall be eliminated during weekends and holidays unless otherwise approved by the District.

3.7 NOISE CONTROL

- A. Minimize noises caused by construction operations. The Contractor shall comply with the requirements of the applicable local laws, permit conditions, and regulations concerning the prevention, control, and abatement of excessive noise.

3.8 Noxious Weed Controls

- A. Noxious weeds exist within the areas in which the District's facilities are located and every means must be employed to avoid noxious weed proliferation and spreading. Bare areas not being actively worked on shall be mulched as a temporary weed preventative and erosion control.
- B. All landscaping materials, straw bales, seed, mulch, and the like shall be certified to be weed free.
- C. All construction vehicles and equipment shall be brought onsite in a clean condition and free from mud and vegetation carryover from other construction sites.

END OF SECTION

SECTION 02 10 00

SURVEYS

PART 1 – GENERAL

1.1 SCOPE OF WORK

- A. Requirements or coordination of District-provided surveying, if applicable, and work to be completed by the Contractor.

1.2 DESCRIPTION

- A. If the District has installed the primary control to be used for establishing lines and grades required for the Work, the Contractor shall check and verify, before beginning Work, all primary control points. The Contractor shall advise the District in writing that the points are acceptable or, if not, the reasons why not.
- B. If the District does not provide primary control, the primary control used shall be approved and agreed upon by the District before beginning the work.
- C. Other survey markers and points may be found in the field. The Contractor shall not use any survey markers or points that are not identified as primary control.
- D. The Contractor shall maintain and preserve all control points established by the District unless authorized to remove them. The Contractor shall also bear full responsibility for preserving all survey markers not established by the District. If the Contractor destroys any control points prior to authorization to remove, or any other survey markers, the Contractor shall be solely responsible for reestablishing and replacing those markers at the Contractor's own expense.

1.3 QUALITY ASSURANCE

- A. The Contractor shall indicate to the District if any conflict exists between the survey controls provided, the construction plans, other construction on site, or for any other reason the lines and grades established from the control points do not reflect the conditions as provided for in the plans.
- B. The Contractor is responsible for maintaining a set of full-size plans dedicated to being "As Constructed" markup drawings in accordance with the requirements of Section 01 33 00 - Submittals.

- C. Field or surveying discrepancies discovered by the Contractor shall be immediately reported to the District. Corrective action shall not be taken until authorized by the District.

1.4 SUBMITTALS

- A. All record drawings shall be submitted in accordance with Section 01 33 00.

PART 2 – EXECUTION

2.1 GENERAL

- A. The Contractor shall use the primary control points to layout and control the Work. The Contractor shall verify to the District that the number of points required for alignment, slope stakes, structures, and facilities are adequate for controlling the Work within the required tolerances and accuracy required.
- B. The Contractor shall mark up all changes in the field on the record drawings with adequate horizontal and vertical measurements. The Contractor shall maintain and provide final record drawings per Section 01 33 00.
- C. All concrete formwork shall be checked to verify the finished concrete will be within the required tolerances.
- D. All pipelines, fittings, valves and equipment shall be checked to assure they are within the lines and grades or tolerances required before backfilling.
- E. The Contractor has the responsibility of maintaining all work within the granted easements and right of way.
- F. The Contractor has the responsibility of maintaining minimum horizontal and vertical set back or encroachment distances as established by the various entities granting right of way. These may include, but not be limited to, the Town of Winter Park, Winter Park Ski Area, Grand County, the Union Pacific Railroad, the US Forest Service, and the Denver Water Department.

END OF SECTION

SECTION 03 41 00

CONCRETE MANHOLES AND PRECAST STRUCTURES

PART 1 – GENERAL

1.1 SCOPE OF WORK

- A. Furnish all labor, materials, and equipment required for installing concrete manholes and bases including iron frames, covers, steps, and appurtenances as shown on the attached drawing and specified herein.

1.2 SUBMITTALS

- A. Submit shop drawings, product data, materials of construction, and details of installation in accordance with Section 01 33 00 and with the District's Rules and Regulations including, in particular, Rule and Regulation 3.15. Include the following:
 - 1. Base sections, riser sections, eccentric and concentric conical top sections, flat slab tops, grade rings with notarized certificate indicating compliance with ASTM C478.
 - 2. Pipe connections to manhole.
 - 3. Manhole frame and cover.
 - 4. Method of repair for minor damage to precast concrete sections.
 - 5. Engineer-stamped design drawings for pre-cast structures other than manholes.
 - 6. Details showing elevations of pipe inverts, pipe dimensions, equipment placement, supports for equipment, and access openings for structures other than manholes.
- B. Design Data
 - 1. Precast concrete sections:
 - a. Sectional plan(s) and elevations showing dimensions and reinforcing steel placement.
 - b. Structural calculations including assumptions.
 - c. Concrete design mix.
 - 2. Cast-in-place Base: Submit same requirements as precast.

C. Test Reports

1. Precast and cast-in-place concrete sections: Concrete test cylinder reports from an approved testing laboratory certifying conformance with specifications.

1.3 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM)

1. ASTM A48 - Specification for Gray Iron Castings.
2. ASTM A615 - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
3. ASTM C32 - Specification for Sewer and Manhole Brick (Made from Clay or Shale).
4. ASTM C33 - Specification for Concrete Aggregates.
5. ASTM C62 - Standard Specification for Building Brick (Solid Masonry Units Made from Clay or Shale).
6. ASTM C150 - Standard Specification for Portland Cement.
7. ASTM C207 - Specification for Hydrated Lime for Masonry Purposes.
8. ASTM C260 – Specification for Air-Entraining Admixtures for Concrete.
9. ASTM C443 - Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.
10. ASTM C478 - Standard Specification for Precast Reinforced Concrete Manhole Sections.
11. ASTM D4101 - Specification for Propylene Plastic Injection and Extrusion Materials.

B. American Concrete Institute (ACI)

1. ACI 318 - Building Code Requirements for Reinforced Concrete
2. ACI 350R - Concrete Sanitary Engineering Structures

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

1. Standard Specifications for Highway Bridges
 2. Standard Specifications for Traffic Rated Manhole Covers
- D. Occupational Safety and Health Administration (OSHA)
- E. Where reference is made to one of the above standards, the revision in effect at the time of the bid opening shall apply.

1.4 QUALITY ASSURANCE

- A. All material shall be new and unused.
- B. Material quality, manufacturing process, and finished sections are subject to inspection and approval by the District's Representative. Inspection may be made at place of manufacture, at work site following delivery, or both.
- C. Materials will be examined for compliance with ASTM specifications, these Specifications and approved manufacturer's drawings. Additional inspection criteria include dimensioning, apparent surface defects, and soundness.
- D. Materials shall be rejected for failure to meet any Specification requirement. Rejection may occur at place of manufacture, at work site, or following installation. Mark rejected materials, remove from work site, and replace at Contractor's cost.
- E. Repair minor damage to manufacturer's recommendations, if allowed by District.

PART 2 – PRODUCTS

2.1 GENERAL

- A. Reference to a manufacturer's name and model or catalog number is for the purpose of establishing the standard of quality and general configuration desired.
- B. Products of one manufacturer shall be supplied. [??]
- C. Provide lifting lugs or holes in each precast section for proper handling.

2.2 PRECAST CONCRETE MANHOLE SECTIONS

- A. Precast concrete riser sections, transition top sections, flat slab tops, and grade rings shall conform to ASTM C478 and meet the following requirements:

1. Top section shall be eccentric cone.
2. Base, riser, and transition top sections shall have tongue and groove joints.
3. Sections shall be cured by an approved method.
4. Transport precast concrete sections after concrete has attained a minimum of 3,000 psi compressive strength.
5. Design precast concrete base, riser, transition top, flat slab top, and grade ring for a minimum H-20 loading plus earth load. Calculate earth load with a unit weight of 130 pcf.

2.3 PRECAST CONCRETE STRUCTURES

- A. Precast reinforced concrete structures including Tee-section manholes.
- B. Structural design calculations and Drawings shall be prepared and stamped by a Professional Engineer registered in the State of Colorado.
- C. Design Criteria
 1. Precast concrete
 - a. Minimum compressive strength shall be 4,000 psi.
 - b. Maximum water content shall be six gallons per 94-pound sack of cement.
 - c. Minimum cement content shall be six 94-pound sacks of cement per cubic yard of concrete.
 2. Cast-in-place Base
 - a. Same design criteria as precast concrete. Ready mix shall meet ASTM C94.
 - b. Slump shall be 4-inches plus or minus 1-inch.
 - c. Air entraining agent per ASTM C260 shall be used with total air content of 5 to 7 percent.
 - d. Admixtures shall be submitted with mix design to the District for approval.
 3. Manufactured products
 - a. Conform to ACI 318 and ACI 350R.

- b. Analyze walls and slabs using accepted Engineering principals.
- c. When ‘fy’ exceeds 40,000 psi, “z” (ACI 318) shall not exceed 95,000 lbs./in. “fs” shall not exceed 50 percent of “fy.”
- d. Design products to support their own weight, weight of soil at 130 pcf, and a live load equal to AASHTO HS-20 applied to top slab.
- e. Cast base slab and walls together to form monolithic base section.
- f. Design structure walls for a water pressure assuming groundwater level at ground surface. Originate pressure diagram at finished ground surface. Include lateral pressure from vehicles in accordance with AASHTO.
- g. Consider discontinuities in structure produced by openings and joints. Provide additional reinforcing around openings. Frame openings to carry full design loads to support walls.
- h. Prevent flotation, with ground water level at finished ground surface, by dead weight of structure and soil load above structure. Do not consider skin friction, soil friction, or weight of equipment in structure.
- i. Locate horizontal wall joints 18-in. minimum from horizontal centerline of wall openings.
- j. Design structure with a minimum number of joints. Maximum number of structure sections, including top slab, shall be four.
- k. Provide lifting hooks for top slab.
- l. Locate access openings, wall sleeves, and pipe penetrations as shown on Drawings.

2.4 MANHOLE FRAME AND COVER

- A. Manhole frame and covers shall be of good quality, strong, tough, even grained cast iron, smooth, free from scale, lumps, blisters, sand holes, and defects of any kind which render them unfit for the service for which they are intended. Manhole covers and frames shall have a lid having machined flat bearing surface, lifting holes, asphalt varnish coating applied at foundry and a frame and cover combined weight of 400 lbs. Minimum.

Castings shall be thoroughly cleaned and subject to hammer inspection. Manhole ring and cover shall be Neenah R-1706 or approved equal.

- B. Each manhole cover shall be marked with the word "WATER" or "SEWER" cast integral with the manhole cover, as is appropriate to the application.
- C. Lids and frames shall be traffic rated, heavy duty, meeting ASSHTO standards for same.

2.5 JOINTING PRECAST MANHOLE SECTIONS AND STRUCTURES

- A. Seal tongue and groove joints of precast manhole and structure sections with preformed flexible joint sealant. Preformed flexible joint sealant shall be Kent Seal No. 2 as manufactured by Ram-Nek as manufactured by K.T. Snyder Company or approved equal.
- B. Completed joint shall withstand 15 psi internal water pressure without leakage or displacement of sealant.

2.6 CORROSION RESISTANT COATING

- A. If required by District, corrosion resistant coating for the inside of the manhole shall be Sewercoat, 2000 HS Regular or Pumpable Grade (PG), as manufactured by Lafarge Calcium Aluminates.

2.7 PIPE CONNECTIONS TO MANHOLE

- A. Connect pipe to manhole with integrally cast flexible rubber boot in precast manhole section or install sleeve in a form or cored opening.
- B. Fasten pipe in sleeve with stainless steel clamp(s). Coat stainless steel clamp(s) with bituminous material to protect from corrosion.
- C. Flexible sleeve shall be Lock Joint Flexible Manhole Sleeve; Kor-N-Seal connector; PSX Press-Seal Gasket or equal.

2.8 DAMP-PROOFING

- A. Damp-proofing shall be Hydrocide 648 by Sonneborn Building Products; Dehydratine 4 by A.C. Horn Inc; RIW by Toch Brothers, or equal.

2.9 STEPS

- A. Steps for manholes and vaults shall be copolymer polypropylene coated steel steps.
- B. Model PS 2-PF by MA Industries, Peachtree City, Georgia, or approved equal.

2.10 SEAM SEALER

- A. Joints shall be seamed as shown on the drawings with self-adhering water proof flexible membrane material, 12-inch wide, and centered on the joint.
- B. Seam sealer shall be Sub-seal as manufactured by MFM Building Products or approved equal.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Manhole and Structure Installation

1. Manholes and structures shall be constructed to the dimensions shown on Drawings and as specified in these Specifications. Protect all work against flooding and flotation. Construct cast-in-place bases in accordance with the requirements of the details shown on the Drawings.
2. Do not set precast sections on a cast-in-place base until the concrete has properly cured to a strength whereby no damage can be done.
3. Place manhole or vault base on a 12-inch bed of free draining, angular structural fill per Section 31 23 33 Trenching and Backfilling. Set base so that a maximum grade adjustment of 8-in. is required to bring the manhole frame and cover to final grade. Use precast concrete grade rings, set in flexible joint sealant, to adjust manhole frame and cover to final grade.
4. Set precast concrete barrel sections and structures plumb with a maximum 1/4-inch out of plumb tolerance. Seal joints of precast barrel sections with preformed flexible joint sealant in sufficient quantity to fill 75 percent of joint cavity.
5. Plug holes in the precast sections that were required for handling with a non-shrinking grout or non-shrinking grout in combination with concrete plugs. Finish flush on both sides.
6. Cut holes in precast sections to accommodate pipes prior to setting precast sections in place to prevent jarring, which may loosen the mortar joints.
7. Seal joints carefully from the exterior by applying a 12-inch wide band of self-adhering membrane sealer, centered on the joint, and pressed into place with sufficient pressure to form a waterproof joint. Install to full compliance with manufacturer's recommenda-

tions.

8. Backfill carefully and evenly around precast sections.

B. Precast Pipe Connections

1. Construct manhole and vault pipe connections, including pipe stubs, as specified above. Close or seal pipes for future connections with gasketed watertight plug.

C. Setting Frames and Covers

1. Set frames in a full bed of bituminous mastic. Utilize precast concrete grade rings, a maximum of 8-in. thick, to assure frame and cover are set to the finished grade. Set frame and cover to final grade prior to placement of permanent paving.
2. For gravel roads, set manhole 6-inches below finish grade.
3. For open areas, set manhole 8-inches above finish grade.

3.2 DAMP-PROOFING

1. Apply damp-proofing specified in Section 2 of this specification to exterior concrete surface to manufacturer's recommendations.

3.3 LEAKAGE TESTS

- A. Test each manhole for leakage. The District's Representative shall observe each test. Perform one of the test options as described below.
- B. Option 1: Assemble manhole in place. Plug all holes. Fill manhole with water to the top to the cone section. If the excavation has not been back-filled and no water is observed moving down the outer surface of the manhole, the manhole is satisfactorily watertight.
- C. Option 2: If the test, as described above, is unsatisfactory as determined by the District's representative, or if the manhole excavation has been back-filled, continue the test. Allow two hours for absorption. Following this period, refill manhole to the top of the cone, if necessary, and allow at least 1 hour to pass. At the end of the test period, if the water level has dropped, that manhole has failed the test.
- D. Option 3: An infiltration test may be used if approved by the District and if the ground water table is above the highest joint in the manhole. If there is no leakage into the manhole as determined by the District, the manhole will be considered watertight.

- E. Option 4: A vacuum test may be used. All pipes entering and exiting the manhole shall be temporarily plugged. The test head shall be placed at the top of the manhole and seal inflated in accordance with manufacturer's recommendations. A vacuum of 10-inches of mercury shall be drawn on the manhole, the valve on the vacuum line closed, and the pump shut off. The time shall be measured for the vacuum to drop to 9-inches of mercury. If the time is less than 60 seconds, the test is failed. The test is valid for a 48-inch manhole up to 24 feet depth, a 60-inch manhole up to 18 feet deep, and a 72-inch manhole up to 14 feet deep.
- F. Manhole Test Failure: Uncover the rejected manhole, as necessary, to disassemble, reconstruct, repair, or replace as needed and as directed by the District's Representative. Retest the manhole and repeat process until satisfactory.
- G. Leakage Tests for Structures
 - 1. The District's Representative will visually inspect structure(s) for possible leaks before backfilling of structures is allowed. Seal all joints to the satisfaction of the District's representative.
 - 2. The District's Representative may require an exfiltration or vacuum test as described for manholes.

3.4 CLEANING

- A. Thoroughly clean all new manholes and vaults of all silt, debris and foreign matter of any kind, prior to final inspection.

END OF SECTION

SECTION 31 23 19

DEWATERING AND DRAINAGE

PART 1 – GENERAL

1.1 SCOPE OF WORK

- A. Design, furnish, install, operate, monitor, maintain and remove a temporary dewatering system as necessary to lower and control water levels below subgrades of excavations to permit construction in dry conditions.
- B. Provide, maintain and remove temporary surface water control measures adequate to drain and remove surface water entering excavations.
- C. Collect and properly dispose of all discharge water from the dewatering and drainage systems in accordance with the provisions of this Section, Section 01 35 43 – Environmental Protection, any applicable permit or regulatory requirement, and any provisions shown on the approved construction drawings.

1.2 DESIGN AND PERFORMANCE RESPONSIBILITY

- A. Fully meet the requirements contained within the Town's Storm Drainage Specifications and the Town's Standards and Specifications for Design and Construction and Town's Earthwork Specifications for permanent drainage features within Town boundaries. Also meet requirements for erosion control for water and wind erosion during and after construction per the Town's Standards.
- B. If construction occurs within the boundaries of the US Forest Service, execute methods of controlling surface water and groundwater using USFS Best Management Practices and guidelines in addition to those provided herein.
- C. For construction within County lands, follow the stipulations and examples from the Erosion and Sediment Control for Construction Activities Guidance Handbook for Grand County.
- D. Be solely responsible for damage to properties, buildings, structures, water lines, sewer lines, drain lines and other utility installations that result from the Contractor's dewatering or surface water control operations.
- E. Design review and field monitoring by District and/or Town shall not relieve the Contractor of responsibility for the Work.

1.3 SUBMITTALS

- A. In accordance with Section 01 33 00 - Submittals, submit a proposed initial plan for dewatering and surface water control and coordinate with methods of excavation and excavation support.
- B. This plan shall be included in the construction drawings submitted for approval.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. Certified weed-free straw bales and wattles.
- B. Jute and other biodegradable mats.
- C. Geotextile fabric equal to Mirafi 140N Drainage Fabric, a non-woven “supple” fabric conforming easily to an irregular excavated surface. Meet or exceed all other characteristics of the specified material.
- D. Portable pumps and piping as conditions dictate.

PART 3 – EXECUTION

3.1 GENERAL

- A. Control surface water and groundwater such that excavation to final grade is made in dry conditions, the bearing soils are maintained undisturbed and softening and/or instability or disturbance due to the presence or seepage of water does not occur. All construction and backfilling shall proceed in-the-dry and flotation of completed portions of work shall not be permitted.
- B. All requirements of the State of Colorado Dewatering General Permit, the Town's construction and grading permit, and any other applicable permits and regulatory requirements shall be strictly adhered to.

3.2 SURFACE WATER CONTROL

- A. Construct surface water control measures, including dikes, ditches, sumps, and other methods to prevent, as necessary, flow of surface water into excavations.

3.3 EXCAVATION DEWATERING

- A. Provide and maintain proper equipment and facilities to remove promptly and dispose of properly all water entering excavations. Excavations shall be kept dry, so as to obtain a satisfactory undisturbed subgrade foundation condition until the fill, structure, or pipes to be built thereon have been

completed to such extent that they will not be floated or otherwise damaged by allowing water levels to return to natural elevations.

- B. Pipe and concrete shall not be laid in water or submerged within 24 hours after being placed. Water shall not flow over new concrete within four days after placement.
- C. In no event, shall water rise to cause unbalanced pressure on structures until the concrete or mortar has set at least 24 hours. Prevent flotation of pipe by promptly placing backfill.
- D. Dewatering shall at all times be conducted in such a manner as to preserve the natural undisturbed capacity of subgrade soils to proposed bottom of excavation. If the subgrade of the trench bottom or excavations becomes disturbed due to inadequate drainage, excavate below normal grade as directed by the District's Representative and refill with approved, screened gravel at the Contractor's expense.
- E. Evaluate the impact of the anticipated subsurface soil/ water conditions on proposed method of excavation and removal of water.
- F. If the groundwater level is above the proposed bottom of excavation level, a pumped dewatering system will be required for pre-drainage of soils prior to completing excavation. This system shall maintain the lowered groundwater level until construction has been completed to such an extent that the structure, pipeline, or fill will not be floated or otherwise damaged. The type of system, spacing of dewatering units and other details of the Work shall be designed by the Contractor to account for soil and water conditions at the particular location of the Work.
- G. Dewatering and excavation shall not cause loss of ground or disturbance to the pipe bearing soil or soil which supports overlying or adjacent structures.
- H. If dewatering does not properly dewater the trench as specified, install groundwater observation wells as directed by the District's Representative. Do not place any pipe or structure until the readings obtained from the observation wells indicated that the groundwater has been lowered a minimum of 6-in. below the bottom of the final excavation within the trench limits.
- I. Dewatering pumps shall be surrounded by suitable filter sands and geotextile fabric, and no fines shall be removed by pumping. Pumping from the dewatering systems shall be continuous until pipe or structure is adequately backfilled. Stand-by pumps shall be provided.
- J. Water entering the excavation from precipitation or surface runoff shall be collected in the shallow ditches around the perimeter of the excavation,

drained to sump and pumped from the excavation to maintain a bottom free from standing water.

- K. Existing or new sanitary sewers shall not be used to dispose of drainage.

3.4 DEWATERING STRUCTURE

- A. Dewatering structures for silt control shall be constructed using the Stormwater Best Management Practices set forth in the Denver Metro Urban Drainage Flood Control District (UDFCD), Storm Drainage Criteria Manual: Volume 3 available at UDFCD.org.
- B. When used, straw bales shall be securely staked and anchored within the ground to UDFCD standards. Wattles, if approved by the District, shall be similarly anchored.
- C. All site water from drainage and dewatering shall be routed through the dewatering structure.
- D. Contractor shall maintain dewatering structures throughout the course of the Work and until directed by the District's Representative to remove them.

3.5 CONCRETE WASHOUT PIT

- A. If a concrete washout pit is approved by the Town and the District, it shall be located per the Town's and the District's representatives. Outside Town limits, approval of the County, State, and applicable property owners is required. Within the boundaries of the National Forest, permission of the U.S. Forest Service is required.
- B. Install and maintain the concrete washout pit per approved construction drawings.
- C. Dispose of the pit through a Town, District, and/or other agency having jurisdiction for approving the plan.

END OF SECTION

SECTION 31 23 33

TRENCHING AND BACKFILLING

PART 1 – GENERAL

1.1 SCOPE

- A. The Work under this Section includes all earthwork required for construction of the Work including the loosening, removing, loading, transporting, depositing, and compacting in its final location of all materials wet and dry, as required for the purposes of completing the Work.
- B. This section also includes blasting, sheeting and bracing to safely support the excavation, the support of structures above and below the ground, all backfill around structures and of trenches and pits, the disposal of excess excavated materials, handling and disposal of contaminated soils, import of materials for fills, and all other incidental earthwork to complete the project.

1.2 TUNNELING OR BORING

- A. If the Contractor proposes or is required to install casing pipe by tunneling or boring methods, then it should be the Contractor's requirement to select a tunneling or boring method compatible with ground conditions, requirements for control of water, placement of carrier pipe, safety of personnel and protection of property.
- B. Tunneling or boring methodology and all materials and designs shall be provided as a submittal for the review and approval of the District.
- C. The method proposed shall include the following information:
 - 1. Sequencing of excavation, including number and duration of daily shifts.
 - 2. Dimensions of excavations including methods of excavation and equipment to be used.
 - 3. Provisions for controlling line and grade, and survey frequency with respect to progress of excavation.
 - 4. Plan for controlling ground settlement, including locations and frequency of settlement and heave monitoring.
 - 5. Proposed size and material for casing pipe and carrier pipe.
 - 6. Allowances for placement of carrier pipe within standard industry

tolerances for line and grade.

1.3 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM)

1. ASTM C 33 – Standard Specification for Concrete Aggregate
2. ASTM D 75 - Standard Practice for Sampling Aggregates.
3. ASTM C 117 - Standard Test for Materials Finer than 75-um (No. 200 Sieve) in Mineral Aggregates by Washing.
4. ASTM C 136 - Standard Method for Sieve Analysis of Fine and Course Aggregates.
5. ASTM C 143 – Test Method for Slump of Portland Cement Concrete.
6. ASTM C 150 – Portland Cement
7. ASTM D 422 - Method for Particle-Size Analysis of Soils.
8. ASTM D 698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5-lb (2.49-kg) Rammer and 12-in (304.8-mm) Drop.
9. ASTM D 1556 - Test Method for Density of Soil in Place by the Sand-Cone Method.
10. ASTM D 1633 - Test Method for Compressive Strength of Molded Soil-Cement Cylinders.
11. ASTM D 2487 – Standard Practice for Classification of Soils.
12. ASTM D 2901 - Test Method for Cement Content of Freshly-Mixed Soil-Cement.
13. ASTM D 2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
14. ASTM D 4253 - Test Methods for Maximum Index Density of Soils Using a Vibratory Table.
15. ASTM D 4254 - Test Methods for Minimum Index Density of Soils and Calculation of Relative Density.
16. ASTM D 4318 - Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils.

17. NFPA 495 - Code for Manufacture, Transportation, Storage, and Use of Explosive Materials.
18. OSHA Safety and Health Standards for Construction - Subpart P, Section 1926
19. Town Standards and Specifications for Design and Construction and Earthwork Specifications
20. District Rules and Regulations

1.4 RELATED WORK

- A. Dewatering shall be per Section 31 23 19.

1.5 SUBMITTALS

- A. Certify that a qualified individual designed the sheeting/shoring and trench support systems in accordance with the most recent OSHA and other governing rules and regulations.
- B. Submit samples of native and import materials to be used in the Work in accordance with the requirements in Section 01 33 00 including gradation, classification and material source.
- C. Submit means, methods and materials for backfilling the newly constructed structures, pipes, and appurtenances.
- D. If applicable, obtain and submit copies of required blasting permits, blasting license, and explosives permit as required by the State of Colorado and any other agency having jurisdiction.
- E. If applicable, submit certification of blasting foreman and blasting plan.

1.6 QUALITY ASSURANCE

- A. All Work shall fully meet the requirements of the jurisdiction having authority. If within Town limits, meet the requirements of the Town's Standards and Specifications for Design and Construction, the Town's Earthwork Specifications, and the requirements provided herein.
- B. All soils testing will be done by a testing laboratory approved by the District at the Contractor's expense.
- C. Where soil material is required to be compacted to a percentage of maximum density, the maximum density at optimum moisture content will be determined in accordance with ASTM D 698, except as otherwise stated in these specifications.

- D. Where cohesionless, free draining soil material is required to be compacted to a percentage of relative density, the calculation of relative density will be determined in accordance with ASTM D 4253 and D 4254. Field density in-place tests will be performed in accordance with ASTM D 1556, ASTM D 2922, or by such other means acceptable to the District.
- E. In case the tests of the fill or backfill show non-compliance with the required density, gradation, or other physical properties, accomplish such remedy as may be required to ensure compliance. Subsequent testing to show compliance shall be at the Contractor's expense.
- F. Certify that all import materials meet the requirements of this Specification. Particle size analysis of soils and aggregates shall be determined in accordance with ASTM D 422.
- G. Unified Soil Classification System: References in these specifications to soil classification types and standards set forth in ASTM D 2487 have the meanings and definitions indicated in the latest revision.

PART 2 – PRODUCTS

2.1 BEDDING AND BACKFILL MATERIAL REQUIREMENTS

- A. Within Town limits, the trench backfill and resurfacing materials shall be in accordance with the Town’s Standards and Specifications for Design and Construction and the Town’s Earthwork Specifications.
- B. The following types of suitable materials are designated and defined as follows:
 - 1. Pipe zone and bedding material: Free draining gravel or crushed rock with 95% passing a 1/2-inch sieve and no more than 5% passing a No. 4 sieve.
 - 2. Riprap: Urban Drainage and Flood Control District Type M (d₅₀ = 12) as follows:

Sieve Size	Percentage Passing
21-inch	70 - 100
18-inch	50 - 100
12-inch	35 - 50

4-inch 2 – 10

Liquid Limit (LL) Less than 30

Plasticity Index (PI) Less than 6

3. Topsoil: Topsoil, defined as the top 12(±) inches of the native soil profile in open or unimproved areas or as determined in the field by the District's Representative.

4. Select Fill: A well-graded, low permeable material that meets the following specifications:

Percent finer than No. 200 Sieve = 20 to 70%

Liquid Limit (LL) = 20 to 40%

Plasticity Index (PI) = 8 to 20%

Swell potential under 500 psf confining pressure = Less than 1%

5. Structural Fill or Backfill: Well graded, free draining, crushed rock or angular gravel meeting the following gradations:

Sieve Size	Percentage Passing
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2-inch	100
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No. 4	10
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6. Trench Plugs: May be constructed from compacted clay soils with ASTM D2487 classification of CL or CH and with at least 60 percent fines (passing the No. 200 Sieve) and a Plasticity Index of 15 or greater. Alternately, trench plugs may be constructed with lean type concrete, approved controlled strength material, or on-site

silty sand soils processed with 20 pounds bentonite clay per cubic yard.

7. All proposed fill material shall be tested by the Contractor and approved by the District's Representative prior to use in the Work. On site materials shall be used whenever possible in the Work and shall be screened and processed as necessary for use in the Work.
8. Lean Concrete: When used for encasing or for backfill, lean concrete should meet the following requirements: 8-inch slump, flowable fill that does not require rodding or vibrating to place, 100 psi compressive strength after 7 days, mix design submitted for approval by District.

2.2 UNSUITABLE MATERIAL

- A. Unsuitable material for fill, backfill and embankment materials, excepting topsoil includes:
 1. Soils which, when classified under ASTM D 2487, fall in the classifications of Pt, OH, CH, MH, ML or OL or obvious clayey materials or expansive soils as determined by the District.
 2. Any soil that cannot be compacted sufficiently to achieve the percentage of maximum density specified for the intended use, shall be classed as unsuitable material.
 3. Materials that are wet, soft, or frozen.
 4. Materials containing asphalt, concrete chunks, cinders, ashes, refuse, vegetable or organic material, boulders, rocks or other deleterious material.

2.3 WATER

- A. Water for backfilling and compaction shall be free from oil and deleterious amounts of acids, alkalis, and organic materials. Water shall be provided at a source designated by the District.
- B. Contractor shall be responsible for the transportation of the water from the source to the point of application by methods approved by the District's Representative.

2.4 BLASTING MATERIALS AND EQUIPMENT

- A. Furnish materials and equipment as required for blasting operations. Material usage, including transportation and storage, shall conform to all applicable regulatory agency requirements.

- B. All materials, methods, equipment, and scheduling of blasting work shall be submitted in the proposed blasting plan for approval.

PART 3 – EXECUTION

3.1 STRUCTURE EXCAVATION

- A. Limits
 - 1. Unless otherwise shown, the bottom of the excavation shall not extend more than 3 inches below the lines and grades shown in the drawings.
 - 2. Unless otherwise specified, excavate a sufficient distance from walls and footings to allow for form placement and removal, services, and inspection.
- B. Over-Excavation and Stabilization: If ordered by the District's Representative, over-excavate beyond the depth shown to the depth ordered and then backfill with rock fill or drain rock, place woven filter fabric (such as Mirafi 500X) 6 inches below the pipe.

3.2 PIPELINE TRENCH EXCAVATION

- A. General: Unless otherwise shown or specified, excavation for pipelines and utilities using open-cut trenches.
- B. Trench Width: Provide a minimum of 12 inches on either side for pipe zone material or minimum 12 inches for flow fill.
- C. Trench Bottom: Excavate uniformly to 6 inches below the bottom of the pipe.
- D. Open Trench: The maximum amount of an open trench permitted in any one location shall be 150 feet, or the length necessary to accommodate the amount of pipe installed in a single day, unless otherwise specified in the Town's standards, when within Town limits, or within other jurisdictions having authority.
- E. Within Town limits, all trenches within roadways and roadway rights-of-way shall be constructed with special attention to Town standards for traffic control and scheduling of backfill operations. Otherwise, Grand County, US Forest Service or CDOT requirements prevail as is applicable to the particular roadway.
- F. Over-Excavation and Trench Stabilization: When ordered by the District's Representative, over-excavate beyond the depth shown to the depth or-

dered and then be backfilled with rock fill or drain rock, place woven filter fabric (such as Mirafi 500X) 6 inches below the pipe.

- G. Where pipelines are to be installed in embankment or structure fills, construct the fill to a level at least one foot above the top of the pipe before the trench is excavated.

3.3 EXCAVATION IN LANDSCAPED AND UNIMPROVED AREAS

- A. Where excavation occurs in landscaped or unimproved areas, the Contractor shall restore the surface areas back to preexisting conditions unless otherwise directed by the District and/or other controlling authorities or parties having jurisdiction over said area.
- B. When working in lawns that are to be restored, the Contractor shall carefully remove, stockpile, and keep sod damp to preserve it for replacement. Excavated material may be placed on lawns temporarily (48-hours) provided that a drop cloth is employed to protect the lawn from damage. Immediately after completion of backfilling of the pipeline, the sod shall be replaced and lightly rolled in a manner so as to restore the lawn as near as possible to its original condition. Contractor shall provide new sod if stockpiled sod has not been replaced within 72 hours.
- C. In other landscaped or unimproved areas, topsoil shall be stripped from the area of disturbance and stockpiled. Topsoil stockpiles shall be suitably protected from erosion by wind and water and shall be clearly identified.
- D. The Contractor shall propose a plan for dealing with other types of landscaping for approval of the District and/or other controlling authorities.

3.4 DISPOSAL OF EXCESS CLEAN EXCAVATED MATERIAL

- A. Clean excess excavated material and rock may be utilized as fill material. Contractor shall comply with all applicable federal, state, county regulations, and Town standards.

3.5 DISPOSAL OF PAVEMENT MATERIAL

- A. Asphalt and/or concrete pavement material may be disposed of at a certified recycling center or at an approved disposal site in accordance with all federal, state, county and town ordinances and requirements.

3.6 BACKFILL – GENERAL

- A. Do not drop directly upon any structure or pipe. Do not place around or upon any concrete structure until the concrete has attained sufficient strength to withstand the loads imposed.

- B. Except for rock fill or drain rock materials being placed in over-excavated areas in trenches, place backfill after all water is removed from the excavation.

3.7 COMPACTION

- A. Each layer of material shall be mechanically compacted in maximum 8” lifts to the specified percentage of maximum density. Equipment that is consistently capable of achieving the required degree of compaction shall be used and each layer shall be compacted over its entire area while the material is at the required moisture content. The compaction of each layer of material shall be tested by a soils testing laboratory as described herein.
- B. Compaction Requirements:
 - 1. The following minimum compaction test requirements shall be in accordance with ASTM D 698 and in accordance with ASTM D 4253 and D 4254. For Town roadway and rights-of-way, meet or exceed minimum Town standards.
 - 2. Topsoil shall be placed per Section 32 92 19 – Seeding and not compacted.

Location or Use of Fill	Percentage of Maximum Density	Percentage of Relative Density
Pipe bedding, pipe zone backfill and over-excavated areas, including trench plugs	95	70
Topsoil	85	60
Structural backfill, Embankments, Structural fill	95	70

- 3. Select fill material shall be placed and compacted to 95% Standard Proctor, ASTM D 698 and -1 to +3% moisture content.
- C. If the allowable deflection specified for the pipe is exceeded, expose and re-round or replace the pipe, repair any damaged linings and coatings, and reinstall the pipe zone material and trench backfill as specified.

3.8 PIPE TRENCH BACKFILL

- A. Pipe Bedding: Pipe bedding as shown on the Drawings shall be pipe zone material placed and compacted as specified herein. After placing the bedding, perform a final trim for establishing grade, such that each pipe sec-

tion when first laid will be continually in contact with the bedding along the extreme bottom of the pipe. Excavation for welding shall be made if needed.

B. Pipe Zone Backfill

1. Pipe zone backfill, as shown on the drawings, shall be pipe zone material.
2. The pipe zone shall be backfilled and compacted with the specified pipe zone material. Backfilling and compaction shall not cause damage to the pipeline coating, cathodic bonds, or the pipe itself during the installation and backfill operations.
3. Place and spread evenly in layers. When compaction is achieved using mechanical equipment, do not exceed 8 inches uncompacted thickness.
4. Restrain pipe as necessary to prevent movement during backfill operations.
5. Place material simultaneously in 8-inch lifts on both sides of pipe and, if applicable, between pipes installed in same trench.
6. Thoroughly tamp each lift, including area under haunches, with handheld tamping bars supplemented by “walking in” and slicing material under haunches with a shovel to ensure that voids are completely filled before placing each succeeding lift.
7. After the full depth of the pipe zone material has been placed, compact the material by a minimum of three passes with a vibratory plate compactor only over the area between the pipes and between the sides of the pipe and the trench walls.
8. Do not use power-driven impact compactors to compact pipe zone material.
9. Where the material moisture content is below the optimum moisture content, add water until the proper moisture content is achieved.
10. Where the material moisture content is too high to permit the specified degree of compaction, dry the material until the proper moisture content is achieved.
11. After placement of pipe zone backfill and prior to placement of trench zone backfill, the center of the pipe(s) shall be marked with plastic warning tape.

- C. Trench Zone Backfill
 - 1. Within Town limits, trench zone backfill, as shown on the drawings, shall be suitable material placed and compacted as specified in the Town standards. When outside of Town limits, County requirements will prevail.
 - 2. After the pipe zone backfill has been placed as specified above, and after any excess water has completely drained or been removed from the trench, backfilling of the trench zone may proceed.
- D. Backfill Beneath Paved Areas: Backfill beneath paved areas shall be in accordance with requirements of jurisdiction having authority.
- E. Topsoil: In unimproved or open areas, topsoil shall be evenly redistributed over all disturbed areas. Care shall be taken to conform to the required final grades.
- F. Trench Plugs: Trench plugs shall be placed every 400 feet of trench or more frequently as directed by the District's Representative. Trench plugs shall be a minimum 2 feet thick as measured along the longitudinal pipe axis and replace the pipe zone material. Trench plugs shall be placed between sewer manholes, regardless of the distance.

3.9 LEAN MIX CONCRETE

- A. When lean mix concrete is utilized for encasing the pipe, the pipe shall be laid on berms of pipe bedding material placed at pipe quarter points.
- B. Lean mix concrete shall be placed from one side of the pipe so that it flows under the pipe until it appears on the other side. Then it shall be added to both sides of the pipe until it completely fills the space between the pipe and the lower portion of the trench.
- C. Where required to prevent uplift, the lean mix concrete shall be placed in two stages, allowing sufficient time for the initial set of the first stage before the remainder is placed. Lean mix concrete shall be deposited as nearly as practicable in its final position without disturbing the pipe trench or causing foreign material to mix in with it.
- D. Lean mix concrete shall be brought to a minimum of 8 inches above the top of the pipe. Backfill shall not be placed until the lean mix concrete has reached the initial set. If it is anticipated that backfill will not be placed over the controlled strength material within 8 hours, a 12-inch minimum cover of moist backfill shall be placed over the lean mix concrete. The moisture in the cover shall be maintained until additional backfill is placed. If the ambient temperature is 50°F or less, an additional 12-inch

minimum cover of loose backfill shall be placed over the moist backfill prior to the end of the day.

- E. Lean mix concrete shall not be mixed or placed when the air temperature is below 40°F. Temperature of the lean mix concrete shall be 50°F or greater at time of placement. If the District Representative determines that weather conditions are unsuitable, lean mix concrete shall not be placed.
- F. No lean mix concrete shall be placed in excavation or pipe trenches when the bottom or walls are frozen or contain frozen material. Backfill over lean mix concrete shall not contain any frozen material.

3.10 BLASTING

- A. Perform blasting with skilled workers and under the direction of a State of Colorado licensed blasting foreman. Perform blasting only when proper precautions have been taken for the protection of people, private property, and existing structures. Injury to people, damage and/or destruction of private property, or existing structures is the responsibility of the Contractor.
- B. Do not conduct blasting within 100 feet of concrete which has been placed less than seven (7) calendar days.
- C. Meet all Town, State, Federal and any other jurisdictional requirements for blasting.

END OF SECTION

SECTION 32 92 19

SEEDING

PART 1 – GENERAL

1.1 SCOPE OF WORK

- A. Preparation, seeding and mulching of areas disturbed by Contractor's activities.

1.2 SUBMITTALS

- A. Contractor shall furnish a proposed plan for preparing, seeding, and mulching disturbed areas in accordance with these specifications.
- B. Furnish seed samples and certificate with seed delivery stating source, quantity, and type of material. Certification shall guarantee that seed was premixed by supplier in accordance with the specifications.

PART 2 – PRODUCTS

2.1 GENERAL

- A. All materials for planting shall be first-grade, commercial quality and shall have certificates indicating the source of material, analysis, quantity, or weight attached to each sack or container or provided with each delivery.

2.2 SEED MIXTURES

- A. All seed shall comply with applicable State and Federal regulations. Seed shall be pre-mixed by dealer. The Contractor shall furnish dealer's guaranteed germination of each variety. Seed which has become wet, moldy, or otherwise damaged prior to use shall not be accepted.
- B. Grass seed shall be fresh, clean, new-crop seed that is composed of the varieties specified below, mixed in the proportions by weight, and tested for the minimum percentage of purity and germination specified.
- C. The seed mixture shall be High Altitude Grass Mix available from Western Native Seed, Salida, Colorado, and shall be applied at a rate of 1 pound per 1,000 square feet for smaller areas or a minimum of 30 pounds of pure live seed per acre for areas greater than an acre. The mixture shall be per the following table.

High Altitude Grass Seed Mix

Common Name	Variety	Percent
Slender Wheatgrass	Elymus Trachycaulus	25
Mountain Brome	Bromus Marginatus	25
Fringed Brome	Bromus Ciliatus	25
Tufted Hairgrass	Deschampsia Cespitosa	15
Alpine Bluegrass	Poa Alpina	10

- D. The CONTRACTOR shall compensate for percentage off purity and germination by furnishing sufficient additional seed to equal the specified pure live seed product. The formula for determining the quantity of pure live seed (PLS) shall be:

$$\text{PLS} = \text{Pounds of Bulk Seed} \times \text{Purity} \times \text{Germination}$$

- E. The OWNER reserves the right to review and modify the seed mix based on site conditions.

2.3 TOPSOIL

- A. Topsoil removed from the site for excavations shall be stockpiled for re-use in the seeding work. If the quantity of stockpiled topsoil is insufficient, additional topsoil to complete seeding shall be imported.
- B. Imported topsoil shall be fertile, friable, natural loam, surface soil reasonably free of subsoil, clay lumps, brush, weeds, roots, stumps, and other litter. It shall be totally free of rocks greater than 2-inches in any dimension.

2.4 FERTILIZER

- A. Fertilizer shall be 18-46-0 and shall have the following composition by weight:
1. 18% Nitrogen with 50% organic minimum
 2. 46% Phosphoric acid (P205)
 3. Elements not specified as organic may be organic or inorganic or a combination of both and shall be available according to the methods adopted by the Association of Official Chemists.
- B. Fertilizer material shall be of neutral character, either in pellets or granular form, uniform in composition and a free-flowing product. It shall be thoroughly pre-mixed by the manufacturer.

- C. Fertilizer shall comply with all local, state, and federal regulations. It shall be fresh and not previously opened, caked, wet, segregated, or beyond application date.

PART 3 – EXECUTION

3.1 GENERAL

- A. All disturbed areas that are not paved, graveled, or to remain free of vegetation by direction of the Town or the District's Representative shall be seeded with the seed mix specified above.
- B. The Contractor shall provide temporary fencing or other approved barricades to protect the seeded areas.
- C. If practical and approved by the District's Representative, sod of the existing grasses and vegetative cover may be set aside and replanted in lieu of seeding.

3.2 TOPSOIL REMOVAL, STORAGE, AND PLACEMENT

- A. In areas to be disturbed, topsoil shall be removed and stored for use in post-construction revegetation to the direction of the District's Representative. Soil stored for longer than two weeks shall be covered with permeable fabric to protect from wind and water erosion.
- B. After re-grading over disturbed areas is complete, topsoil shall be reapplied at the approximate depth that it was removed. Top soil shall not be compacted when applied and shall be roughened to receive broadcast seed. If seed is to be drilled, then the surface shall be smoothed over, but not compacted.

3.3 FERTILIZATION

- A. All area to be seeded shall be fertilized. Fertilizer shall be incorporated into the top four inches of soil as part of the seed bed preparation.
- B. Fertilizer shall be applied in dry form in a manner to assure uniform distribution. The application rate shall be 150 pounds per acre or 3.5 pounds per 1000 square feet.
- C. Fertilize only in appropriate weather conditions and not when exposed to high winds, heavy rains, on frozen ground, etc.

3.4 SEEDING

- A. Seeding shall be accomplished by either broadcast or drill methods using the specified seed mix.

- B. If the seed is drilled, in lieu of broadcast, then the application rate can be cut in half of the recommended rate in the table. If drilled, the Contractor shall provide a rangeland drill capable of properly metering “trashy” seed. Drill seed at 1/2 inch depth.
- C. Along pipelines, drill seed in furrows perpendicular or angular to the down slope to thwart erosion.
- D. Broadcast seed shall proceed on freshly disturbed (raked or harrowed) top-soil surface. Following broadcast, immediately rake or harrow seed into the surface using metal garden/landscape rakes or English harrow.
- E. Hydroseeding may be used if approved by the District's Representative. Areas to be hydromulched shall be treated with 3,000 pounds per acre of virgin fiber produced by steam separation. Guara gum base takifier shall be included at the rate of 70 pounds per acre. Bonded fiber matrix, where required, shall be applied at the rate of 3,000 pounds per acre; two angle application shall be strictly required.
- F. Seeded areas shall be mulched with straw or other woody product approved by the District's Representative and wetted according to seed supplier's recommendations during the construction period. Mulch shall be certified clean and free of noxious weeds and applied at about 1.5 tons per acre.

END OF SECTION

SECTION 33 14 13

WATER DISTRIBUTION PIPE AND FITTINGS

PART 1 – GENERAL

1.1 SCOPE OF WORK

- A. This section specifies water piping for distribution systems including fittings, pipe restraints, installation, pressure and leak testing, cleaning, and disaffection.

1.2 REFERENCES

- A. The latest version of the following standards is a part of this section as referenced and modified. In case of conflict, the requirements of this section shall prevail.

<u>Reference</u>	<u>Title</u>
AASHTO HS20	Loading, Tractor Truck with Semi Trailer
AASHTO T99	Standard Specifications for Highway Bridges
ACI 214	Recommended Practice for Evaluation of Strength Test Results of Concrete
ACI 304	Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete.
ACI 306	Recommended Practice for Cold Weather Concreting
ANSI B16.25	Butt-Welding Ends.
ASTM A153	Zinc Coating.
ASTM C 33	Specification for Concrete Aggregates.
ASTM C 39	Test Method for Compressive Strength of Cylindrical Concrete Specimens.
ASTM C 94	Specification for Ready-Mixed Concrete.
ASTM C 143	Test Method for Slump of Portland Cement Concrete.
ASTM C 150	Specification for Portland Cement.
ASTM C 192	Method of Making and Curing Concrete Test Specimens in the Laboratory.
ASTM C 260	Specification for Air-Entraining Admixtures for Concrete.
ASTM C 518	Test for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter.

ASTM C 578	Specifications for Preformed Cellular Polystyrene Thermal Insulation.
ASTM D 1621	Test for Compressive Properties of Rigid Cellular Plastics.
ASME B31.1	Power Piping - ASME Code for Pressure Piping.
ASME B31.3	Chemical Plant and Petroleum Refinery Piping
ASME	Code for Pressure Piping.
ASME B31.9	Building Services Piping - ASME Code for Pressure Piping.
ASME	Boiler and Pressure Vessel Code.
AWWA C111	Rubber Gasket Joints for Cast Iron and Ductile Iron Pressure Pipe and Fittings.
AWWA C104	Cement-Mortar Lining for Ductile Iron Piping.
AWWA C105	Polyethylene Encasement for Ductile Iron Piping for Water and Other Liquids.
AWWA C151	Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or San-Lined Molds for Water or Other Liquids
AWS QC1	Certification of Welding Inspections.
MSS SP-58	Pipe Hangers and Supports - Material/Design and Manufacturer.
MSS SP-69	Pipe Hangers and Supports - Selection and Application.
NFPA	Standard for Installation of Private Fire Service Mains and Their Appurtenances
SSPC SP1	Surface Preparation Specification No. 1 - Solvent Cleaning.
SSPC SP3	Surface Preparation Specification No. 2. - Hand Tool Cleaning.

1.3 DEFINITIONS

- A. Wetted and Submerged refer to locations on walkways over and elevations below the inside of hydraulic structures and channels.
- B. Pressure Terms
 - 1. Maximum operating pressure: The greatest pressure at which the system operates.
 - 2. Test pressure: The pressure applied to determine system acceptance.

1.4 SUBMITTALS

- A. If used, provide following submittals.
 - 1. Ductile Iron Wall Pipe: Manufacturer's data, thrust collar type and test report substantiating the pressure rating and safety factor.
 - 2. Expansion Joints: Manufacturer's data on materials, construction, and ratings.
 - 3. Couplings: Manufacturer's data on materials, construction and ratings for middle rings, followers, gaskets, nuts and bolts.
 - 4. Hydraulic Thrust Restraint: Details including materials, sizes, and assembly ratings, and pipe attachment methods for each pipe material.
 - 5. Thrust Blocks: Concrete mix, quantity, area of bearing on pipe, and fitting joint locations.
 - 6. Pipe Base and Pipe Zone Materials: Material type, gradation, and source.
 - 7. Hydrostatic Testing and Cleaning Plan:
 - 8. Detailed plan for cleaning, flushing, filling, testing and disinfecting pipeline; 14 days in advance of testing.
 - 9. Detailed procedures, equipment, materials and schedule.
 - 10. Results of all pipe and cleaning, certified by District Representative.
- B. Evidence of construction and grading permits from the Town or County as applicable.

1.5 QUALITY ASSURANCE

- A. All materials to be new, industrial quality, and manufactured by reputable manufacturer with minimum of ten years of manufacturing history for the items provided.
- B. All installations shall fully meet manufacturer's written instructions.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Pipe:
 - 1. Protect, support, and handle so as to prevent damage, especially to

linings and coatings.

2. For cement-mortar lined pipe, keep ends tightly closed to manufacturer's recommendations to protect mortar lining and keep pipe clean until installation.
3. Store pipe on skids or berms to manufacturer's recommendations.
4. Use implements, tools, facilities, and equipment suitable for proper and safe protection and handling of piping.
5. Use heavy canvas or nylon slings or other approved lifting devices, not chains or cables, to lift pipe and fittings.
6. Remove pipe that, in the opinion of the District's Representative, is damaged.
7. Do not allow entrance by rodents or other small animals into any pipe by sealing open ends or by other means acceptable to the District's Representative.

B. Gaskets:

1. Store in a cool, well-ventilated area.
2. Do not expose to the direct rays of the sun.
3. Do not allow contact with oils, fuels, or petroleum solvents.

1.7 SYSTEM DESIGN REQUIREMENTS

- A. General: Provide piping in accordance with laws and regulations and intended use, including: Building Service Piping: ANSI/ASME B31.9 Code, as applicable, and Uniform Plumbing Code.
- B. Buried Piping: Meet design conditions for HS20 traffic loads (AASHTO Standard Specifications for Highway Bridges) with 1.5 impact factor for piping with and without internal pressure.
 1. Support Systems:
 2. Design, size and space supporting devices adequate to maintain the pipelines, appurtenances and equipment in proper position and alignment under all operating and testing conditions with allowances for expansion and contraction.
 3. Design all supporting devices to minimize interference with access and movement and to eliminate potential injuries due to protrusion.

4. Meet ANSI/MSS SP-58, Pipe Hangers and Supports-Materials, Design, and Manufacture.

PART 2 – PRODUCTS

2.1 GENERAL

- A. Main Line Pipe Materials:
 1. Minimum Class 52 ductile iron pipe, ANSI A21.5/AWWA C151.
 2. All ductile iron pipe mortar lined, AWWA C 104.
 3. All ductile pipe and fittings, polyethylene encased in place per AWWA C105.
 4. Joints buried: mechanical and push-on per ANSI A 21.15/AWWA C111.
 - a. Synthetic rubber gaskets, NSF approved for potable water use.
 - b. Water soluble, nontoxic, vegetable soap compound conforming to United States Pharmacopoeia No. P39 for use in potable waterlines. Recommended by gasket manufacturer.
 - c. Provide joint thrust restraint designed for test pressures.
 - d. Provide thrust restraint by concrete thrust blocks.
 - e. Provide thrust restraint by mechanical joint anchor gland follower where thrust ties or thrust blocking are not practical. Anchor-type, wedge action, ductile iron with break-off tightening bolts; EBAA Iron, Inc., Megalug, or approved equal.
 5. Flanged pipe for vaults, ANSI A21.15/AWWA C115.
 - a. ANSI B16.1 flanges, flat faced, 125-lb unless otherwise specified or warranted by pressure conditions.
 - b. Fitted with Neoprene gaskets per AWWA C110, Appendix A.
 - c. Bolts shall have a ¼-inch projection beyond the nut when joint with gasket is assembled.
- B. Components: Furnish new products of equal material and rating as connecting pipe.

C. Galvanizing:

1. Hot-dip applied, meeting ASTM A153 with Grade 85 coating thickness.
2. Hardware: Hot-dip galvanized, ASTM A153.
 - a. Bolts, nuts and washers may be mechanically galvanized, ASTM B695.
 - b. Galvanize all connecting components using same galvanizing process.
 - c. Oversize threaded components in accordance with the respective ASTM specifications for the galvanizing process and material fabrication.
 - d. Lubricate nuts with a clean, non-oily and dry to touch lubricant. Provide lubricant with visible dye.
3. Electroplated zinc or cadmium plating is unacceptable.
4. Stainless steel components may be substituted where galvanizing is specified.
5. Repair methods per ASTM A780.

D. Fittings:

1. Manufacture to standard dimensions and for pressure specified. Provide the same or heavier wall thickness as the connecting pipe.
2. Where galvanized is specified, hot-dip galvanize after fabrication in accordance with ASTM A123.

E. Compatibility: Provide fittings and couplings from same manufacturer to assure uniformity and compatibility piping components.

F. Grooved-End Joints: Alternate for exposed piping in lieu of flanged joints, if approved by District representative. Rigid unless otherwise approved by District representative.

2.2 PIPE ANCHORS

A. Galvanized steel anchor chair with U-bolt strap. Grinnell, Figure 198 or B-Line, Figure B3147A or B.

2.3 COUPLINGS FOR METALLIC PIPING

- A. General:
 - 1. Thrust Ties: Provide to restrain 1-1/2 times the test pressure specified.
 - 2. Exposed Installations: High-strength, low-alloy steel, in accordance with AWWA C111 for use on cast iron and ductile iron couplings.
 - 3. Buried and Submerged Installations: Type 304 stainless steel bolts and nuts.

- B. Steel Sleeve Type Couplings
 - 1. General
 - a. Pressure rating equal to test pressure of the pipeline.
 - b. Middle Rings and Followers: Provide middle rings without pipe stop and at least 3/8 inch thick and 7 inches wide for 10-inch through 30-inch pipe with steel meeting ASTM A513.
 - c. Followers: Rolled AISI C1012 or C101B steel and of proper thickness.
 - d. Gasket Material: NSF potable water approved rubber compound gaskets.
 - e. Bolting Hardware for Exposed Installations: Steel bolts and nuts meeting AWWA C111 or ANSI A21.11.
 - f. Coatings: NSF approved factory-applied epoxy.
 - 2. Flexible Couplings:
 - a. Manufacturers for Steel Pipe: Dresser, Style 38; Smith Blair, Style 411.
 - b. Manufacturers for Ductile Iron Pipe: Dresser, Style 53 or 153; Smith Blair, Style 431, Romac Style 501.
 - 3. Transition Couplings: For similar pipe with small change in outside diameter.
 - a. Manufacturers: Dresser, Style 162; Rockwell, Style 413.
 - 4. Flanged Coupling Adapters:

- a. Steel Pipe: Smith Blair, Series 913; Dresser Industries, Inc., Style 128.
- b. Ductile Iron Pipe: Smith Blair, Series 912; Dresser Industries, Inc., Style 127, Romac Style FCA 501.

2.4 SERVICE LINES

A. Service Taps:

- 1. All service taps on cast iron pipe shall be completed with double-strap bronze or iron saddles rated for 200-psi internal pressure without leakage or overstressing.
- 2. Run diameter compatible with outside diameter of the host pipe.
- 3. Taps on ductile iron pipe shall be completed with bronze or iron saddles as specified above or with iron pipe threads if the ductile line is 6-inches or larger in diameter.
- 4. Malleable or ductile iron bodies and galvanized steel straps, steel hex nuts with washers, and neoprene seals.
- 5. Manufacturers: Rockwell, Series 313 or 366; Dresser, Style 91.
- 6. Bronze saddles with bronze straps can be used if approved by District.

B. Service Piping:

- 1. Type K copper, lines 3/4- through 2-inch, ASTM B88, soft temper or hard drawn.
- 2. Type K marking visible on all pipe segments or the pipe will be rejected.
- 3. Services greater than 2-inch, ductile iron pipe per this specification.

C. Pressure Reducing Valves

- 1. Service lines shall have a pressure reducing valve between main and meter.
- 2. Pressure reducing valve installed per the attached drawing.

D. Corporation Stop

- 1. District approved corporation stop shall be provided per the at-

tached drawing.

- E. Meter: See District Manager for further details and information.
 - 1. Meters must be purchased from the District; however, the customer's cost of a meter shall be the same as the District's cost to purchase the meter. The meter shall be owned by the District.
 - 2. All meters shall be maintained by the District and shall be tested, repaired or replaced as necessary. Meter repair or replacement is responsibility of the customer after one year.
 - 3. Meter installation shall be inside building and protected from freezing as per the attached drawing. The area housing the meter shall allow adequate room for access and maintenance.
 - 4. A floor drain shall be provided near the meter for new services.
 - 5. All meter settings or yokes shall keep the meter horizontal, even when installed on vertical lines. All meter settings or yokes shall have a continuous electrical conductive path around the water meter. If a bonding jumper is required, it shall be heavy copper ground wire with fittings suitable for the bonding jumper and water pipe material. The meter setting installation shall be in compliance with the National Electric Code.
 - 6. Absolutely no bypass piping around a meter is allowed.
- F. Valves
 - 1. All service line isolation valves will meet the latest version of AWWA C800.
 - 2. Ball valves shall be used for service lines of 2 inches diameter or less.
 - 3. Gate valves shall be used for service lines larger than 2 inches diameter.
 - 4. Valves shall be placed as shown on the attached drawings.
- G. Backflow Prevention Devices: See District Manager for further details and information. The District has implemented a Backflow Prevention and Cross-Connection Control Policy and a Backflow Prevention and Cross-Connection Control Program, which must be complied with by all customers and contractors. The Policy and the Program are available from the District at its administrative offices.

H. Insulation

1. When directed by District's Representative, polystyrene insulation shall be placed over the water service line as shown on the drawing.
2. Equal to Styrofoam 40 High Load Square EXE, ASTM C518, C578, and D1621.

2.5 SLAB, FLOOR, WALL, AND ROOF PENETRATIONS

A. Ductile Iron Wall Pipe:

1. For watertight penetrations through concrete walls, floors, slabs, or roofs.
2. Diameter and Ends: Same as connecting ductile iron pipe.
3. Thickness: Equal to or greater than remainder of pipe in line.
4. Manufacturer: American Cast Iron Pipe Co. or approved equal

2.6 PIPING SUPPORT SYSTEMS

A. General:

1. Provide designed system as specified herein.
2. Galvanized or epoxy coated by manufacturer to district representative's approval.

B. Saddle Support equal to:

1. Pedestal Type: Schedule 40 steel pipe stanchion, saddle, and anchoring flange.
2. Nonadjustable saddle, MSS SP-69, Type 37 with U-bolt: Grinnell, Figure 259; B-Line, Figure B3093.
3. Adjustable saddle, MSS SP-69, Type 38 without clamp: Grinnell, Figure 264; B-Line, Figure B3092.
4. Neoprene Waffle Isolation Pad: Mason Industries, Type W; Korfund, Korpad 40.

C. Wall Brackets equal to:

1. One-hole clamp type: Grinnell, Figure 126.

2. Welded steel, MSS SP-69, Type 33 (heavy-duty): Grinnell, Figure 199; B-Line, Figure B3607.
 3. Channel Type: Unistrut; Kin-Line.
- D. Pipe Clamps: Riser, MSS SP-69, Type 8; Grinnell, Figure 261; B-Line, Figure B3373.

2.7 CONCRETE

- A. Thrust blocks per attached drawing. Concrete as follows
1. Minimum 28-day compressive strength 3,000 psi per ASTM C 39 and ACI 214.
 2. Portland Type II Cement per ASTM C 150, minimum 5½ bags per cubic yard.
 3. Slump 3 to 5-inches per ASTM C 143.
 4. Maximum water-cement ratio of 0.58.
 5. Air content 6% \pm 1%.
 6. Aggregates per ASTM C 33.
 7. Air entraining agent per ASTM C 260.
 8. Ready-mix per ASTM C 94.
 9. Test specimens per ASTM C 192.
 10. Submit mix for approval.

2.8 TRENCH EXCAVATION, PIPE BEDDING, AND BACKFILL

- A. Trench excavation, backfill, and road repaving shall be as specified in the Town of Winter Park's Standards and Specifications for Design and Construction.
- B. Pipe zone and bedding material shall be well-graded, crushed stone or angular gravel per Section 02200.
- C. Lean mix per Section 02200 shall be used in lieu of granular bedding when conditions, in the opinion of the District's Representative, dictate its use.

2.9 PIPE MARKING TAPE

- A. Marking Tape shall be 6 inches wide, inert plastic with foil backing made for direct burial. Tape shall be equal to Allen Systems, W. H. Brady Co. or Marking Services Inc.
- B. Tape marking: “*Caution Caution Caution - Water Pipe Buried Below*” in bold letters approximately 2 inches high, printed at maximum intervals of 2 feet, or approved equal.

PART 3 – EXECUTION

3.1 EXAMINATION

- A. Verification of Existing Pipe and Penetrations:
 - 1. Expose all existing pipes that are to be connected to new pipelines.
 - 2. Verify the size, material, joints, elevation, and horizontal location.
 - 3. Inspect size and location of structure penetrations to verify adequacy of wall pipes, sleeves, and other openings before installing connecting pipes.

3.2 PREPARATION

- A. New Pipe and Fittings:
 - 1. Inspect before installation or lowering into the trench.
 - 2. Clean pipe thoroughly and keep clean during and after placing.
- B. Field Installation: Notify District Representative at least 2 weeks prior to installation of piping and fittings.

3.3 PIPING INSTALLATION

- A. General: Install in conformance with approved construction drawings.
- B. Piping Expansion Provisions:
 - 1. Piping: Allow for thermal expansion due to differences between installation and operating temperatures.
 - 2. Anchors and Anchor Walls: Install to withstand thrust loads and to control thermal expansion.
- C. Piping Flexibility Provisions:
 - 1. Install thrust protection as specified.

2. Install flexible couplings where needed.
 3. Install additional pipe anchors and flexible is needed.
- D. Pipe Fittings and Appurtenances: Per manufacturer's instructions and as specified.
- E. Service taps may be direct taps on ductile iron lines 6-inches in diameter or larger, but must be saddle taps on lines 4-inches in diameter or smaller. Cast iron pipelines always require a saddle.

3.4 FLEXIBLE COUPLINGS, FLANGED COUPLING ADAPTERS, GROOVED JOINT COUPLINGS, AND SERVICE SADDLES

- A. Thoroughly clean oil, scale, rust, and dirt from pipe to provide a clean seat for the gasket.
- B. Wipe gaskets clean prior to installations.
- C. Lubricate flexible couplings and flanged coupling adapter gaskets with manufacturer's standard lubricant before installation on the pipe ends.
- D. Install couplings, service saddles, and anchor studs in accordance with manufacturer's instruction.
- E. Tighten bolts progressively on opposite sides until all bolts have a uniform tightness.
- F. Use only torque-limiting wrenches to tighten bolts.
- G. Service taps shall be a minimum of 5-feet apart along the distribution pipeline unless otherwise approved by the District's Representative.

3.5 PIPING SUPPORT SYSTEMS

- A. General:
1. Install approved support system in accordance with Manufacturers Standardization Society of the Valve and Fitting Industry, Inc. (MSS) SP-69, "Pipe Hangers and Supports-Selection and Application" and as specified herein.
 2. Support piping connections to equipment by pipe support and not by equipment.
 3. Support heavy valves, fittings, and appurtenances independent of piping.
 4. Support no pipe from the pipe above it.

5. Provide supports at piping changes in direction or elevation, adjacent to flexible joints and couplings, and as otherwise needed or directed.
6. Dielectric Barrier: Provide between supports and copper or stainless steel pipe. Provide between stainless steel supports and non-stainless steel ferrous piping.

3.6 SLAB, FLOOR, WALL, AND ROOF PENETRATIONS

A. Wall Pipes:

1. Isolate embedded metallic piping from concrete reinforcement using coated pipe penetrations.
2. Support wall pipes securely by formwork to prevent contact with reinforcing steel and tie-wires.

B. New Penetrations of Existing Slabs, Floors, Walls and Roofs:

1. Core drill openings of diameter required to accommodate pipe penetration system.
 - a. Locate reinforcement with pachometer prior to coring. Adjust core location as required to avoid damage to reinforcement.
 - b. Clean opening surfaces of coring residue.
2. Install modular mechanical expanding rubber seal or other District approved seal per manufacturer's recommendations.
3. Grouted penetration:
 - a. Fill and pack annular space between pipe and opening with non-shrink grout. Finish grout flush with face of opening when backer rod and sealant are not required.
 - b. Install backer rod and sealant at face of opening when indicated.

3.7 TRENCH EXCAVATION AND BACKFILL

- A. Trench excavation, backfill, and road repaving shall be as specified in Section 02200.
- B. Construction and grading permits shall be obtained through the Town prior to any excavation.

3.8 BURIED PIPE PLACEMENT

A. General:

1. Lay pipe and fittings in conformance District approved construction drawings and manufacturer's instructions at the alignment and elevations shown.
2. Provide special tools and devices, such as special jacks, chokers, and similar items required for proper installation.
3. Use NSF approved pipe joint lubricant as specified; no substitutions will be permitted.
4. Do not lay pipe in water or when trench conditions are unsuitable.
5. Prevent uplift and floating of pipe prior to backfilling.
6. Minimum Pipe Cover: 9-feet for water lines; 5-feet for sewer lines.
7. Do not deviate more than 2-inches from line or grade.
8. Dig bell holes at joint locations of ample dimensions in the bottom and sides of the trench where necessary to permit visual inspection and testing of the entire joint.
9. Prevent foreign material from entering pipe at all times during placement.
10. Lay pipe upgrade with bell ends pointing in direction of laying.
11. After a section of pipe has been lowered into the prepared trench, clean the end of the pipe to be joined, the inside of the joint, and the rubber ring immediately before joining the pipe.
12. Check gasket position with feeler gauge furnished by the pipe manufacturer to assure proper seating. Feeler Gauge shall be of proper size, type, and shape for use during installation for each type of pipe furnished.
13. Install closure sections and adapters for gravity piping at locations where pipe laying changes direction.
14. Joint Deflection:
 - a. Deflect pipe at joints for pipelines laid on a curve, using unsymmetrical closure of spigot into bell.
 - b. Maximum Deflection: 75 percent of maximum deflection

recommended by pipe manufacturer.

- c. Use one of the following methods if joint deflection of standard pipe lengths will not accommodate horizontal or vertical curves in alignment: Standard or special fabricated bends to District approval.
 - d. Install thrust blocking if bends are used.
15. Do not vary actual horizontal position of pipe centerline on alignment around curves by more than 1.5 feet from position shown.
 16. Apply sufficient pressure in making the joint to assure that the joint is "home," as defined in the standard installation instructions provided by the pipe manufacturer.
 17. Place sufficient pipe zone material to secure the pipe from movement before the next joint is installed.
 18. Keep trench dry until the pipe laying and jointing are completed.
 19. Close and block the open end of the last laid section of pipe-to prevent entry of foreign material or creep of the gasketed joints at all times when laying operations are not in progress, at the close of the day's work, or when the workers are absent from the job.

3.9 FLEXIBLE SLEEVE COUPLINGS

- A. Before coupling, clean pipe holdback area of oil and dirt.
- B. Remove pipe coating only if necessary to present smooth surface. Do not remove pipe coating; repair if damaged before joint is made.
- C. Install couplings in accordance with manufacturer's instructions. Clean gaskets before installation and, if necessary, lubricate with gasket lubricant for installation on pipe ends.
- D. Tighten coupling bolts progressively, drawing up bolts on opposite sides a little at a time until all bolts have uniform tightness.
- E. Tighten bolts with torque-limiting wrenches; do not overstress bolts to compensate for poor alignment of flanges.

3.10 CONNECTING DISSIMILAR PIPE

- A. Flexible Transition Couplings: Install in accordance with pipe manufacturer's instructions.

3.11 FLEXIBLE JOINTS AT CONCRETE STRUCTURES, WALLS, BACKFILL OR ENCASEMENT

- A. Install flexible pipe joints at the terminations of any concrete wall, backfill or concrete encasement.
- B. Rubber ring joints, mechanical joints, flexible couplings, and proprietary restrained ductile iron pipe joints are considered flexible joints; welded pipe joints are not.
- C. If not shown on Drawings, provide a joint flush with face or not further than 24 inches away from face.

3.12 CLOSURES

- A. Install closure pieces as necessary to complete closure assembly where pipes meet other pipes or structures.
- B. Pressure Pipeline Closures: Plain end pieces with double flexible couplings, unless otherwise shown or approved.
- C. Restrained Joint Pipe Closures: Install with thrust tie-rod assemblies as shown or in accordance with NFPA No. 24, Standard for the Installation of Private Fire Service Mains and their appurtenances or use mechanical joints with restrained joint pipe and fittings per 3.13 below, if applicable and approved by the District.

3.13 THRUST RESTRAINT

- A. Location: At pipeline tees, plugs, caps, bends, and other locations where unbalanced forces exist. Thrust blocks and ties shall be installed where required, whether or not shown.
- B. Mechanical Joint Valves in Proprietary Restrained Joint Pipe and Fittings: Restrain mechanical joints with the proprietary restrained joint manufacturer's adapter gland follower and pipe end retainer or provide thrust tie-rods and socket clamps.
- C. Thrust Blocking:
 - 1. Allowable soil pressure: 1,000 pounds per square foot.
 - 2. Place between undisturbed ground and fitting to be anchored.
 - 3. Quantity of concrete: Sufficient to cover area of bearing on pipe, as shown or as approved.
 - 4. Place blocking so that pipe and fitting joints will be accessible for

repairs, unless otherwise approved.

5. Measuring, mixing, transport, and placing of concrete per ACI 304. Cold weather placement per ACI 306.
6. For Low Pressure Pipelines, when bearing surface of the fitting against soil provides an area equal to or greater than area required for thrust restraint, concrete thrust blocks will not be required. Determine bearing area for fittings without thrust blocks by the projected area of 70 percent of the internal diameter multiplied by the chord length for the curve along the centerline of the fitting.

3.14 MARKING TAPE & TRACER WIRE

A. Marking Tape

1. In accordance with manufacturer's recommendations.
2. Placed 4-feet above the pipe top unless otherwise directed.
3. When splicing, roll together 12-inches of each end of tape with the foil faces touching each other to ensure an electrical connection and secure splice by wrapping with waterproof tape.

B. Tracer Wire

1. Placement, installation, and testing of tracer wire shall be in accordance with the manufacturer's recommendations.
2. Tracer wire shall be placed on water lines with access lines placed in access boxes affixed to the ground flange on fire hydrants to District approval.
3. The access boxes shall be as provided by the wire manufacturer or an approved equal, labelled and colored for water line location, and shall include anode ground wire installation to manufacturer's specifications. Anode ground shall be also provided at any dead ends.
4. Two feet of slack wire should be placed in the access box for easy connection.
5. All connections of and splicing of tracer wire shall be in lockable sealed connectors provided by the wire manufacturer for that purpose or an approved equal.
6. If there are no hydrants for locating access boxes, then the District shall provide direction for location of access generally every 500

feet.

7. Acceptable manufacturer's include Pro-Trace HF-CCS, Copper-head #12 High Strength, or an equal approved by the District. Wire shall be high strength, HDPE coated, copper clad steel, and color coded for waterline application.

3.15 EXPOSED PIPING INSTALLATION

A. General:

1. Install parallel to building lines and in a straight line.
2. Install piping without springing or forcing the pipe and creating stresses in the pipe, valves, or connected equipment.
3. Use torque-limiting wrenches to tighten bolts.

B. Pipe Flanges:

1. Set level, plumb, and aligned.
2. Install flanged fittings true and perpendicular to the axis of the pipe.
3. Bolt holes shall straddle vertical centerline of pipes.

C. Unions: Install where required for piping or equipment installation.

D. Valve Orientation: Orient to permit easy access to the valve operator, and to avoid interference.

3.16 CORROSION PROTECTION

A. Buried or Encased Ductile Iron

1. Enclose buried ductile iron and cast iron soil piping with specified polyethylene encasement and, when possible, enclose fittings and specials. If fittings and specials cannot be fully enclosed, coat with mastic coal tar epoxy to District's approval.
2. Install encasement in accordance with AWWA C105/ANSI A21.5 and manufacturer's instructions.
3. Do not provide polyethylene encasement for concrete encased pipe.

- B. Buried Piping Accessories including, but not limited to tie rods, exposed bolted fittings, couplings, and valves that cannot be encased in polyethylene shall be coated with mastic coal tar epoxy to District's approval.
- C. Atmospheric Exposed Pipe, Fittings and Accessories:
 - 1. Paint with epoxy paint per District approval.
 - 2. Piping and fittings exposed to sunlight shall also receive a topcoat of UV resistant Urethane paint per District's approval.

3.17 DISINFECTION

- A. General:
 - 1. For the tablet method of disinfection to be effective, the pipeline must be installed in a clean condition. Therefore, all pipes must be clean prior to placement of chlorine tablets and must be maintained in a clean condition during construction.
 - 2. If there is dirt in the pipe, it shall be cleaned and flushed or, if it cannot be flushed, the interior of the pipe shall be cleaned by mechanical means then swabbed with a one percent hypochlorite solution to District approval.
 - 3. Disinfect using the tablet method as specified herein or other method meeting the latest AWWA standards, if approved by the District.
 - 4. Disposal and neutralization of spent disinfecting water shall be approved by the District and meet Section 01 35 43 for protection of the environment.
- B. Tablet Method:
 - 1. Whenever possible and approved by the District, disinfect new or repaired lines by employing the tablet method.
 - 2. Hypochlorite tablets are installed in the water main as it is being placed. Pipes and appurtenances must be kept clean and dry during and after placement until the pipe is filled for testing and disinfection procedures.
 - 3. Tablets of 5 grams each, with a minimum of 3.25 grams of available chlorine, shall be placed in each section of pipe and one placed at each branch and hydrant. Initial concentration of chlorine shall be not less than 50 mg/l.

4. The number of tablets required shall be determined from the following table to obtain an initial chlorine concentration of approximately 50 mg/l.

Pipe Diameter (inches)	13-feet or less	18-feet	20-feet
4	1	1	1
6	1	2	2
8	2	4	4
10	4	6	6
12	6	8	8
16	8	10	10

5. Attach with adhesive equal to Permatex No. 1 to the manufacturer's recommendations. There shall be no adhesive on the tablet except on the broad side attached to the surface of the pipe. Attach all tablets inside and at the top of the pipe with approximately equal numbers of tablets at each end of a given pipe length. If tablets are attached before the pipe section is placed, the top of pipe shall be marked on the pipe so it is installed properly.
6. When installation is complete, the main shall be filled at a velocity no greater than 1 foot per second. Provisions shall be made to eliminate air pockets. One or more corporation stops at top of pipe section to be disinfected may be needed, per District approval. Water shall remain in the pipe for at least 48 hours.
7. Pipeline being disinfected shall be isolated from the working water distribution system throughout the disinfection procedures.
8. After the retention period, the chlorinated water shall be flushed from the main until chlorine measurements show that the concentration in the water leaving the main is equal to that generally prevailing in the system.
9. The chlorinated water shall be discharged either to a tank for disposal elsewhere to the District's approval, to the sewer system for disposal as directed by the District, or be neutralized and disposed of as directed by the District.
10. Chlorine residual shall be not less than 25 mg/l at the end of the disinfection period. If the chlorine residual is lower than 25 mg/l, the line shall be refilled with a chlorine solution to the District's approval for an additional 24-hour period. After the chlorine test has passed, the line shall be flushed with potable water.

11. Spent chlorine solution may be neutralized by treatment with one of the following chemicals.

Pounds of Chemical to Neutralize Residual Chlorine in 100,000 Gallons of Water

Residual Chlorine (mg/l)	Sulfur Dioxide (SO ₂)	Sodium Bisulfite (NaHSO ₃)	Sodium Sulfite (Na ₂ SO ₃)
5	4.1	6.2	7.3
10	8.3	12.5	14.6
25	20.8	31.3	36.5
50	41.7	62.6	73.0

12. Final residual chlorine in the disinfected pipeline should generally be equal to the system and not more than 2.5 mg/l.

C. BACTERIOLOGIC TESTS

1. Twenty-four hours after the testing and flushing operations are complete and certified by the District, District staff will collect samples from the pipeline to test for bacteriological contamination.
2. The number and frequency of samples shall conform to the requirements of the Grand County Health Department.
3. The samples will be tested through a certified water quality lab and a passing test will show the absence of coliform organisms.
4. If the test fails, disinfection, flushing and sampling procedures shall be repeated to the District's satisfaction until subsequent test results show no coliform organisms.

3.18 PIPE LEAK TESTING

A. General:

1. Conduct pressure and leakage tests on newly installed pipelines and appurtenances, in accordance with District approved testing plan and schedule.
2. Furnish necessary equipment and make taps in piping as approved by District.
3. District representative will observe all tests.
4. Provide 14 days advance written notice of start of testing to the District.
5. Separately test pressure pipe sections that can be isolated by valves.

- B. Test Records: Make records of each piping system during the test to document the date of test, description and identification of piping tested, test fluid, test pressure and remarks.
 - 1. Remarks to include: Leaks (type, location), repairs made, certification by Contractor and sign off by District representative on satisfactory completion.
- C. Testing New Pipe Connected to Existing Pipe:
 - 1. Isolate new pipe with grooved-end pipe caps or blind flanges.
 - 2. Test joint between new piping and existing piping by methods approved by the District, never place the entire existing system under test load.

3.19 HYDROSTATIC LEAK TESTING

- A. Procedure for Buried Pressure Piping:
 - 1. Pipe With Concrete Thrust Blocking: Do not conduct pressure test until a minimum of 7 days after thrust blocking is installed. If high-early strength cement is used for thrust blocking, reduce to 3 days if approved by District.
 - 2. Cement-Mortar Lined Piping: Slowly fill test section with clean potable water approved by District 24 hours before test and allow to stand under low pressure. If testing is being completed in conjunction with disinfection, then allow water to stand under low pressure for 48 hours.
 - 3. Expel all air from piping system prior to testing. One or more corporation stops at top of pipe section to be tested may be needed, per District approval.
 - 4. All valves within a test section shall be opened during testing. All valves at the end of a test section shall be closed during testing.
 - 5. With hydraulic force pump, apply and maintain test pressure of 150 psi at the lowest point in test section, unless otherwise directed by District.
 - 6. Valve off the piping system when test pressure is reached.
 - 7. Maintain hydrostatic test pressure continuously for 2 hours minimum, reopening isolation valve only as necessary to restore test pressure.

B. Allowable Leakage

1. Leakage is the quantity of water added to the pipe to maintain pressure within 5 psi of the test pressure after the air has been expelled and the pipe is filled with water.
2. Maximum allowable leakage:

$$L = SD(p^{0.5})/133,200$$

Where: S = length of pipe in feet
D = pipe diameter in inches
p = test pressure in psi

3. If the test provides for less than the maximum allowable leakage over the two-hour test period, than it passes. Otherwise it fails and the pipe must be repaired and retested until a District representative witnesses and certifies a satisfactory test.
4. All visible leaks must be repaired regardless of test results.

- C. If vault or other exposed piping is tested, follow same procedure as for buried piping.

END OF SECTION

SECTION 33 14 14

WATER DISTRIBUTION VALVES AND HYDRANTS

PART 1 – GENERAL

1.1 SCOPE

- A. The Contractor shall furnish, install, and test isolation valves and fire hydrants meeting the requirements of this Section.

1.2 REFERENCES

- A. Standards:

ANSI B16.5 Pipe Flanges and Flanged Fittings

ANSI B16.34 Valves - Flanged and Buttwelding End

ASTM A 105 Forgings, Carbon Steel, for Piping Components

ASTM A 182 Forged or Rolled Alloy-Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High Temperature Service

ASTM A 216 Steel Castings, Carbon, Suitable for Fusion Welding, for High-Temperature Service

API 609 Butterfly Valves, Lug-Type and Wafer-Type

AWWA C500 Standard for Gate Valves for Water and Sewerage Systems

AWWA C509 Standard for Resilient-Seated Gate Valves for Water and Sewerage Systems

AWWA C550 Standard for Protective Interior Coatings for Valves and Hydrants

MSS SP-25 Standard Marking System for Valves, Fittings, Flanges and Unions

MSS SP-61 Pressure Testing of Steel Valves

1.3 CONTRACTOR SUBMITTALS

- A. Manufacturer furnishing valves, and hydrants shall present certification of compliance with the reference specifications noted herein including materials, testing, and coatings.

- B. For isolation valves, manufacturer shall certify that valve seat is field replaceable, without the use of special tools.
- C. Drawings and data shall be submitted as follow:
 - 1. For vault or building piping, provide complete dimensioned layout drawings depicting the placement of the valves and operators, floor stands, piping, gages, and fittings.
 - 2. Product information including assembly drawings, material descriptions, dimensions, operational descriptions, installation instructions, weights, fabrication details, tolerances, clearances, and surface finishes.
- D. Provide operation and maintenance manuals per Section 01 33 00.
- E. The Contractor shall provide one set of manufacturer's recommended spare parts for each type and size of valve and hydrant, including any special tools needed for servicing and/or operation.
- F. Warranties for all products specified herein and related accessories.

1.4 QUALITY ASSURANCE

- A. All valves and hydrants shall be completely shop-assembled including operators and gearboxes (when applicable). Isolation valves shall operate smoothly under maximum unbalanced water pressure.
- B. All flanged valves shall be hydrostatic tested to ANSI B 16.34 and, when applicable, MSS SP 61. All threaded valves shall be hydrostatic tested to applicable AWWA and ANSI specifications and to MSS SP 61 as applicable.
- C. For isolation valves, valves shall be seat tested and, with valve in the closed position and seats under pressure, leakage shall be zero.
- D. For all valves being tested, valve parts shall show no evidence of distress and there shall be no signs of any leakage or weeping anywhere on the valve.
- E. Factory test pressures shall be a minimum of 1.5 times the rated working pressure. Field test pressures shall be identical to adjacent pipeline test pressure.

PART 2 – PRODUCTS

2.1 GENERAL – VALVES

- A. All buried isolation valves shall have mechanical joint ends per AWWA C111 and 2-inch AWWA-style square nuts that open by turning counter-clockwise (to the left). Valves shall be fitted with an operating nut extension shaft to bring the operating nut to within 3 to 5 feet of the surface. Extension shaft shall be of a material and caliber equal to the valve operating shaft.
- B. Tee-head bolts and hexagon nuts shall be fabricated from a high-strength, low alloy steel known in the industry as Cor-Ten or US Alloy or approved equal.
- C. Valve boxes shall be adjustable screw type, 6-inches diameter, manufactured by the Tyler Pipe Company, Series #6860 with a round base or an approved equal. Valve box covers shall be marked with the word "WATER" and shall have a lip or flange extending into the valve box shaft. Slip-type valve boxes are not allowed. The valve box design shall not transmit shock or stress to the valve and shall be centered and plumb over the operating nut of the valve. The valve box cover shall be set to the Town of Winter Park standards with regard to surface of pavement, gravel, or unpaved areas within Town limits and to County standards if outside of Town limits.
- D. When desired by the District, valve markers consisting of 8-foot long blue fence posts set in 3-cubic feet of concrete shall be provided in non-paved or remote areas. Each post shall extend approximately 5 feet above finish grade.
- E. Valves placed in vaults or buildings shall be flanged with minimum ANSI Class 150 flanges.
- F. Generally, all buried isolation valves up to 12-inch diameter shall be gate valves. All buried isolation valves greater than 12-inch shall be butterfly valves. All valves located in vaults and buildings shall be butterfly valves. The District reserves the right to specify other isolation valves in unique situations.

2.2 GATE VALVES

- A. Gate valves shall be resilient seated, cast iron body, with non-rising stem. Conforming to AWWA C509 with minimum working pressure of 200 psi. Valve stems shall be sealed with two O-style rings, each of which shall be designed to allow replacement under full line pressure when the valve is in the full open position.
- B. Approved resilient wedge gate valves include those manufactured by Mueller, Clow, AFC, Waterous, and US Pipe Metro Seal.

2.3 BUTTERFLY VALVES

- A. Butterfly valves shall be high performance, double offset or with offset seat and eccentric shaft. They shall be capable of seating against full differential pressure in either flow direction. In buildings or vaults, valves shall be either wafer type, mounted between flanges of other piping or fittings, or be flanged. Valves shall conform to AWWA C504 and be minimum ANSI Class 150.
- B. Body: Valve body shall meet the minimum wall thickness requirements of ANSI B 16.34. Laying lengths shall conform to the current API-609 and MSS SP-68 standards. Body shall be carbon steel per ASTM A 216, Grade WCB.
- C. Disc: Valve disc shall be constructed of 316 stainless steel per ASTM A 182. Offset design shall minimize cycle wear and distortion of the seat. Valve disc shall provide for maximum flow capacity and low differential pressures in the open positions.
- D. Shaft: Shaft design shall be single or dual piece. Shaft shall be 17-4 series stainless steel, corresponding to the design requirements of ASTM A 564, H1075. Valve stems shall be attached to the disc so as to be inherently blowout proof without impairing shaft strength.
- E. Valve Seats: Valve seats shall be a full circle 360 seat located in the body only and shall be high temperature reinforced polytetrafluoroethylene (PTFE). Seat design shall be a bi-directional, bubble-tight shutoff with zero leakage for all differential pressures through the full pressure class rating. The seat shall be designed for high cycle service with minimal wear and low torque.
- F. Bearings: All shaft bearings shall be of the self-lubricating, corrosion-resistant, sleeve type. Bearings shall be designed for horizontal and/or vertical shaft loading. Valve journals shall have pressed fitted upper and lower bushings located immediately adjacent to flattened body bore surface for maximum stem support.
- G. Packing: Stem packing shall be adjustable and replaceable without removing the valve actuator. Stem packing adjustment nuts shall have full 180-degree clearance for ease of wrench access and rotation. Stem packing shall be equally suitable for full vacuum and pressure service and shall be polytetrafluoroethylene (PTFE).
- H. Linings and Coatings: Valves shall be epoxy lined per NSF standards for potable water. Valves shall be provided with standard manufacturer's coating on exterior surfaces. Valves shall be the same color as adjacent piping or factory primed and field coated to same color as adjacent piping when installed in buildings or vaults.

- I. For installation in vaults or buildings, the actuator shall be a spring loaded, standard sized lever for all butterfly valves specified herein unless a hand wheel with reduction gearing is necessary to meet the manual force constraint of 40 pounds. Oversized levers are not allowed. The lever or hand wheel shall provide for completely opened, completely closed, and partially opened settings. The valve shall include an indicator depicting whether it is totally opened, closed, or partially opened.
- J. Enclosure: The actuator shall meet weatherproof, submersible or buried service conditions as required by the valve's location. Actuators shall be built with corrosion resistant input shaft and hardware.
- K. Mechanical Stops: An integral mechanical stop device shall be provided to prevent over-travel. All stops shall be of steel material.
- L. Butterfly valves shall be as manufactured by Keystone Valve USA, Inc.; Flowseal Soft Seat Valve, Mark Controls Corporation; or an approved equal.

2.4 HYDRANTS

- A. The hydrant shall be 5¹/₄-inch diameter, dry barrel with breakaway traffic flange.
- B. Outlets shall include two each, 2¹/₂-inch diameter hose nozzles and one each, 5¹/₂-inch pumper nozzle with outlet threads conforming to NFPA 194.
- C. Shoe inlet shall be 6-inch, mechanical joint with retainer gland.
- D. Operating nut shall be pentagon and measure 1¹/₂ inches from point to flat at the base of the nut and 1⁷/₁₆ inches at the top with a 1-inch minimum height.
- E. Hydrant shall be Mueller Mountain-bury, 9¹/₂ feet, red color, and open left with direction of opening cast in top of hydrant.

PART 3 – EXECUTION

3.1 CLEANING

- A. Carefully clean all valves, hydrants, fittings and pipe of foreign material and inspect valves and hydrants in open and closed positions before installation.
- B. Prior to installation of all components, thoroughly clean flange faces, or threaded ends.

3.2 GENERAL INSTALLATION

- A. Install all items specified in conformance with manufacturer's recommendations.
- B. For threaded joints, apply Teflon joint tape.
- C. After cleaning flanges or mechanical fittings, insert the gasket and tighten the nuts progressively and uniformly.
- D. Piping, valves, and fittings shall be installed so that bolt holes of flanged or mechanical joints shall straddle the centerline of the pipe run.

3.3 GATE VALVES AND BOXES

- A. All buried gate valves shall be mechanical joint and installed with restrained glandular adapters per Section 15140.
- B. All buried gate valves shall be provided with valve boxes installed as shown on the attached gate valve drawing.
- C. The valves shall be set plumb and the valve box shall be centered over the valve with the box cover flush with the finished grade. The gate valve and box shall be bedded and backfilled as shown on the drawing with pipe zone and bedding material per Section 02200.
- D. A concrete collar shall be provided at finish grade as shown on the attached gate valve drawing.
- E. The valve shall be shown to operate smoothly.

3.4 FIRE HYDRANTS

- A. Hydrants shall be installed as shown on the attached fire hydrant drawing. Gravel shall be provided around the hydrant weep hole from six inches above to 18 inches below the hydrant drain opening.
- B. Hydrants shall be installed plumb with the pumper nozzle toward the street.
- C. Protective posts shall be provided as shown on the attached fire hydrant drawing.
- D. Set traffic flange 3 inches above finished grade.
- E. Install all hydrants with a guard valve and restraints as shown on the drawing.

3.5 TESTING AND DISINFECTION

- A. Pressure-test and disinfect all valves, hydrants, and accessories with adjacent piping.
- B. Test the operations of all valves and hydrants under all operating conditions, while pipe is pressurized.

END OF SECTION

SECTION 33 14 20

PRESSURE REDUCING VALVES AND VAULT

PART 1 – GENERAL

1.1 SCOPE

- A. The Contractor shall furnish, install, and test pressure reducing valves and vault piping meeting the requirements of this Section.
- B. Pipe and fittings shall meet the requirements of Section 33 14 13 - Pipe and Fittings
- C. Valves not specified herein shall meet requirements of Section 33 14 14 - Valves and Hydrants.
- D. Vault shall meet the requirements of Section 03 41 00 - Concrete Man-holes and Precast Structures.

1.2 REFERENCES

A. Standards:

ANSI B16.5 Pipe Flanges and Flanged Fittings

ANSI B16.34 Valves - Flanged and Buttwelding End

ASTM A 105 Forgings, Carbon Steel, for Piping Components

ASTM A 182 Forged or Rolled Alloy-Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High Temperature Service

ASTM A 216 Steel Castings, Carbon, Suitable for Fusion Welding, for High-Temperature Service

API 609 Butterfly Valves, Lug-Type and Wafer-Type

AWWA C500 Standard for Gate Valves for Water and Sewerage Systems

AWWA C509 Standard for Resilient-Seated Gate Valves for Water and Sewerage Systems

AWWA C550 Standard for Protective Interior Coatings for Valves and Hydrants

MSS SP-25 Standard Marking System for Valves, Fittings, Flanges and Unions

MSS SP-61 Pressure Testing of Steel Valves

1.3 CONTRACTOR SUBMITTALS

- A. Manufacturer furnishing valves, fittings and appurtenances shall present certification of compliance with the reference specifications noted herein including materials, testing, and coatings.
- B. Drawings and data shall be submitted as follow:
 - 1. For vault piping, provide complete dimensioned layout drawings depicting the placement of the valves and operators, floor stands, piping, gages, and fittings.
 - 2. Product information including assembly drawings, material descriptions, dimensions, operational descriptions, installation instructions, weights, fabrication details, tolerances, clearances, and surface finishes.
 - 3. Precast Vault submittal shall be per Section 00 26 05 Concrete Manholes and Precast Structures.
- C. Provide operation and maintenance manuals per Section 01 03 30.
- D. The Contractor shall provide one set of manufacturer's recommended spare parts for each type and size of pressure reducing valve, including any special tools needed for servicing and/or operation.
- E. Warranties for all products specified herein and related accessories.

1.4 QUALITY ASSURANCE

- A. Valves shall be completely shop-assembled and shall operate smoothly under maximum unbalanced water pressure.
- B. All flanged valves shall be hydrostatic tested to ANSI B 16.34 and, when applicable, MSS SP 61. All threaded valves shall be hydrostatic tested to applicable AWWA and ANSI specifications and to MSS SP 61 as applicable.
- C. For all valves being tested, valve parts shall show no evidence of distress and there shall be no signs of any leakage or weeping anywhere on the valve.
- D. Factory test pressures shall be a minimum of 1.5 times the rated working pressure. Field test pressures shall be identical to adjacent pipeline test pressure.

PART 2 – PRODUCTS

2.1 PRESSURE REDUCING VALVES

- A. The main pressure reducing valve shall be the same size as the main line it is installed in unless otherwise approved. The valve shall be Cla-Val Model 690G-01 as shown and specified on the Drawings. The valve shall be equipped with a Cla-Val Dura-Kleen Stem, a rifled, self-cleaning stem designed to keep deposits from building on the stem allowing low friction operation in variable conditions.
- B. The 3-inch bypass pressure reducing valve shall be Cla-Val Model 690G-01, also as shown and specified on the Drawings.
- C. District utilizes Cla-Val as its standard manufacturer for all PRVs, so no other manufacturer will be considered. Cla-Val vendor contact for Colorado is isi-West, telephone 970.535.0571.
- D. Pressure reducing valves, fittings, and other components shall be installed per the layout and details provided on the Drawings, unless otherwise approved by the Owner/Engineer.

2.2 PRE-FABRICATED VAULT

- A. The PRV vault shall be per a pre-fabricated vault complete with valves and piping as shown in the drawings, equal to Corix Water Systems pressure reducing valve vaults. Vendor contact is isi-West, 970.535.0571 or an Owner/Engineer approved equal.

2.3 OTHER VALVES

- A. Valves other than the previously specified pressure reducing valves shall be as specified in Section 15 01 10 Valves and Hydrants and as shown on the Drawings.

PART 3 – EXECUTION

3.1 CLEANING

- A. Carefully clean all valves, hydrants, fittings, and pipe of foreign material and inspect valves and hydrants in open and closed positions before installation.
- B. Prior to installation of all components, thoroughly clean flange faces, or threaded ends.

3.2 GENERAL INSTALLATION

- A. Install all items specified in conformance with manufacturer's recommendations.
- B. For threaded joints, apply Teflon joint tape.
- C. After cleaning flanges or mechanical fittings, insert the gasket and tighten the nuts progressively and uniformly.
- D. Piping, valves, and fittings shall be installed so that bolt holes of flanged or mechanical joints shall straddle the centerline of the pipe run.
- E. Vault shall be installed per Section 00 26 05 Concrete Manholes and Pre-cast Structures.

3.3 TESTING AND DISINFECTION

- A. Pressure-test and disinfect all valves, and accessories with adjacent piping per District standards.
- B. Test the operations of all valves under all operating conditions, while pipe is pressurized.
- C. Testing shall be witnessed by Owner's representative.

END OF SECTION

SECTION 33 31 11

GRAVITY SEWER PIPE

PART 1 – GENERAL

1.1 SCOPE OF WORK

- A. Furnish all labor, materials, equipment and incidentals required to install and test polyvinyl chloride (PVC) sewer pipe and fittings, complete as shown on approved construction drawings and as specified herein.
- B. Pipe or piping refers to all pipe, fittings, material, and appurtenances required to construct PVC sewer pipe complete, in place.

1.2 SUBMITTALS

- A. Submit the name of the pipe and fitting manufacturers and a list of materials to be furnished by each manufacturer.
- B. Construction drawings shall include piping layouts, pipe schedules, dimensioning, fittings, appurtenances, joint details, methods and location of supports, anchorage, gasket material, grade of material, and all other pertinent technical information for all items to be furnished.
- C. Pipe must clearly be labeled to the standard(s) specified herein.

1.3 REFERENCE STANDARDS

- A. American Society for Testing and Materials (ASTM)
 - 1. ASTM D1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
 - 2. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
 - 3. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and other Gravity-Flow Application.
 - 4. ASTM D3212 - Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
 - 5. ASTM D3034 - Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings

6. ASTM F679 - Standard Specification for Poly (Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings.
7. ASTM F794 - Standard Specification for Poly (Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter.

1.4 QUALITY ASSURANCE

- A. All PVC sewer pipe and fittings of a similar type (e.g. solid wall or profile wall) shall be from a single manufacturer. The supplier shall be responsible for the provisions of all test requirements specified in ASTM D3034 as applicable. The CONTRACTOR shall require the manufacturer's cooperation in these inspections.
- B. The District's Representative will inspect all pipe prior to placement. The pipe shall be subject to rejection due to failure to meet specification requirements, damage, or sun exposure. Pipe rejected after delivery shall be marked "reject" and shall be removed from the job at once.

1.5 SYSTEM DESCRIPTION

- A. The equipment and materials specified herein are intended to be of standard types for use in transporting sewage.
- B. Contractor is responsible for compatibility between pipe materials, fittings and appurtenances.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. All items shall be bundled or packaged in such a manner as to provide adequate protection of the ends during transportation to the site. Any pipe damaged in shipment shall be replaced as directed by the District's Representative.
- B. PVC items deteriorate in sunlight and can be brittle at lower temperatures, so care shall be taken in loading, transporting and unloading items to prevent injury to items. Handling and installation of pipe and fittings shall be in accordance with the manufacturer's instruction, referenced standards and as specified herein.
- C. Any pipe or fitting showing a crack or which has received a blow that may have caused an incident fracture, even though no such fracture can be seen, shall be marked as rejected and removed at once from the work.
- D. While stored, pipe shall be adequately supported from below at no more than 3-foot intervals to prevent deformation. The pipe shall be stored in stacks no higher than given in the following table:

Pipe Diameter (inches)	Max. No. of Rows Stacked
8 or less	5
12 to 21	4
24 to 30	3

- E. Pipe and fittings shall be stored to keep them at ambient outdoor temperatures and out of the sunlight. Temporary shading shall be provided as needed. Simple covering of the pipe and fittings allowing temperature buildup or direct or indirect sunlight will not be permitted.
- F. If any defective item is discovered after it has been installed, it shall be removed and replaced with an exact replacement items in a satisfactory manner by the Contractor, at the Contractor's own expense.
- G. In handling the items, use special devices and methods as required to achieve the results specified herein. No uncushioned devices shall be used in handling the piping and related materials.

PART 2 – PRODUCTS

2.1 POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS

- A. PVC solid wall gravity pipe and fittings shall be PVC SDR 35 with full diameter dimensions and shall conform to ASTM D3034, for sizes 4-inch through 15-inch and shall conform to ASTM F679 for sizes 18-inch through 27-inch. Straight pipe shall be furnished in lengths of not more than 13-feet.
- B. PVC pipe and fittings shall have bell and spigot push-on joints. The bell shall consist of an integral wall section with a solid cross-section elastomeric gasket securely locked in place to prevent displacement during assembly. Installation of elastomeric gasketed joints and performance of the joint shall conform to ASTM F477, ASTM D3139 or ASTM D3212.
- C. All fittings and accessories for sewers shall have bell and/or spigot configurations compatible with the pipe.

2.2 BACKFILL MATERIALS

- A. Bedding and backfill materials shall be per Section 31 23 33.
- B. Lean concrete, if applicable, shall be per Section 31 23 33.

PART 3 – EXECUTION

3.1 INSTALLATION OF PVC PIPE AND FITTINGS

- A. No single piece of pipe shall be laid unless it is straight. The centerline of the pipe shall not deviate from a straight line drawn between the centers of the openings at the ends of the pipe by more than 1/16-inches per foot of length. If a piece of pipe fails to meet this required check for straightness, it shall be rejected and removed from the site. Laying instructions of the manufacturer shall be explicitly followed.
- B. If any defective pipe is discovered after installation, it shall be removed and replaced with sound pipe in a satisfactory manner at the Contractor's cost. All pipe and fittings shall be thoroughly cleaned before installation and shall be kept clean when installed.
- C. Pipe shall conform to the lines and grades required and shall not be more than 1/4-inch out of grade or 1-inch out of alignment at any point.
- D. PVC pipe and fittings shall be installed in accordance with requirements of the manufacturer and ASTM D2321.
- E. As soon as the excavation is complete to normal grade of the bottom to the trench, bedding shall be placed, compacted, and graded to provide firm, uniform, and continuous support for the pipe per Section 02200. Bell holes shall be excavated so that only the barrel of the pipe bears upon the bedding. The pipe shall be laid accurately to the lines and grades indicated on the Drawings. Blocking under the pipe will not be permitted. Bedding shall be placed evenly on each side of the pipe to mid-diameter and hand tools shall be used to force the bedding under the haunches of the pipe and into the bell holes to give firm continuous support for the pipe. Bedding shall then be placed in 8-inch layers and completely compacted. Generally, the compaction shall be done evenly on each side of the pipe and compaction equipment shall not be operated directly over pipe until sufficient backfill has been placed to ensure that such compaction equipment will not have a damaging effect on the pipe. Equipment and methods used in compacting the initial 3-feet of backfill shall meet the approval of the pipe manufacturer.
- F. All pipe and fittings shall be kept clean until testing and completion. When installation is not in progress, the open ends of the pipe shall be closed by watertight plug or other approved means. Good alignment shall be preserved during installation. Deflection at joints is not allowed.
- G. When cutting pipe is required, the cutting shall be done by machine, leaving a smooth cut at right angles to the axis of the pipe. Cut ends of pipe to be used with a bell shall be beveled to conform to the manufacturer's spigot end.
- H. The District's Representative may examine each bell and spigot end to determine whether any preformed joint has been damaged prior to installa-

tion. Any pipe having defective joint surfaces shall be rejected, marked as such and immediately removed from the job site.

- I. Each length of the pipe shall have the assembly mark aligned with the pipe previously laid and held securely until enough backfill has been placed to hold the pipe in place. Joints shall not be “pulled” or “cramped.”
- J. Before any joint is made, the pipe shall be checked to assure that a closed joint with the next adjoining pipe has been maintained and that the inverts are matched to conform to the required grade. The pipe shall not be driven down to the grade by striking it.
- K. Precautions shall be taken to prevent flotation of the pipe in the trench.
- L. When moveable trench bracing such as trench boxes, moveable sheeting, shoring, or plates are used to support the sides of the trench, care shall be taken in placing and moving the boxes or supporting bracing to prevent movement of the pipe, or disturbance of the pipe bedding and backfill. As trench boxes, moveable sheeting, shoring or plates are moved, pipe bedding shall be placed to fill any voids created and the backfill shall be re-compacted to provide uniform side support for the pipe.
- M. Sewer lines shall be set at slopes equal to or greater than the minimum slope and equal to or less than the maximum slope per the table presented below. Any proposed deviations shall be submitted as a variance to the District representative and the Engineer for review and response.

Sewer Pipe Diameter (inches)	Minimum Slope (feet per hundred feet)	Max Slope (feet per hundred feet)
8	0.30	5.0
10	0.23	3.6
12	0.18	2.8
15	0.14	2.2
18	0.11	1.6

3.2 JOINTING PVC PIPE (Push-on type)

- A. Joints shall be made in strict accordance with manufacturer’s instructions. Pipe shall be laid with bell ends looking ahead. A rubber gasket shall be inserted in the groove of the bell end of the pipe and the joint surfaced cleaned and lubricated. The plain end of the pipe to be entered shall be then inserted in alignment with the bell of the pipe to which it is to be joined and pushed home with a come-along or by other means. Check that the reference mark on the spigot end is flush with the end of the bell.

3.3 JOINING POLYVINYL CHLORIDE (PVC) SEWER PIPE AND FITTINGS

- A. PVC sewer pipe and fitting shall be jointed in accordance with the recommendations of the latest ASTM Standards and detailed instructions of the manufacturer.
- B. All manhole connections shall be as specified in Section 03 41 00 including sealant such that a positive watertight seal is established between and pipe and the manhole.
- C. PVC fittings for manhole drops shall be installed as shown on the Drawings. Concrete for encasements shall be lean concrete mix per Section 31 23 33. No backfill shall be placed over this concrete within 16 hours of placing.

3.4 TESTING OF SEWERS

- A. Testing of pipe shall closely follow pipe laying. The CONTRACTOR shall have no more than 1000-ft of untested sewer constructed at any time.
- B. The CONTRACTOR shall test all sewer lines by an air test performed in strict accordance with the procedures described in ASTM C828.
 - 1. The air test equipment shall be specifically designed and manufactured for testing pipelines with low-pressure air and shall be provided with an air regulator valve or safety valve set to prevent the air pressure in the pipeline from exceeding 6 psig.
 - 2. Each section of sanitary sewer between two successive manholes shall be tested by plugging all pipe outlets with suitable test plugs. Air shall be slowly added until the internal pressure is raised to 4 psi. The internal pressure of 4 psi shall be maintained for at least 2 minutes to allow the air temperature to stabilize after which the air supply valve shall be closed. The time to drop from 4.0 psi to 3.0 psi shall be measured. Minimum allowable time is calculated from the following table:

Minimum Allowable Time for Loss of 1.0 PSIG

Pipe diameter	100 feet or less	150 feet	200 feet	250 feet	300 feet	350 feet	400 feet
Inches	min:sec	min:sec	min:sec	min:sec	min:sec	min:sec	min:sec
4	3:46	3:46	3:46	3:46	3:46	3:46	3:46
6	5:40	5:40	5:40	5:40	5:40	5:40	5:42
8	7:34	7:34	7:34	7:34	7:36	8:52	10:08
10	9:26	9:26	9:26	9:53	11:52	13:51	15:49
12	11:20	11:20	11:24	14:15	17:05	19:56	22:47
15	14:10	14:10	17:48	22:15	26:42	31:09	35:36
18	17:00	19:13	25:38	32:03	38:27	44:52	51:16
21	25:14	26:46	35:28	44:10	52:92	61:74	70:56

24	32.83	34.56	46.08	57.60	69.12	80.64	92.16
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For lengths of pipe between those shown on the table, use the higher value unless the District's Representative directs the Contractor otherwise.

3. An air pressure correction shall be used when the prevailing groundwater is above the sewer section being tested. Under this condition, the air test pressure shall be increased 0.433 psi for each foot the groundwater level is above the invert of the pipe. If the groundwater is more than 2 feet above the invert of the pipe, a visual infiltration test will be substituted to the District's satisfaction. Internal air pressure shall never exceed 5 psi for an air test.
4. If the allowable time is greater than allowed in the above equation, further inspection shall be conducted by T. V. inspection to determine where repairs are needed. The air testing shall be redone after repairs are made and this cycle competed until a satisfactory test is witnessed by the District's representative. All costs for testing, repairs, and retesting are the sole responsibility of the Contractor.

3.5 FINAL CLEANING

- A. At the conclusion of the work, thoroughly clean all pipelines by flushing with water or other means to remove all dirt, stones, pieces of wood, or other material entering the pipe during construction. Debris cleaned from the lines shall be removed from the low end of the pipeline and properly disposed of.
- B. After the pipelines are cleaned and if the groundwater level is above the pipe or following a heavy rain, the District's Representative will examine the pipes for leaks. If any defective pipes or joints are discovered, they shall be repaired by the Contractor and at the Contractor's expense if the inspection is completed within the one-year warrantee period.
- C. The Contractor will TV all completed sewer lines after all testing, flushing, and cleaning have been completed to the District's satisfaction.

END OF SECTION