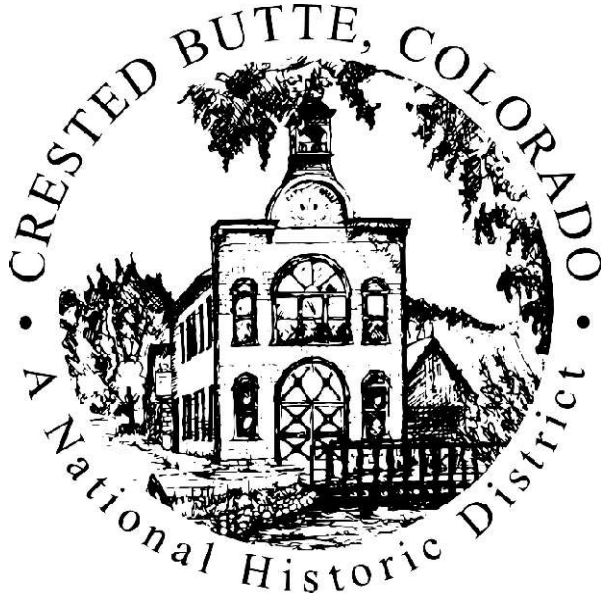

Criteria for Design and Construction

Public Works Department

Town of Crested Butte, Colorado

Updated August 2025

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FOREWORD

This is a living document, meant to be periodically reviewed, updated and made available to users as part of the Town of Crested Butte's responsibility to provide technical criteria and specifications for design and construction projects within Crested Butte. Contractors are encouraged to contact the Public Works Department for document interpretation and clarification.

The Public Works Department greatly values public and private input to this document. Regardless, deviation from these criteria cannot be made without prior written approval of the Public Works Director.

This document is effective upon issuance and can be found, free of charge, on the Town of Crested Butte website.

Authorized By:

Dara MacDonald
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Town of Crested Butte

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Town of Crested Butte

Original Issuance dated March 2009

Updated August 2025

SECTION 100

GENERAL SPECIFICATIONS AND DESIGN CRITERIA

I) SCOPE

These standards including material specifications and construction requirements are for all construction within Town right-of-way and in other areas under Town jurisdiction or ownership.

These specifications are the minimum requirements for materials and construction and may only be modified by written approval of the Town of Crested Butte.

The standards do not include all specifications for use on public works projects due to many specialized applications. They are intended to encompass construction typical to most residential projects.

Although this document and details have been prepared and reviewed by Professional Engineers and, as such, should be considered as applicable for most standard construction without further revisions, they are not intended to eliminate the need for the involvement of a Registered Professional Engineer on a specific project. The Registered Professional Engineer, when referencing the documents for a specific project is responsible for ensuring the specifications and drawings are appropriate for the specific use.

Not all possible requirements are included in the Standards. Should additional or revised requirements be desired, the items should be included under the Special Provisions and Special Technical Provisions in the Contract Documents for the project.

When reference is made to ASTM, AWWA, AASHTO, or other specifications or methods, it shall be understood to mean the latest edition or revision of said specification as amended and issued at the time of the Invitation to Bid.

II) DEFINITIONS AND ABBREVIATIONS

Wherever the following words, phrases or abbreviations appear in these specifications, they shall have the following meanings:

Town: The Town of Crested Butte, Colorado.

Town Code: The official adopted Town of Crested Butte Municipal Code of the Town of Crested Butte, Colorado.

Land Development Code: The official adopted Town of Crested Butte Land Development Code of the Town of Crested Butte, Colorado.

Engineer: The Town Engineer, Town of Crested Butte, Colorado, or an authorized representative on behalf of the Town.

Traffic Control Officer: An authorized representative acting on behalf of the Town of Crested Butte, Colorado.

Inspector: An authorized representative of the Engineer at the site of the work.

Utility: The Water, Sewer, Storm Sewer, Irrigation, and Electric Utilities Department of the Town of Crested Butte, Colorado and all other utilities.

Base Course: The upper course of the granular base of the pavement or the lower course of an asphalt concrete pavement structure.

Culvert: Any structure not classified as a bridge, which provides an opening under or adjacent to the roadway.

Pavement: Any surfacing of streets, alleys, sidewalks, courts, driveways or similar areas, consisting of mineral aggregate bound into a rigid or semi-rigid mass by a suitable binder such as, but not limited to, portland cement, or asphalt cement.

Pavement Structure: The combination of base course and surface course placed on a subgrade to support the traffic load and distribute to the roadbed.

Private Street: Any vehicular access serving residential properties whose average daily traffic volume exceeds sixty (60) trips a day.

Public Improvements: The term "public improvements" includes public facilities and shall refer to the construction or installation of streets, including curb and gutter, sidewalks,

development or extension of the municipal water system, municipal sanitary sewer system, municipal storm sewer system, municipal irrigation system and landscaping.

Right-of-Way: A general term denoting land, property or interest therein, usually in a strip, acquired for or devoted to a street, highway or other public improvement.

Road: A general term denoting an open way for purposes of vehicular and pedestrian travel.

Roadway: The improved portion of the right-of-way intended primarily for vehicular traffic.

Sanitary Sewer: Conduits and related appurtenances employed to collect and carry off wastewater to a suitable point of final discharge.

Shoulder: That portion of the roadway contiguous with the traveled way for accommodation of stopped vehicles, for emergency use, and for lateral support of base and surface courses.

Sidewalk: That portion of the street primarily constructed for the use of pedestrians.

Storm Sewer: Any conduit and appurtenance intended for the reception and transfer of storm water.

Street: The improved area of the right-of-way.

Structures: Bridges, culverts, catch basins, drop inlets, retaining walls, cribbing, manholes, end walls, buildings, sewers, service pipes, under drains, foundation drains, fences, swimming pools and other features which any be encountered in the work and not otherwise classed herein.

Subgrade: The supporting structures on which the pavement and its special under courses rest. Whenever the words, "as directed", "as required", "as permitted" or words of like meaning are used, it shall be understood that the direction, requirements or permission of the Engineer is intended. Similarly, the words "approved", "acceptable", "satisfactory" shall refer to approval by the Engineer. Whenever references are made to standard specifications, methods of testing materials, codes, practices and requirements, it shall be understood that the latest revision of said references shall govern unless a specific revision is stated.

Wherever any of the following abbreviations appear, they shall have the following meaning:

AASHTO - American Association of State Highway Transportation Officials
ASA - American Standards Association
ASTM - American Society for Testing and Materials
AWWA - American Water Works Association
APWA - American Public Works Association

CDOT - Colorado Department of Transportation
CDOT-SSCRB - Colorado Department of Transportation Standard Specifications for Construction of Roads & Bridges
NACE - National Association of Corrosion Engineers International, Inc.

III) RESPONSIBILITY OF THE TOWN

1) **Authority of the Engineer or Town Representative**

The Engineer/Town Representative shall have the authority on behalf of the Town to determine that all design and construction of facilities is equal to or better than the minimum requirements set forth in these specifications.

The Engineer/Town Representative shall have the additional authority to assign an inspector to observe any and all work, including all materials to be incorporated in the work, excavation, bedding, backfill, and all construction methods and practice.

Permits shall be issued subject to any other special requirements of conditions that the Town deems necessary in order to maintain the health, welfare, safety, and convenience of the public.

2) **Authority of the Inspector**

Inspectors are assigned to assist the Contractor in complying with these specifications. They have the authority to reject defective materials, or inferior materials and defective workmanship until such time as the Contractor shall correct the situation in question, subject to final decision by the Engineer.

IV) RESPONSIBILITY OF THE CONTRACTOR

1) **Application for Work in Town Right-of-way**

Any person seeking a right-of-way permit must submit an application on forms provided by the Town accompanied by an administrative fee in an amount prescribed by the Town. The Town Manager may specify the terms and conditions under which a right-of-way permit is to be issued so as to protect the best interests of the Town. All right-of-way permits granted under this Section shall be revocable by the Town with or without cause at any time.

Application for a right-of-way permit shall be made no later than five (5) working days prior to the planned commencement of the work. The Town Representative may allow the applicant to obtain a permit sooner than five (5) working days prior to the planned commencement of the work if the scope of the work is deemed to be de minimis. Emergency situations shall be exempt following communication and verbal approval from the Town Representative; however, a permit for such emergency work must be obtained as soon as is possible and no later than the next business day.

No permit for construction within any Town public right of way shall be issued until plans have been submitted to and approved by the Town.

2) **Notice Before Beginning Work**

The Contractor shall notify the Town Representative at least five (5) working days before beginning any construction.

Should there for any reason be a change in scope from the work described in the right-of-way permit, the Contractor shall immediately notify the Town.

If for any reason work should stop on a project during any stage of construction for a period of more than twenty-four (24) hours, it is the responsibility of the Contractor to notify the Town Representative at least forty-eight (48) hours prior to any resumption of work on the project.

If the Contractor intends to work extended shifts, double shifts, or hours other than the normal workday of Town personnel, he shall notify the Town Representative at least twenty-four (24) hours prior to such extension, except in the event of an emergency. Failure to provide notification may provide sufficient cause for suspension of the project.

3) **Termination of Project if Not Expeditiously Completed**

All work shall be commenced at the time specified on the permit and shall be diligently and continuously performed until completed, with a maximum allowable time as set forth in the permit. In the event that weather, process of law or any other unexpected obstacles cause work to be stopped for so long that public travel is unreasonably obstructed, the Town may order the encroachment removed or excavation refilled, compacted and repaved as if the work contemplated in the permit were actually completed.

4) **Traffic Control**

The Contractor shall be required to provide adequate construction signing, flagmen, barricades, etc., to warn vehicular and pedestrian traffic of work in progress and divert traffic as may be required during the course of construction.

All signing shall conform to the Manual of Uniform Traffic Control Devices and shall be subject to the approval of the Town Representative.

When specifically authorized by the Town Representative, portions of the streets shall be allowed to be closed to traffic for construction. However, the Contractor shall make every attempt to keep the time of closure to such streets to a minimum.

It shall be the responsibility of the Contractor to notify the Fire Department, Marshal's Office and Ambulance Service twenty-four (24) hours prior to the closure of any street.

For all work within State of Colorado highway rights-of-way the Contractor shall submit a traffic control plan to the CDOT Traffic Engineer for review.

5) **Emergency Access Required**

No construction shall be performed or excavation made in such manner so as to prohibit access by emergency vehicles to any building, structure or dwelling unit abutting the street or public rights-of-way. It shall be the responsibility of the permittee to notify the Town Manager when any construction or excavation obstructs the roadway from sunset to sunrise.

6) **Rejected Materials**

All materials installed shall be free of defects of manufacture. Any defective or damaged materials found in the construction or on the construction site shall be marked and removed from the site. In the event the Contractor fails to remove rejected materials from the construction site within a reasonable length of time, the Engineer may arrange for such removal at the expense of the Contractor.

7) **Familiarity of Specification**

It shall be the responsibility of the contractor to read and fully comply with all the provisions of these specifications and all laws and regulations that apply to local and state agencies.

8) **Compliance Required**

Any work performed that is not in strict conformity with this Article or damage caused to public property during such work shall, within three (3) days after notice to the permittee, be repaired made to conform to this Article at the expense of the permittee, or the same shall be corrected or removed by the Town at the expense of the permittee and the cost of such correction or removal may be assessed upon and made a lien upon the land so benefited. The Town shall have the right to make an assessment against the property and collect such costs in the same manner as general taxes are collected under state and local laws.

9) **Maintenance of Site**

The cleanup and restoration of grounds shall be a continuous process from the beginning of construction to final completion of the work. The Contractor shall keep the work site free from the accumulation of debris and waste material caused by the work.

Immediately after the construction activity or major portion thereof is complete, the area shall be cleaned and restored to the original grade and condition. All fences shall be replaced to the same elevation and alignment and restored to a condition equal to or better than that at the beginning of construction.

All backfill and any pavement or improvement shall be maintained in a satisfactory condition, and all places showing signs of settlement shall be filled and maintained for a period of twenty-four (24) months following the date of final acceptance. When the permittee is notified by the Town Manager that any backfill, patch or paved improvement is hazardous, it shall immediately correct such hazardous condition.

Backhoe equipment outriggers shall be fitted with rubber pads or other like protective material whenever outriggers are placed on any paved surface. Tracked vehicles that may damage pavement surfaces shall not be permitted on paved surfaces unless specific precautions are taken to protect the surface.

Any utilities or paved improvements damaged by settlement shall be immediately repaired by the permittee to the satisfaction of the Town Manager or their designee.

10) **Public Relations**

The Contractor shall carry on the work in such manner as to cause as little inconvenience as possible to the public, particularly to occupants of property along the project, as is consistent with good workmanship. He shall notify occupants at least twenty-four (24) hours in advance of proposed work that may block entrances or otherwise cause undue

difficulty to occupants of property affected and shall restore such entrances to usable condition as soon as possible. The Contractor, Subcontractors and employees shall at all times be courteous to the public while engaged upon this work.

The Contractor shall notify all business managers and residents affected by the interruption of utilities and other services caused by the work. Such notice shall be given at least twenty-four (24) hours prior to the interruption of service. Notice shall be given for the interruption of domestic water, irrigation water, sewer, trash pickup, mail delivery, and changes in access to property.

Notifications may be verbal or in written form if the business manager or resident cannot be located. The Contractor is responsible for posting notice cards for interruption of domestic water service only.

Where trees, hedges, shrubs, or other ornamental plantings or structures within the construction limits are not designated to be protected or saved, the Contractor shall notify the owner of the property fronting the plantings or structures in question, not less than ten (10) calendar days prior to their removal.

(a) The Contractor shall bid the project based on assuming responsibility for all removals.

(b) This notification shall include allowing the property owner an option to transplant the plantings or relocate structures fronting his property onto his property instead of having the Contractor remove them.

(c) This notification requirement is intended as a positive public relations action.

All notifications described and required in this section are considered as incidental to the Work and will not be measured or paid for separately.

11) **Utilities: Service, Locating, Protecting, and Relocating**

For all construction projects where Town utilities are made available for the Contractor's use, the Town may require the Contractor to pay for Town utility service used (potable water, sewer, etc.).

The Contractor is responsible for calling in all underground utility locates prior to construction.

Subsurface utility engineering ("SUE") plans are required whenever the requirements in Colorado SB 18-167 are met. SUE plans must meet at least a quality level B as defined in the American Society of Civil Engineers Standard Guidelines 38.

It is the responsibility of the Contractor to provide for the protection of all structures and utilities including pipes, fences, or similar items.

In the event of a break in an existing water main, gas main, sewer or underground cable, the Contractor shall immediately notify the responsible official of the organization operating the utility interrupted and shall lend all possible assistance in restoring services.

The Contractor shall be responsible for damage to any Town utility system resulting from construction operations. Any repair performed by the Contractor shall be inspected by the Town prior to backfilling.

The Contractor shall bear the entire expense of repairing or replacing any utilities or structures disturbed or damaged during construction.

Unless otherwise specified in the Contract Documents, all utility relocations will be the responsibility of the utility companies; the Contractor shall be responsible for coordinating the relocation work with the Utility Companies and shall bear any reasonable and customary cost associated with the work.

12) **Safety and Protection**

The Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the work. He shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury or loss to:

(a) All employees on the Work and other persons who may be affected thereby;

(b) All work and all materials or equipment to be incorporated therein in storage on or off site;

(c) Other property at the site or adjacent thereto, including trees, shrubs, lawns, walks, pavement, roadways, structures, and utilities not designated for removal, relocation or replacement in the course of construction.

The Contractor shall comply with all applicable laws, ordinances, rules, regulations, and orders of any public body having jurisdiction for the safety of persons or property or to protect them from damage, injury, or loss.

The Contractor shall erect and maintain, as required by the conditions and progress of the work, all necessary safeguards for safety and protection.

13) **Dust Control**

Contractor is responsible for dust control measures during excavation and saw cutting. Dust control measures shall occur as often as necessary as determined by the Town.

14) **As-Builts**

Upon completion of the work, the applicant shall furnish as-built drawings showing all utilities encountered during the excavation and construction, their size, identification and location, based on swing ties to fixed monuments such as manholes, streetlights, curbs and their depths below the surface of the street, alley or sidewalk area. As built drawings shall also identify any new improvements made to the area, including but not limited to utility connections, sidewalks, driveways, curb, gutter or other street improvement. As-built drawings shall be submitted in a digital format acceptable to the Town.

15) **Warranty**

All materials and workmanship employed in the performance of the work described in the right-of-way permit will be of such character and quality so as to ensure it to be free from all defects, in continuous good order and in a condition satisfactory to the Town for a period of two (2) years from the date of issuance of the final inspection log indicating one hundred percent (100%) satisfactory completion of the work and final acceptance thereof.

16) **Cost of Testing**

The contractor shall bear all costs of testing unless otherwise specified or agreed to in writing by the Town.

V) CRITERIA FOR DESIGN

1) **Streets**

Street Layout

A) Street layout shall be designed to conform to the standards described in Urban Street Design Guide published by the National Association of City Transportation Officials,

latest edition. When there are Conflicts between the standards set forth herein and the Urban Street Design Guide, the standards set forth herein shall prevail.

B) Street layout shall conform to the Master Street Plan in the Crested Butte Land Use Plan.

C) Construction of new streets shall conform to all relevant current CDOT Specifications.

2) **Water System**

General

A) All new construction of domestic water mains, valves, and fire hydrants must be designed by a Professional Engineer licensed in the State of Colorado and shall meet all Colorado state design and construction regulations.

B) Developer and/or property owner is responsible for all state compliance and associated fees with regards to new construction and/or repair and replacement of existing infrastructure. This includes, but is not limited to, site applications and/or amendments to existing site applications.

C) The Professional Engineer must provide the following information,

(1) Adequate fire flow and supply calculations using available flow data from nearest existing fire hydrants.

(2) Data that demonstrates the new construction design life.

D) Construction Drawings shall include pertinent project-specific notes to clarify or bring attention to construction requirements that effect the Town's water systems and those who work on these systems.

E) The following shall be provided to the Town for review and approval as applicable and/or for record purposes.

(1) One hard copy and one electronic copy of shop drawings

(2) One hard copy and one electronic copy of complete "as built" drawings, upon completion of the construction work.

(a) Water main and service "as-builts" shall include measurements of the distance between the new main and service taps, locations of water services, locations of valves, locations of fire hydrants, etc.

Water Main Extensions

A) Water main extensions shall be required to ensure that all lots of proposed subdivisions/developments within town limits will have access to water from the Town water system.

B) Water main extensions and fire hydrants shall be required to ensure that all lots are within 300 feet to the nearest hydrant based on frontline distance.

C) Valves should be provided on all main extensions to ensure that The Town has adequate capacity to isolate sections of main for maintenance or repairs with minimal impact to users.

D) Looped extensions with multiple taps/connections to existing water mains are preferred. Long, dead-end extensions are to be avoided were possible. If unavoidable, dead-end mains will require means for flushing. The Town may also require sampling ports on dead-end mains. This will be determined on a case-by-case basis.

Water Services

A) Single family and multi-family dwellings, containing 2 to 4 units, will generally require individual water services for each dwelling. This will be considered by the Town on a case-by-case basis.

B) Property owner shall be responsible for maintenance and repair of water service from water main to building/residence.

3) **Sanitary Sewer System**

General

A) All new construction of sanitary sewer mains, manholes, and lift stations must be designed by a Professional Engineer licensed in the State of Colorado and shall meet all Colorado state design and construction regulations.

B) Professional Engineer is responsible for all state compliance and associated fees with regards to new construction and/or repair and replacement of existing infrastructure. This includes, but is not limited to, site applications and/or amendments to existing site applications.

C) The Professional Engineer must provide the following information,

(1) Calculations relevant to the design flows at initial build and final build out. Including, but not limited to, peaking factors, per capita daily flows, commercial capacity allowances and inflow and infiltration allowances.

(2) Data that demonstrates the new construction design life.

D) Construction Drawings shall include pertinent project-specific notes to clarify or bring attention to construction requirements that effect the Town's sanitary sewer systems and those who work on these systems.

E) The following shall be provided to the Town for review and approval as applicable and/or for record purposes.

(1) One hard copy and one electronic copy of shop drawings

(2) One hard copy and one electronic copy of complete "as built" drawings, upon completion of the construction work.

(a) Sanitary sewer service "as-builts" shall include measurements of the distance between the new service tap and the upstream and downstream manholes, route of sewer service, location of clean outs, etc.

Lift Stations

A) Design calculations, signed by a Professional Engineer, must be submitted to the Town for review and shall contain the following computations: capacity at peak flow, system head, cycle time, buoyancy calculations, and storage volumes.

B) Lift Stations shall be sized based upon the anticipated upstream flow that will be realized in a 20-year period of development. The amount of development in a basin is judgmental and will be determined by the Town.

C) O&M Manual

(1) One hard copy and one electronic copy of the O & M manual. O & M manual must include,

(a) Detailed preventative maintenance schedules and procedures

(b) Generator information if applicable

(c) Electrical wiring diagram which depicts all breakers, relays, controls, switches, alarm system, etc.

D) All new lift stations must meet Colorado state regulations.

(1) The lift station shall be sized based upon the anticipated upstream flow that will be realized in a five (5) year period of development. The amount of development in a basin is subjective and will be determined by the Town.

(2) The lift station design shall include a concrete pad around the wet well hatch with a minimum diameter of ten (10) feet.

(3) Design shall include a convenience receptacle on its own circuit.

(4) The lift station shall operate using three (3) phase, four-hundred sixty (460) volt AC, four (4) wire power. Unless otherwise required by the Town.

(5) Check valves and isolation valves shall be located in valve boxes outside of the wet well.

(6) The area within a twenty (20) foot diameter of the lift station shall maintain a positive grade of six (6) inches per (10) feet away from the lift station hatch. The area within the twenty (20) foot diameter of the lift station, as well as along the access way to the lift station, must have at least twenty (20) feet of vertical clearance.

(7) All structures including the hatch shall be traffic-rated.

Gravity Sanitary Sewer Mains

A) The design shall include a manhole at any sanitary sewer main change in direction or grade or at a maximum of 500 feet from adjacent manholes.

Sanitary Sewer Service Laterals

A) Single family and multi-family dwellings, containing 2 to 4 units, will generally require a sewer service for each dwelling. This will be considered by the Town on a case-by-case basis.

B) Property owner shall be responsible for maintenance and repair of sewer service from sewer main or sewer manhole to building/residence.

4) **Stormwater & Erosion Control Permit and Plan**

General

A) For construction disturbing an area of one acre or more, a stormwater permit and plan must be obtained as required by the State of Colorado.

B) All new development within Town limits shall provide a narrative or Grading and Drainage Plan prepared by a Professional Engineer licensed in the State of Colorado and shall meet all Colorado state design and construction regulations. The narrative or plan should discuss or show how increased stormwater runoff resulting from added impervious areas will be mitigated.

C) The rate of direct runoff from any newly developed area shall not exceed the rate of runoff from the historic, native state for the one hundred (100) year run off event.

Drainage flows in excess of this amount shall be detained on-site or handled in a storm sewer system for any development disturbing an area of one acre or more.

D) All new construction of storm sewer mains, manholes, inlets, etc. within Town ROW must be designed by a Professional Engineer licensed in the State of Colorado and shall meet all Colorado state design and construction regulations.

E) Property owner is responsible for all state compliance and associated fees with regards to new construction and/or repair and replacement of existing infrastructure. This includes, but is not limited to, site applications and/or amendments to existing site applications.

F) The Professional Engineer must provide the following information,

(1) Calculations relevant to the design flows at initial build and final build out. Including, but not limited to, peaking run off for the twenty-five (25) and one hundred (100) year storm events along with accompanying supporting calculations.

G) Construction Drawings shall include pertinent project-specific notes to clarify or bring attention to construction requirements that effect the Town's storm sewer system and/or town Right-of-Way.

H) The following shall be provided to the Town for review and approval as applicable and/or for record purposes.

(1) One hard copy and one electronic copy of shop drawings

(2) One hard copy and one electronic copy of complete "as built" drawings, upon completion of the construction work.

(a) Storm sewer "as-builts" shall include measurements of the distance between the new upstream and downstream manholes, route of private storm sewer connection to town owned infrastructure, location of inlets, manholes, channels, chases etc.

Gravity Storm Mains

A) The design shall include a manhole or inlet structure at any storm sewer main change in direction or grade or at a maximum of 500 feet from adjacent manholes or inlet structures

Dry wells

A) Private dry well overflows shall be designed to tie into the town storm system. If no town storm system tie-in is available, the overflow should be directed to a daylight point on the subject property. If neither is available, drywells may daylight to a designed curb cut within town Right of Way. In no cases shall drywells be designed to overflow into a sanitary sewer system, neither town owned or private.

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SECTION 200

GENERAL EARTHWORK SPECIFICATIONS

I) SCOPE

The purpose of this General Earthwork Specification is to set forth the criteria to be used for all construction within the rights-of-way and in any other areas of jurisdiction or ownership of the Town of Crested Butte. Work shall include, but not be limited to, surface removals, excavation, dewatering, trench embankment, bedding, and backfill for all utilities, structures, and roads.

II) MATERIALS

1) **Fill Material**

A) On-Site: All on-site material suitable for STRUCTURAL BACKFILL shall be soil or soil-rock mixture which is free from frozen material, organic matter, and other deleterious substances. It shall contain no rocks over eight (8) inches in greatest dimension. It shall have less than twenty percent (20%) by weight passing the No. 200 sieve and a liquid limit not greater than 35.

B) Imported: Pit Run: Shall be well-graded eight (8) inch minus material. It shall have less than twenty percent (20%) by weight passing the No. 200 sieve and a liquid limit not greater than 35.

C) Other Materials: Other materials may be selected by the Contractor subject to the approval of the Engineer/Town Representative.

D) Granular Bedding Material: Granular bedding material shall be a well-graded, gravelly material meeting the requirements of ASTM D448, as follows: Class B bedding shall be the minimum acceptable bedding for all pipe. (See Table 2.1)

Bedding Material Table 2.1

Sieve Size	Mass Percent Passing Square Mesh Sieves		
	Class A	Class B	Class C
75 mm (3")	100		
37.5 mm (1½")		100	
19.0 mm (¾")	20-90		100
4.75 mm (No. 4)	0-20	20-60	60-100
1.18 µm (No. 16)		10-30	
300 µm (No. 50)		0-10	10-30
150 µm (No. 100)			0-10
75 µm (No. 200)	0-3	0-3	0-3

E) Subbase Course Aggregate: CDOT Class 2 Aggregate Base Course

F) Base Course Aggregate: CDOT Class 6 Aggregate Base Course

Aggregate Base Course Table 2.2

Sieve Size	Mass Percent Passing Square Mesh Sieves						
	LL not greater than 35			LL not greater than 30			
	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6	Class 7
150mm (6")			100				
100mm (4")		100					
75mm (3")		95-100					
60mm (2½")	100						
50mm (2")	95-100			100			
37.5mm (1.5")				90-100	100		
25mm (1")					95-100	100	100
19mm (3/4")				50-90		95-100	
4.75mm (#4)	30-65			30-50	30-70	30-65	
2.36mm (#8)						25-55	20-85
75 mm (#200)	3-15	3-15	20 max	3-12	3-15	3-12	5-15
NOTE: Class 3 material shall consist of bank or pit run material.							

G) Sand: GCEA requirement for electrical conduit installation

H) Controlled Low Strength Material (Flow-Fill):

Ingredients	Pounds/CY
Cement (1 sack)	60
Water (45 gallons)	375 (or as needed)
Fly Ash	60
Coarse Aggregate (Size No. 57)	1,213
Coarse Aggregate (Size No. 08)	344
Sand (ASTM C-33)	1,626
Air Content	4.00%

I) Stabilization Material:

Stabilization Material Table 2.3

Sieve Size	Mass Percent Passing Square Mesh Sieves
2 inch	95-100
1 inch	35-70
½ inch	10-30
Number 4	0-5

J) Geo-textile Fabrics:

(1) One of the following or equal:

(a) Ten Cate Geosynthetics, Mirafi 600X

(b) Town approved alternative

2) **Concrete**

A) Concrete Classification

(1) Mix design for concrete shall conform to Concrete Class D as specified in **Table 2.4**

Concrete Table 2.4

Concrete Class	Required Field Compressive Strength (psi)	Cementitious Material Content: Minimum or Range (lbs/yd^3)	Air Content: % Range (Total)	Water/Cementitious Material Ratio: Maximum or Range
B	4500 at 28 days	N/A	5 - 8	0.45
BZ	4000 at 28 days	610	N/A	0.45
D	4500 at 28 days	615 to 660	5 – 8	0.45
DT	4500 at 28 days	700	5 – 8	0.44
E	4500 at 28 days	520	4 – 8	0.44
G	4500 at 28 days	N/A	5 – 8	0.45
H	4500 at 56 days	500 to 640	5 – 8	0.42 - 0.44
HT	4500 at 56 days	500 to 640	5 – 8	0.42 - 0.44
P	4500 at 28 days	520	4 – 8	0.44
S35	5000 at 28 days	615 to 720	5 – 8	0.42
S40	5800 at 28 days	615 to 760	5 – 8	0.40
S50	7250 at 28 days	615 to 800	5 – 8	0.38
Shotcrete	4500 at 28 days	N/A	7-10 *	0.45
* Prior to pumping for wet process.				

(2) The Town reserves the right to modify the concrete mix design after review of the final mix design submitted by the Contractor if an acceptable alternate mix can meet the following general concrete mix design criteria:

(a) Compressive Strength: 4,000 psi minimum at 28 days

(i) Minimum No. of Passing Cylinders: 90%

(ii) Minimum Acceptable Cylinder Strength: 3,800 psi

(b) Cement Content: minimum 6 bags per cubic yard

(c) Maximum permissible water-cement ratio for 4000 psi strength, air entrained, absolute ratio by weight 0.45

(d) Slump: maximum 4-inch

(e) Air Content: 6% +/- 1% for all concrete

(f) Reinforcing Fiber Material: Town reserves the right to require contractor to add fiber to the mix design dependent on application

III) EXECUTION

1) **Dewatering**

A) A construction dewatering permit, as required by the State of Colorado, shall be obtained by the Contractor.

B) Dewatering of ground water on excavation site shall be done in such a manner as not to impact neighboring properties.

C) Dewatering on to the Town's right away or storm sewers must be pre-approved.

D) Dewatering shall be done in a manner as not to allow pollutants or silt to collect on Town right of ways, stream courses, or storm sewers.

E) Trenches shall be kept free of water during pipe laying operations by draining, pumping, or other approved methods. The water level shall be maintained below the trench bottom throughout the placement of bedding, pipe laying, joining, and backfilling operations. The dewatering shall be carried out so that it does not destroy or weaken the strength of the soil under or alongside the trench. Water shall be disposed of in a suitable manner without damage to adjacent property and without being a menace to public health and convenience.

F) Under no circumstances shall trench water be discharged into sanitary sewers.

G) The method of disposal of trench water shall be approved by the Engineer/Town Representative.

2) **Clearing, Grubbing, and Stripping**

A) Clearing **-** Excavation and grading for street improvements and paving projects shall include removal of trash, rubbish, and low-lying vegetation in the construction area. All vegetation and objects designated to remain shall be protected from injury or defacement.

B) Grubbing - All vegetation such as trees, stumps, hedges, shrubs, brush, heavy sod, heavy growth of grass, decayed vegetable matter, rubbish, and other unsuitable material within the area of excavation or upon which embankment is to be placed shall be stripped or otherwise removed to a minimum depth of three (3) inches.

(1) All such materials shall be wasted or spread outside the construction area or disposed of as directed by the Town Representative.

(2) In no case shall such objectionable material be allowed in or under embankment. Except in areas to be excavated, stump holes, and other holes from which obstructions are removed, shall be backfilled with suitable material and compacted in accordance with these specifications.

C) Stripping shall consist of removing unsuitable overburden material before removal of other materials for use in the roadway. All areas to be graded and all embankments or fill areas under paved slabs shall be stripped.

D) Noxious Weed Management. Contractors shall conform to the standards described by the Town of Crested Butte Noxious Weed Management Plan, as required by the Colorado Noxious Weed Act of 2008.

3) **Excavation**

A) After all clearing, grubbing, and stripping has been completed, excavation of every description and of whatever materials encountered within the grading limits of the project shall be performed. All suitable excavated materials shall be transported to and placed in embankments or fills within the limits of the work.

B) Variation from the subgrade plane shall not be more than one (1) inch of soil.

C) Excavation operations shall be conducted so that material outside of the limits of slopes will not be disturbed, but all cuts shall be made to subgrade a minimum of one (1) foot outside the proposed edge of paving slab or curb.

D) The Contractor shall not excavate beyond the dimensions and elevations established and material shall not be removed prior to the staking.

E) If excavation to the finished graded section encounters a subgrade or slopes of spongy material, vegetable matter, or trash pockets, the Town Representative may require the Contractor to remove the unsuitable materials and backfill to the finished graded section with suitable material.

(1) The Town Representative may designate as unsuitable those soils or materials that are in his judgement detrimental to the finished roadway. All unsuitable materials shall be disposed of outside the construction area.

F) Where the excavation is carried beyond or below the lines and grades staked or shown on the plans, the Contractor shall, at his own expense, refill and compact all such excavated space with suitable granular material.

G) If any excavation occurs under existing curb, gutter or sidewalk, that curb and gutter and sidewalk shall be removed and replaced. The replacement shall be from the nearest concrete joint. The curb, gutter and sidewalk must be replaced within seven (7) working days after the excavation is complete. The permittee may bore under curb, gutter and sidewalk and not have to replace the same to the extent approved by the Town Manager . All such work shall be performed in accordance with the Public Works Criteria for Design and Construction.

4) **Roadway Excavation and Grading**

A) This work shall consist of excavation, disposal, shaping, or compaction of all material encountered within the limits of the roadway in close conformity with the lines, grades, and typical cross sections shown on the plans or as directed by the Town Representative.

B) All cuts in asphalt shall be made in a neat manner by saw-cutting, rotomilling or other approved method which assures cuts with square edges and straight lines to the required depth of cut. Asphalt pavement cuts shall be such that no longitudinal joint lies within the wheel track. All cuts in concrete shall be sawed; and sidewalk, curb and gutter shall be removed to the nearest joint if, in the opinion of the Town Manager the portion otherwise remaining would be too small to function satisfactorily.

C) The excavation and embankments for roadway and ditches shall be finished to reasonably smooth and uniform surfaces.

D) Unauthorized Pavement Removal: Unless authorized by the Town Representative, all removed pavement and excavations made beyond the lines and grades shown on the Construction Drawings or described in the Specifications shall be replaced at the Contractor’s expense.

5) **Roadway Backfill and Paving**

A) Trenches within existing roadways are expected to be backfilled to the top of pavement entirely with controlled low strength material (flowfill).

(1) Contractor is expected to protect the excavation until flowfill has cured

B) Once cured and immediately prior to permanent paving, flowfill shall be excavated to four (4) inches below top of pavement or to the bottom of adjacent asphalt, whichever depth is greater.

C) Pavement patching;

(1) See Standard Drawings

(2) Sawcut and remove asphalt twelve (12) inches or far enough to encompass any cracked or damaged pavement from the edge of the trench. Leave subgrade undisturbed.

(3) Mill top lift (at least two (2) inches) of existing asphalt another twelve (12) inches from asphalt sawcut to create a shear step.

(4) Apply ample joint bond or tack coat at the shear step prior to pavement placement

(5) Joints shall be seal coated following pavement placement.

6) **Shouldering and Miscellaneous Work**

A) The Contractor shall deposit sufficient suitable earth between curb and sidewalks or property lines so that when smoothed and consolidated in final deposition, it will provide a uniform smooth slope no greater than 2% from top of curb to the adjacent sidewalk or property line. In case excavation is necessary to accomplish the above purpose, the Contractor shall make such necessary excavation and shall leave the area so filled or excavated free from all trash and debris.

B) The Contractor shall set all manholes, water boxes, or other service boxes, to the proper finished grade of the pavement or of the fill back of the curb. This work will be considered as part of the grading.

7) **Embankments**

A) Embankment construction shall consist of constructing roadway embankments, including preparation of the areas upon which they are to be placed; the construction of dikes; the placing and compacting of approved material within project areas where unsuitable material has been removed; and the placing and compacting of embankment material in holes, pits, and other depressions within the project area. Only approved materials shall be used in the construction of embankments and backfills as specified in Section II of this Section.

B) Free running water shall be drained from the material before the material is placed.

C) When an embankment is to be placed and compacted on hillsides, when new embankment is to be compacted against existing embankments, or when embankment is built one-half width at a time, the slopes that are steeper than 4:1 when measured longitudinally or at right angles to the roadway shall be continuously benched over those areas where it is required as the work is brought up in layers.

(1) Benching shall be well-keyed and, where practical, a minimum of eight (8) feet wide. Each horizontal cut shall begin at the intersection of the original ground and the vertical sides of the previous cuts.

(2) Material thus cut out shall be recompacted along with the new embankment material at the Contractor's expense.

D) Embankment material shall be placed in horizontal layers not to exceed eight (8) inches in loose depth and compacted prior to placing each following layer.

E) When pipe is to be installed in areas requiring fills or embankments, the embankment or fill shall be completed a minimum of one (1) foot above the top of pipe to be installed, prior to trenching and installation of the pipe.

F) The Contractor shall add moisture to, or dry by aeration, each layer as may be necessary to meet the requirements for compaction.

G) Moisture content range – material dependent

(1) Not more than 3% above optimum moisture content

(2) Not less than 5% below optimum moisture content

H) Under roadways and extending one (1) foot beyond proposed curb line as measured perpendicular from the centerline, embankments shall be compacted for the entire depth of the fill.

I) Compaction Requirements

(1) Top three (3) feet: Minimum of ninety five percent (95%) maximum density as defined by ASTM D698 / AASHTO T-99.

(2) Excluding top three (3) feet: Not less than ninety percent (90%) maximum density

8) **Trench Excavation**

A) Surface Removal and Topsoil Preservation

(1) The Contractor shall remove surface materials and obstructions only to the widths necessary for excavation of the trench. All fences, landscaping, and structures not designated for removal shall be protected or, if moved, restored to their original condition after construction is complete. Removal of concrete curbs, gutters, sidewalks, and driveways shall be along existing joints or neatly cut lines.

(2) Where excavation is required under paved areas, the pavement shall be cut in such a manner as to affect a smooth, straight-cut edge, and as a vertical face, six (6) inches minimum beyond the trench wall.

(3) Clean topsoil suitable for final grading shall be stripped, stockpiled separately in approved location, and restored to the surface after the trench is backfilled.

(a) Where excavation is in a lawn-covered area, the sod shall be cut, removed, and replaced after trench filling so as to promote regrowth. Where sod is disturbed, the Contractor shall re-sod with like grass at their own expense.

B) Stockpiling Excavated Material

(1) Excavated material shall be piled in locations that will not endanger the work, create traffic hazards, or obstruct sidewalks and driveways.

(2) Fire hydrants, valve boxes, manholes, and other utility access points shall be left unobstructed until the work is complete. Gutters and other water courses shall not be obstructed unless other provisions are made for runoff and street drainage.

(3) All surplus material and excavated material unsuitable for backfilling shall be removed from the site and disposed of in areas secured by the Contractor.

C) Trenching

(1) Trenches shall be excavated to the width necessary to permit the pipe to be laid and jointed properly and backfill materials placed and compacted as required.

(2) Where conduit is to be installed outside of existing pavement and pipes have an inside diameter of thirty-three (33) inches or less, the trench shall be excavated at pipe level a minimum of sixteen (16) inches wider than the outside diameter of the

pipe so that a clear space of not less than eight (8) inches is provided on each side of the pipe.

(3) For pipes having an inside diameter of thirty-six (36) inches or greater, the trench shall be excavated at pipe level a minimum of twenty-four (24) inches wider than the outside diameter of the pipe so that a clear space of not less than twelve (12) inches is provided on each side of the pipe.

(a) Wherever it is necessary to exceed these limits, approval of the Town Representative shall be obtained and provisions made for the additional load imposed on the pipe.

(b) When sheeting is used, the widths indicated above shall be measured to the inside dimension between the sheeting.

D) Bracing and Sheeting of Trenches

(1) All trenches shall be properly braced, sheeted, or otherwise supported to provide safe working conditions and protection of the work, workers, and adjacent property. Bracing and sheeting shall conform to the recommendations in the Occupational Safety and Health Administration (OSHA) Standards for Construction.

(2) A sand box or trench shield may be used in lieu of sheeting and bracing as permitted by OSHA. All trench support materials shall be removed in a manner that will prevent caving of the sides and movement or other damage to the pipe.

E) Trenches with Sloping Sides

(1) In traveled streets, alleys, or narrow easements, only vertical trenches with proper bracing will be allowed.

(2) Where working conditions and right-of-way width permit (as determined by the Town Representative), trenches may be excavated with sloping sides in accordance with OSHA requirements. Sloping sides will not be allowed when it requires excavation beyond the limits shown on the approved Construction Drawings.

(3) Where trenches with sloping sides are permitted, the slopes shall not extend below a point twelve (12) inches above the top of pipe. The trench shall be excavated with the vertical sides below this point with widths not exceeding those specified on the Standard Drawings.

F) Over-Excavating for Rock

(1) When bedrock, boulders, or loose/stony soil are encountered in the trench bottom so that there is the possibility of pipe being subjected to "point" contacts, the trench shall be over-excavated a minimum of six (6) inches. The over-excavated material shall be replaced with Town Representative-approved material and compacted.

(2) If blasting is required for rock excavation, all work with explosives shall conform to Federal and State Laws, and OSHA rules and regulations. Any damage caused by blasting shall be repaired by the Contractor at his expense.

G) Unstable Trench Bottom

(1) Where the excavation is found to consists of organic matter, or any other material that the Town Representative determines to be unsuitable for supporting the pipe, the trench shall be excavated to an additional depth as directed by the Engineer/Town Representative and replaced with an approved granular stabilization material.

(2) Suitable materials will be determined by the Town Representative.

H) Trench Bedding

(1) All trenches shall be excavated to at least four (4) inches below the pipe grade and backfilled to grade with approved granular bedding material.

(2) The bedding material shall be hand-shaped and graded until the trench bottom is uniform and free from rocks, bumps, and depressions.

(3) A coupling or bell hole shall be dug at each pipe joint with sufficient length, width, and depth to permit assembly of the joint and provide a minimum clearance of two (2) inches between the coupling and the trench bottom.

(4) If, in the opinion of the Town Representative, the pipe is subjected to unusual loading, Class A – Concrete Arch bedding may be required.

(a) The Contractor shall provide an analysis of the load conditions and the bedding required if directed by the Town Representative.

I) Backfilling Pipes and Structures

(1) During initial backfilling, the Contractor shall take all necessary precautions to prevent movement or distortion of the pipe or structure being backfilled.

(2) Pipe bedding material shall be placed and compacted in even lifts on both sides of the conduit to six (6) inches above the top of the pipe.

(3) Above the bedding material, earth backfill material shall be placed full-width in uniform layers not more than twelve (12) inches thick.

(4) Each layer shall be compacted to the required density with approved mechanical or hand tamping equipment.

(5) Unless otherwise specified or approved by the Town Representative, all backfill material shall be placed with moisture-density control in accordance with the typical trench detail shown on the Town's Standard Drawings.

(a) Moisture content range

(i) Two percent above (+2%) the optimum moisture content

(ii) Four percent below (-4%) the optimum moisture

(6) Jetting or water soaking trenches to achieve compaction of the backfill will not be permitted except when:

(a) Soil sample tests show that the backfill and excavated trench materials consist of gravel or other granular material having less than fifteen percent (15%) by weight passing on No. 200 sieve.

(b) The Town Representative has given written approval prior to water soaking.

(7) Concrete structures shall not be backfilled until the concrete and mortar therein has attained a minimum compressive strength of two thousand (2,000) psi, and can sufficiently support the loads imposed by the backfill.

(8) Select backfills shall be compacted to not less than ninety-five percent (95%) of the maximum dry density determined in accordance with ASTM D698 / AASHTO T-99.

J) Compacting Backfill Material

(1) Backfill material in trenches shall be compacted to at least ninety percent (90%) of maximum density up to the top three (3) feet of the trench under existing or proposed roads or structures. Maximum density shall be defined by ASTM D698 / AASHTO T-99.

(2) All approved backfill material shall be moisture-compacted to between two percent above (+2%) and four percent below (-4%) the optimum moisture content prior to its placement in the trench.

K) Backfilling with Flow-Fill

(1) Top three (3) feet of trench under existing or proposed roads shall be flowable fill as specified in Section 200.II.1.H

9) **Street Construction**

Streets shall be constructed by the subdivider to conform to the standards described in State Department of Highways, State of Colorado, Standard Specifications for Road and Bridge Construction, 2005, or latest revision. When there are conflicts between the standards set forth herein and State Department of Highways, Division of Highways, State of Colorado, Standard Specifications for Road and Bridge Construction, 1991, the Standards set forth herein shall prevail.

10) **Sidewalks**

The Town utilizes Standard Specifications for Roadway and Concrete Construction which are based upon CDOT Standard Specifications for Road and Bridge Construction, 2011 or latest revision.

11) **Restoration to Original Condition**

All construction work permitted in the public rights-of-way shall be performed such that such public rights-of-way, streets, alleys, stormwater conduits and structures, and all sidewalks, driveways, curbs, and gutters, and related street improvements are returned to the same condition or better, if required in the permit, as existed prior to the commencement of such work.

12) **When not feasible to construct sidewalk, curb, and gutter**

If the Town deems that the construction of improvements is inappropriate at the time of completion of the principal improvements due to existing conditions or future Town plans, the Building Inspector may issue a certificate of occupancy after the owner of the property has complied with one (1) of the following:

A) The owner shall have escrowed funds. This procedure shall be used only if it appears feasible that the improvements will be constructed within three (3) years. In the event that the improvements are not made within three (3) years, the escrowed funds shall be released, and the owner shall enter into an agreement as required in Subparagraph (b) of this Section.

B) If existing improvements or conditions make construction of sidewalk, curb and gutter within three (3) years unfeasible, the owner shall have entered into an agreement with the Town whereby he or she shall agree to construct or pay for the construction of said improvements when the Town deems their construction necessary and feasible. This agreement shall be a covenant running with the land.

IV) QUALITY CONTROL AND TESTING

1) **Embankments**

A) In-Place Density: One test for every six thousand (6,000) square feet per lift

2) **Trenches**

A) For every four hundred (400) lineal feet of trench and each branch or section of trench less than four hundred (400) feet in length, at least one compaction test shall be performed for each two (2) foot vertical lift of backfill material placed.

B) The first test shall be taken approximately two (2) feet above the top of pipe, and the last test shall be at the pavement subgrade or six (6) inches below the ground surface in unpaved areas.

C) Compaction tests shall be taken at random locations along the trench and wherever poor compaction is suspected. If any portion of the backfill placed fails to meet the minimum density specified, the area shall be defined by additional tests as necessary and the material in the designated area shall be removed and replaced to the required density at the Contractor's expense.

3) **Acceptance**

A) All compaction testing shall be performed by an independent soil testing laboratory acceptable to the Town.

B) It shall be the Contractor's responsibility to make necessary excavations to accommodate compaction tests or retests at all locations designated.

C) A summary report of all compaction tests shall be submitted to the office of the Engineer/Town Representative. The test results are required as a basis of acceptance of facilities by the Town.

SECTION 300

WATER DISTRIBUTION SYSTEM SPECIFICATIONS

I) SCOPE

A) General:

(1) The purpose of this Water Distribution System Specification is to set forth the criteria to be used for in the construction of water mains and service lines for approval and acceptance by the Town of Crested Butte. Work covered in this Section includes, but is not limited to

(2) All excavation and backfilling shall be performed in accordance with Section 200 – General Earthwork Specifications.

(3) All water mains shall be a minimum of six (6) inches in diameter.

II) MATERIALS

1) **Pipe Six (6) Inches and Larger**

A) Ductile Iron Pipe (DIP)

(1) DIP for water mains shall conform to AWWA C151, Class 52. DIP shall be cement-lined in accordance with AWWA C104.

B) Polyvinyl Chloride (PVC) Pipe

(1) Contractor may utilize C900 PVC pipe where approved and accepted by the Town of Crested Butte.

2) **Pipe Four (4) Inches and Smaller**

A) Service lines shall be constructed with high-density polyethylene (HDPE) pipe or copper pipe and conform to AWWA C901, or other if approved by the Town. Refer to Section 11 –Service Lines for further detail.

B) Ductile Iron Pipe (DIP)

(1) DIP for water mains shall conform to AWWA C151, Class 52. DIP shall be cement-lined in accordance with AWWA C104.

C) Polyvinyl Chloride (PVC) Pipe

(1) Contractor may utilize C900 PVC pipe where approved and accepted by the Town of Crested Butte.

3) **Joints**

A) All joints shall be of restrained type unless otherwise indicated

B) Mechanical and push-on joints

(1) Shall have a pressure rating no less than that of adjoining pipe

(2) Mechanical joints

(a) Less than 30-inches in diameter: Shall be in accordance with ANSI A21.11/AWWA C111

(3) Push-on joints

(a) Less than 24-inches in diameter: Shall be in accordance with ANSI A21.11/AWWA C111

(b) Gaskets shall be neoprene or other synthetic rubber (SBR). Natural rubber is not acceptable.

(4) Lubricant: Heavy vegetable soap non-toxic solution suitable for potable water contact

C) Threaded connections

(1) ANSI B1.20.3 NPT: Provide boss or tapping saddle at all tapped connections

D) Mechanical joint restraint device

(1) 360° serration lock engagement type

(2) Nuts and bolts torqued to requirements of manufacturer

(3) Working pressure rated at 150 psi minimum

(4) 24-inch and below:

(a) EBBA Iron Inc., Meg-a-Lug Series 1100

(b) Uni-Flange Corporation, 1400 Series

(c) Or accepted substitution

E) Restrained push-on joints

(1) 30-inch and below:

(a) American Flex-Ring

(b) Griffin Snap-Lok

(c) U.S. Pipe TR-Flex

(d) Or accepted substitution

F) Restrained mechanical joints

(1) 30-inch and below:

(a) Griffin Bolt-Lok

(b) American MJ Coupled Joint

(c) Or accepted substitution

G) Restrained mechanical joints at fittings

(1) EBAA Iron Inc., Megalug Series 1100

(2) Uni-Flange Corporation (Ford Meter Box), 1400 Series

(3) Or accepted substitution

H) Bolts and nuts: Corrosion-resistant bolts and nuts for use with ductile iron joints shall be high strength, low alloy steel as specified in ANSI/AWWA C111/ANSI A21.11

(1) Cor-Ten

(2) Usalloy

(3) Durabolt

(4) Or accepted substitution

I) Gaskets shall be neoprene or other synthetic rubber (SBR). Natural rubber is not acceptable.

4) **Couplings**

A) Mechanical Couplings:

(1) Dresser Style 38

(2) Rockwell 411

(3) Romac Industries 501

(4) Smith Blair 461

(5) Or accepted substitution

B) Insulated Mechanical Couplings:

(1) Dresser Style 39

(2) Romac Industries IC501

(3) Or accepted substitution

C) Transition Couplings:

(1) Rockwell 415

(2) Dresser Style 39

(3) Romac Industries TC400

(4) Smith Blair 413

(5) Or accepted substitution

D) Glands color coded: Black

5) **Fittings**

A) Ductile iron full body fittings

(1) ANSI A21.10/AWWA C110, ASTM A536

(2) 24-inch and below: 350 psi rating, mechanical joint

B) Ductile iron compact fittings

(1) ANSI A21.53/AWWA C153

(2) 24-inch and below: 350 psi rating, mechanical joint

C) Fittings shall have a pressure rating no less than that of adjoining pipe

D) Fittings for pipe with mechanical or push-on joints shall have mechanical joints in accordance with ANSI A21.11/AWWA C111

E) Comply with requirements for restrained fittings as indicated on Drawings

F) Tapping Sleeve and Tapping Valve:

(1) Complete assembly, including tapping sleeve, tapping valve, and bolts and nuts. Use sleeve and valve compatible with tapping machine

(2) Tapping Sleeve: Cast-iron or ductile-iron 2-piece bolted sleeve with flanged outlet for new branch connection. Sleeve may have mechanical joint ends with rubber gaskets or sealing rings in sleeve body. Use sleeves that mate with size and type of pipe material being tapped. Outlet flange shall be of a size required for branch connection

G) Provide all specials, taps, flanges, plugs and wall fittings as required

H) Provide openings for air valve, drain, sampling, testing, sensing and all other connections with threaded bosses sized and located as indicated and specified

(1) Threaded connections

(a) Shall be in accordance with ANSI B2.1.NPT: provide boss or tapping saddle at all tapped connections

6) **Bonding Straps**

A) Bonding straps shall be deoxidized copper conforming to ASTM-B 152-58 D.H.P., a minimum of 1-1/4 inch wide by 1/8 inch thick and of sufficient length to attach to each pipe.

B) Bonding may be accomplished using Cad Weld method for DIP with a minimum wire requirement of No. 4 BSD Copper.

7) **Valves and Valve Boxes**

A) Valve boxes shall be provided for each valve.

B) All valves shall open counterclockwise (open left).

C) Valve boxes shall be 2- or 3-piece, buffalo-type, with extension as required.

D) Shafts shall be not less than six (6) inches in diameter and will be capped with a standard flush-type lid weighing not less than ten (10) pounds and marked “WATER”.

E) Valves twelve (12) inches and larger shall be provided with a bonnet.

F) All valves shall be equipped with a non-rising stem and standard two (2) inch square wrench nut.

G) Stems shall provide "o" ring dirt seal and pressure seal packing.

H) Gate Valves

(1) Gate valves shall be in accordance with AWWA C509, equal to the class of pipe being used, with mechanical joint ends.

I) Butterfly Valves

(1) Butterfly valves shall be Town approved and shall conform to AWWA C504.

8) **Fire Hydrants**

A) Fire hydrants shall be in accordance with AWWA C502.

B) Guardian Model K81A as manufactured by ITT Kennedy Valve.

C) Adjustable grade device (as required by Town): Gradelok or approved equivalent.

9) **Encasements**

A) Concrete used for encasements shall have a minimum compressive strength of two thousand five hundred (2,500) psi in twenty-eight (28) days.

10) **Appurtenances**

A) Joints: Larger than two-inch shall conform to Section 3 – Joints. Joints two inch and smaller shall be compression.

B) Fittings two inch and smaller shall be compression.

11) **Service Lines**

A) Service lines shall be a minimum of one (1) inch in diameter.

12) **Corporation Stops**

A) Size: 1-inch to 2-inch

B) Style: ball-style

C) Rating: three hundred (300) psi

13) **Curb Valves/Stops**

A) All curb valves/stops shall be one (1) inch to two (2) inch ball-style curb valves/stops.

14) **Curb Boxes**

A) AY McDonald Curb Box

B) Mueller Extension Type

C) Or similar substitution

15) **Service Saddles**

A) Must be rated for working pressure no less than 200 psi

16) **Tracer Wire**

A) No. 12 insulated copper wire

(1) Insulated coating color should match corresponding utility per industry standards

(2) Pro-Trace HF-CCS or similar product

B) Termination/Access Point

(1) Grade level/in-ground access box

(a) Private Property

(i) SnakePit LD14B2T-SW or approved equivalent

(b) Roadway

(i) SnakePit RB14B2T-SW or approved equivalent

III) EXECUTION

1) **Depth**

A) Pipe shall be installed a minimum of seven (7) feet from top of pipe to proposed final grade.

B) If installation of the pipe 7 feet below grade is unfeasible by either obstruction or other unforeseen cause, Contractor shall install insulation above or around the new pipe.

2) **General**

A) No pipe shall be laid when, in the opinion of the Town or their representative, trench conditions are unsuitable.

B) All pipe and fittings shall be carefully lowered into the trench by means of a hoist, ropes, or other suitable tools or equipment in such a manner as to prevent damage to the materials, protective coatings, and linings.

C) Under no circumstances shall water main materials be dropped or dumped into the trench.

D) All pipe and fittings shall be carefully examined for cracks or other defects immediately before installation in final position.

E) Every precaution shall be taken to prevent foreign material from entering the pipe while it is being installed.

F) During laying operations, no debris, tools, clothing, or other material shall be placed in the pipe.

G) At times when pipe laying is not in progress, the open ends of the pipe shall be closed by a watertight plug or other means approved by the Town. If water is in the trench, the plug shall remain in place until the trench is pumped completely dry.

H) As each length of pipe is placed in the trench, the spigot end shall be centered in the bell and the pipe forced on and brought to correct line and grade.

I) Where pipe is laid on a grade of ten percent (10%) or greater, the laying shall start at the bottom and shall proceed upward with the bell ends of the pipe up grade.

J) The cutting of pipe for inserting valves, fittings, or closure pieces shall be done in a neat and workmanlike manner without damage to the pipe and so as to leave a smooth end at right angles to the axis of the pipe.

K) Wedging or blocking of the bell or pipe is not permitted for achieving slope before backfilling.

3) **Joints**

A) Connect piping in accordance with manufacturer's recommendations

B) All plugs, tees, valves, bends, and hydrants or a change in direction of ten (10) degrees or more shall be mechanically restrained to provide 100% thrust protection. Traditional thrust blocks shall not be installed unless approved by the Town.

C) Restrained Joint Pipe

(1) Pipe shall be restrained in each direction from a plug, tee, bend, hydrant, or change of ten (10) degrees or more shall be mechanically restrained to provide 100% thrust protection.

(2) The length of pipe restrained shall be determined by the manufacturer or as shown in Standard Drawings unless a design is provided by a Registered Professional Engineer and approved by the Town.

D) Restrained Push-on joints

(1) Lay pipe with bell ends facing the direction of laying except when Engineer authorizes reverse laying

(2) Assembly of PVC plain end into bell: follow PVC pipe manufacturer's recommendation

(3) For PVC pipe, Contractor to ensure that pipe is not inserted into the bell ends beyond the push line

(4) Utilize EBAA Mega-Stop bell protection, or approved substitution, if necessary, to ensure previously laid pipe joints are not impacted by ongoing installation

(5) Lubricate joint surfaces immediately before completing the joint

(6) Bevel spigot ends of field cut piping

(7) Groove spigot ends of field cut restrained joint piping if required by joint system

(8) Install restrained joints following manufacturer's recommendations

E) Mechanical joints with restraint device

(1) Before assembling joint, clean both bell and plain end of rust and foreign matter

(2) Assemble joint following AWWA C111, C600, C605 and as specified

(3) Lubricate gasket and install in accordance with manufacturer's instructions

(4) If an effective seal is not obtained, disassemble joint, clean thoroughly, and reassemble

(5) Do not overtighten bolts to compensate for poor installation

(6) Carefully align holes in mechanical joints with restraint device to permit installation of the harness bolts

(7) Install mechanical joint pieces so the mechanical joint holes straddle the top centerline for horizontal piping, or the side centerline for vertical piping

4) **Bonding Strap**

A) For ductile iron pipe installation, a bonding strap shall be installed across each joint to provide metal to metal continuity. Bonding straps shall be attached at each end by means of magnesium weld or other approved method.

5) **Valves**

A) Valves shall have the interior cleaned of all foreign matter before installation.

B) Valves shall be inspected in the open and closed positions to ensure that all parts are in working condition.

C) Valves shall be set and joined to pipe/fittings in the manner specified for cleaning, laying, and joining pipe and fittings.

6) **Valve Boxes**

A) Valve boxes shall be centered and plumb over the wrench nut of the valve with the box cover flush with the level of the finished grade or such level as may be directed by the Town.

B) Upon completion of backfill around the valve box, a standard 4 x 4-inch timber shall be placed vertically next to each valve box, the exposed portion of which shall be at least found (4) feet above finished grade.

7) **Fire Hydrants**

A) Fire hydrants shall be installed 3 to 6 inches above finished grade elevation. A class 150 valve shall be required with each hydrant, and both shall be installed at the location designated by the Town.

B) Hydrant drainage

(1) Pervious soil – Provided at the base of the hydrant by placing coarse gravel or crushed stone from the bottom of the trench to at least six (6) inches above the water openings (weep holes) in the hydrant and to a distance of one (1) foot around the elbow.

(2) Clay or other impervious soils – Provided by a drainage pit two (2) feet in diameter and three (3) feet deep excavated below the hydrant and filled compactly with coarse gravel or crushed stone under and around the elbow of the hydrant and to a level of six (6) inches above the water openings (weep holes).

8) **Warning Ribbon**

A) All utility installations must have warning ribbon placed in the trench, eighteen (18) inches above the utility. The color of the tape shall conform to APWA standards.

9) **Tracer Wire**

A) Tracer wire shall be installed along all pipe, main and service, and across all fittings and appurtenances.

B) Tape wire on each side of fittings and at ten (10) foot maximum spacing on center along the top of pipe.

C) Tracer wire shall be terminated or provide a test station at the following: the end of each pipe run, long runs of pipe two thousand five hundred (2,500) feet or greater, within manholes, at valve boxes not in roadways, and fire hydrants.

(1) Include a minimum of two (2) feet of excess/slack ware at all termination/access points

(2) Tracer wire shall not be terminated within a valve box with access to a valve actuator.

(3) When terminating tracer wire anywhere beside manholes, tracer wire shall be terminated at designated termination stations

(4) When terminating tracer wire in manholes, secure wire to the inside of the manhole in such a fashion that makes it accessible to an operator without entering the manhole.

D) Splice connections shall be fastened in such a way that continuity is ensured, the connection is secured, no uninsulated wire is exposed, and corrosion is mitigated.

(1) At tees use a single three-way direct bury wire connector

10) **Encasements**

A) Prior to placing the concrete for cradles or encasements, temporary supports consisting of concrete blocks or bricks shall be used to support the pipe in place.

B) Not more than two (2) supports shall be used for each pipe length, one adjacent to the shoulder of the bell and the other near the spigot end.

C) No encasements shall be poured until the Town has inspected and approved the pipe and supports to be encased.

11) **Water Taps and Services**

A) Water taps and services shall be a minimum of seven (7) feet from top of pipe to proposed finish grade.

B) All service lines shall be installed with insulated pipe foam from the water main to the water meter if obstruction or other circumstance does not allow for a 7 foot bury.

C) Curb Valves shall be installed within five (5) feet of the edge of property on the property owner's side.

D) A bonding strap shall be installed on all DIP.

E) Installation of service lines and taps on the water main shall be installed to the property line at the time of water main construction.

F) For all service taps, follow manufacturer recommendations for minimum water main size for direct tapping.

G) The main shall be tapped at twenty-two (22) degrees from the horizontal centerline of the pipe, and the stop must be turned so that the T-handle will be on the side.

H) All non-HDPE water service lines shall be installed with a frost loop. See the Standard Drawings in the Appendix

I) All service lines shall have coated solid locating wire attached and accessible at the ground surface. See the Standard Drawings.

J) Any water service line installation that crosses an irrigation ditch requires the installation of culvert pipe in the irrigation ditch. Installation and materials shall be approved by the Town.

K) 18 inch minimum spacing between any joint, fitting, appurtenance, or adjacent service line.

L) Hot Tapping:

(1) Hot tapping is permitted on a case-by-case basis upon Town Approval

(2) Hot tapping is strictly prohibited on Cast Iron mains

M) Fire Service Lines:

(1) Buildings requiring fire service shall use only one tap on the main for both fire and domestic water services

(2) Install a tee in the service at the property line to separate domestic water and fire service

(3) Install a curb stop valve on both the domestic and fire service lines on the owner's property within five (5) feet of the property line

12) **Curb Boxes and Pre-Taps**

A) Curb boxes and valve stems shall be located within five (5) feet of the property line on the property owner's side

B) Should curb valves be placed within a drive path or parking area, the curb valve stem shall be placed within a valve can with an appropriately labeled valve can lid.

C) Upon completion of backfill around the valve box, a standard 4 x 4 inch timber shall be placed vertically next to each valve box, the exposed portion of which shall be at least found (4) feet above finished grade.

D) Pre-Taps shall be tested and disinfected with the main per Section 300.IV

13) **Relationships between Water System Piping and Sanitary Sewer System Piping**

A) "Lines" shall mean all water or sewer lines including mains, laterals, and service lines.

B) When water and sewer lines are within ten (10) feet horizontally of each other and the sewer line is above or less than eighteen (18) inches below the water line, the portion of the sewer line within that area shall:

(1) Be constructed of approved waterline pipe and joints (PVC C900);

OR

(2) Be constructed of SDR 35 PVC sewer pipe with all joints and pipe within ten (10) feet of the water line encased in concrete that is a minimum of six (6) inches thick centered on the crossing pipe.

C) In all cases, suitable backfill or other structural protection shall be provided to preclude the settling or failure of both pipes.

D) Crossings of sewer and water lines shall not be at an angle less than forty-five (45) degrees, unless approved by the Town.

E) See the Standard Drawings for this section.

IV) QUALITY CONTROL AND TESTING

The Contractor shall furnish all labor, equipment, tools, water, and other incidental items required to conduct the tests. Test results are not considered valid without the presence or sign-off of the Town Representative throughout the test.

1) **Water Main Pressure Testing**

A) Water mains shall be tested for pressure and leakage in accordance with these Specifications and AWWA C600.

B) Pressure test shall be conducted and approved prior to connection to the Town's water distribution system. Pavement or other permanent structures shall not be placed until all testing are satisfactorily completed.

C) Test Pressure

(1) The test pressure for all pipes shall be fifty percent (50%) more than the maximum operating pressure, as determined by the Town, at the lowest elevation of the test section, but shall be a minimum of one-hundred fifty (150) psi at any elevation in the test section.

D) Filling

(1) The pipeline shall be filled with potable water at least twenty-four (24) hours before being subjected to the hydrostatic pressure test. Each section of pipeline shall be filled slowly and all air expelled by means of taps at points of highest elevation.

E) Leakage

(1) The specified test pressure shall be applied by means of a pump connected to the pipe in a manner satisfactory to the Town. The leakage test shall be performed for a minimum of two (2) hours. No pipe installation will be accepted if the leakage for the section of line being tested is more than the rate calculated using a standard formula.

$$L = \frac{ND\sqrt{P}}{7{,}400}$$

where:

L = testing allowance, gallons per hour
N = number of joints in the tested line
D = nominal pipe diameter, inches
P = average test pressure, psi

Table 2620-1 Hydrostatic Testing Allowance per 1000 ft. of Pipeline (gph)

Avg. Test Pressure (psi)	Nominal Pipe Diameter (in.)												
	3	4	6	8	10	12	14	16	18	20	24	30	36
450	0.48	0.64	0.96	1.27	1.59	1.91	2.23	2.55	2.87	3.19	3.82	4.78	5.73
400	0.45	0.60	0.90	1.20	1.50	1.80	2.10	2.40	2.70	3.00	3.60	4.50	5.41
350	0.42	0.56	0.84	1.12	1.40	1.69	1.97	2.25	2.53	2.81	3.37	4.21	5.06
300	0.39	0.52	0.78	1.04	1.30	1.56	1.82	2.08	2.34	2.60	3.12	3.90	4.68
275	0.37	0.50	0.75	1.00	1.24	1.49	1.74	1.99	2.24	2.49	2.99	3.73	4.48
250	0.36	0.47	0.71	0.95	1.19	1.42	1.66	1.90	2.14	2.37	2.85	3.56	4.27
225	0.34	0.45	0.68	0.90	1.13	1.35	1.58	1.80	2.03	2.25	2.70	3.38	4.05
200	0.32	0.42	0.64	0.85	1.06	1.27	1.49	1.70	1.91	2.12	2.55	3.19	3.82
175	0.30	0.40	0.60	0.79	0.99	1.19	1.39	1.59	1.79	1.99	2.38	2.98	3.58
150	0.28	0.37	0.55	0.74	0.92	1.10	1.29	1.47	1.66	1.84	2.21	2.76	3.31
125	0.25	0.34	0.50	0.67	0.84	1.01	1.18	1.34	1.51	1.68	2.01	2.52	3.02
100	0.23	0.30	0.45	0.60	0.75	0.90	1.05	1.20	1.35	1.50	1.80	2.25	2.70

(2) Leakage is defined as the quantity of water to be supplied to the section of pipeline being tested, which is necessary to maintain the specified leakage test pressure after the pipe has been filled with water and the air expelled.

2) **Water Main Disinfection**

A) After completion of pressure testing and prior to connection to the Town distribution system and being placed into service, all new water mains and extensions of existing mains shall be chlorinated by the Contractor with strict supervision of the Town or a Town authorized third party in accordance with AWWA C601.

(1) No contractor shall operate any working valve within the existing Town water system

B) Preliminary Flushing

(1) Sections of pipe to be disinfected shall first be flushed with potable water between 2 and 3 pipe volumes

(2) If a hydrant was not installed at the end of the main, then a two and one-half (2-1/2) inch tap shall be installed to flush the line.

C) Form of Applied Chlorine

(1) Chlorine shall be applied in liquid form described in AWWA C601, subject to approval by the Town.

(2) Initial chlorine concentration shall be at least fifty (50) mg/L at the beginning of the disinfection process

D) Point of Application

(1) The prepared point of application of the chlorinating agent is at the beginning of the pipeline extension or any isolated section of it, and through a corporation stop inserted in the pipe.

(2) The water injector for delivering the chlorinated water into the pipe shall be supplied from a tap made on the pressure side of the gate valve controlling the flow into the pipeline extension.

(3) Alternate points of application may be used when approved or directed by the Town.

E) Chlorinating Valves and Hydrants

(1) In the process of chlorinating newly laid pipe, all valves and other appurtenances shall be operated while the pipeline is filled with the chlorinating agent and under normal operating pressure.

F) Retention Period

(1) Treated water shall be retained in the pipe for at least twenty-four (24) hours.

(2) After the retention period, the chlorine residual at pipe extremities and at other representative points shall be at least twenty-five (25) mg/L.

G) Neutralization

(1) All chlorinated water shall be neutralized to a chlorine residual of no greater than one (1.0) ppm before discharge to the Town storm sewer system as approved or directed by the Town.

(2) Water shall never be discharged to the Town sanitary sewer system without approval of the Town Public Works Director and the Town Wastewater Division Manager.

H) Testing

(1) After neutralization and flushing, and before the water main is placed in service, samples for bacteriologic tests (Bac-T) shall be collected by the Town in accordance with AWWA C601.

(2) Contractors shall be responsible for delivering test samples to a certified laboratory and obtaining a certified test report.

I) Connection

(1) Following successful testing, and with Town approval, connection to the water main will be permitted.

(2) Connection to the main must be in the presence of a Town representative.

J) Final Flushing

(1) Once connected, the Town will oversee the Final flush through the new pipe.

3) **Continuity Testing or Line Tracing**

Prior to backfill or immediately following the first lift of backfill, contractors are expected to contact the Town to conduct continuity testing or line tracing. Final approval shall not be granted until either test has been conducted.

4) **Trench Backfill Compaction Testing:**

A) Testing shall be performed according to Section 200 – General Earthwork Specifications, IV. Testing.

SECTION 400

SANITARY SEWER SYSTEM SPECIFICATIONS

I) SCOPE

A) General:

(1) The purpose of this Sanitary Sewer System Specification is to set forth the criteria to be used for in the construction of sewer mains, services, manholes, and lift stations for approval and acceptance by the Town of Crested Butte.

(2) All excavation and backfilling shall be performed in accordance with *Section 200 – General Earthwork Specifications*. All sanitary sewer system designs shall follow the conditions provided within this section and *Section 100.V - Criteria For Design*.

(3) All sanitary sewer mains shall be a minimum of eight (8) inches in diameter unless otherwise approved by Town.

(4) All material shall conform to appropriate ASTM designation. The Town may reject any material showing defects.

(5) All new construction of sewer mains, manholes, and lift stations must be designed by a Professional Engineer licensed in the State of Colorado. Design shall include but not limited to, construction design life, peaking factors, per capita daily flow, commercial capacity allowances and inflow and infiltration allowances.

II) MATERIALS

1) **Pipe**

A) Sanitary Sewer Main (Gravity)

(1) SDR 35 Pipe

(2) Polyvinyl Chloride (PVC) C900

(a) Contractor may utilize C900 PVC pipe where approved and accepted by the Town of Crested Butte.

(b) Internal diameter needs to be specified and specification of fitting sizes to fit thickness.

(3) Town approved pipe alternative

(4) Fittings

(a) All fittings shall be gasketed.

(b) Strongback-Style fitting may be used upon approval by Town.

(c) Push-on type plastic or PVC fittings without sanitary sweeps WILL NOT be permitted.

(d) Sanitary sewer mains shall be a minimum of eight (8) inches in diameter unless otherwise approved by Town.

B) Sanitary Sewer Main (Pressurized)

(1) Ductile Iron Pipe (DIP)

(a) DIP for wastewater mains shall conform to AWWA C151, Class 52. DIP shall be cement-lined in accordance with AWWA C104.

(b) DIP without cathodic protection systems shall be installed with polyethylene encasement.

(c) 316 stainless steel nuts and bolts shall be used on all joints and fittings

(d) Fittings

(i) Fittings shall be ductile-iron conforming to AWWA C152, Class 350, and mechanical joints conforming to AWWA C111 with appropriate gaskets for the connected pipe.

(2) Air Release Valves and Mechanical Components

(a) Designed specially for sewage applications and all interior mechanical components shall be fabricated of stainless steel.

(b) Valves with plastic components are not acceptable

(3) Isolation Valves including Pressure Main Cleanouts

(a) Viton-gasketed stainless steel pressure blank covers, and or approved equal.

C) Sanitary Sewer Service Line (Gravity)

(1) SDR 35 Pipe

(2) Polyvinyl Chloride (PVC) C900

(a) Contractor may utilize C900 PVC pipe where approved and accepted by the Town of Crested Butte.

(3) Sanitary sewer services shall be a minimum of four (4) inches in diameter unless otherwise approved by Town.

(4) Fittings

(a) All fittings shall be gasketed or glued.

(b) Rubber coupling (Fernco) style fitting may be used upon approval by Town.

(c) Push-on type plastic or PVC fittings without sanitary sweeps WILL NOT be permitted.

(5) Service Taps

(a) Gasketed saddle Y's or T's with stainless-steel reinforcement.

(b) Gasketed Y's or T's for new construction.

D) Sanitary Sewer Service Line (Pressurized)

(1) Ductile Iron Pipe (DIP)

(a) DIP for wastewater service lines shall conform to AWWA C151, Class 52. DIP shall be cement-lined in accordance with AWWA C104.

(b) 316 stainless steel nuts and bolts

(c) Fittings

(i) Fittings shall be ductile-iron conforming to AWWA C152, Class 350, and mechanical joints conforming to AWWA C111 with appropriate gaskets for the connected pipe

2) **Manholes**

A) Manholes shall be precast. Details of manholes shall clearly indicate a properly formed channelized base and shall indicate proper watertight grouting of all pipe penetrations and precast sections. Cast-in-place reinforced concrete manholes may be used upon approval by Town.

(1) Manholes shall be cylindrical in shape with a minimum diameter of 48 inches.

B) All pipe penetrations require rubber boots with stainless bands. Non-shrink grout shall be required to seal all penetrations on the interior.

C) Manholes shall have a protective interior coating

(1) Calcium aluminate or other approved product.

D) Manhole sections shall be constructed together utilizing Butyl style joint sealer.

E) Bituminous Damp-proofing Exterior Coating required upon Town request.

F) Manhole lids shall be constructed of cast iron steel, 24" in diameter, and identified with "sanitary sewer"

3) **Lift Stations**

A) Materials:

(1) The lift station shall be equipped with backup power in the form of an onsite generator.

(2) All equipment shall be guaranteed by the manufacturer for a period of at least one (1) year from the date of final inspection

(3) Wet well shall have a protective interior coating to be approved by the Town. One hundred percent (100%) calcium aluminate is recommended.

B) Documentation and Training:

(1) One hard copy and one electronic copy of the O&M Manuals shall be provided to the Town. O&M Manuals shall include generator information, if applicable.

(2) One hard-copy and one electronic-copy of approved site application and any additional CDPHE approvals.

(3) A copy of the lift station's electrical wiring diagram, which depicts all breakers, relays, controls, switches, etc., shall be included in the final O&M Manual. A laminated copy of this diagram shall be posted at the lift station.

(4) Detailed preventative maintenance schedules and procedures shall also be included in the O&M Manual.

C) Mechanical Equipment:

(1) Mechanical equipment located in a wet well shall be explosion proof.

(2) A hour meter shall be provided for each pump.

(3) Any horizontal well coverings shall open full, one-hundred eighty (180) degrees, and be equipped with a device to prevent accidental closure.

(4) The air release/vacuum relief required on force main shall be equipped with fittings to allow for back flushing.

(5) The lift station shall have an emergency bypass hose connection assembly installed on the pressure main exiting the lift station to allow for lift station bypass with a portable pump or force main bypass. This hose connection assembly shall be equipped with a plug valve in the closed position and a four (4) inch or six (6) inch quick-coupling-type cam-lock connectors (female) with protective cam-lock plugs (male).

(6) 316 Stainless-steel shall be used for all hardware within the wet well.

(7) The force main shall have a minimum inner diameter of four (4) inches.

(8) Isolation valves shall be plug-type.

(9) Pump type and manufacturer to be approved by the Town.

(10) Sewer force main shall be marked with detectable warning tape to identify the pipe as a sewer force main in order to prevent accidental water service taps.

(11) Any special tools required for such work as operation, calibration, adjustment, or service maintenance shall be provided to the Town and listed in the O&M Manual.

(12) Pumps shall be removable without entering the wet well

D) Electrical Equipment:

(1) Control system brand, type, and configuration shall be approved by the Town.

(2) Control circuitry shall be configured so that failure of any single component does not disable both pumps.

(3) Control boxes shall be designed to operate in negative forty (-40) to one hundred (100) degrees F ambient temperature.

(4) Wet well shall be equipped with a pressure transducer level indicator or radar level indicator, and shall have a backup float switch.

(5) Control boxes shall meet NEMA standards.

(6) The lift station shall be equipped with a red alarm light to indicate a high-level condition. This light shall be visible from the nearest road.

(7) The lift station shall be capable of indicating pump motor seal failure and overheat conditions with a yellow or red light visible from the nearest road.

(8) Lift Station controls and alarming shall be integrated into the Town SCADA network. Coordination with Town's Integration Contractor is required.

(9) No electrical splices or junction boxes are allowed within a wet well.

E) Generators:

(1) The generator shall self-test at least once per week by running under load for a minimum time recommended by the manufacturer.

(2) The generator shall be housed in a weather-proof enclosure. Quiet site soundproofing shall be provided to reduce noise to seventy (70) dB at a distance of seven (7) meters. Housing shall include a critical grade exhaust muffler. The generator shall be mounted so that all doors can open ninety (90) degrees. Equipment shall be permanently fastened to the pad in accordance with the manufacturer's instructions.

(3) The entire standby generator set shall be warrantied for a period of five (5) years from the date of commissioning. The generator must be able to start when the ambient temperature is as low as negative forty (-40) degrees F.

(4) Generator set shall be supplied with all auxiliary systems necessary for operation (e.g. batteries, battery charger, block heater, etc.).

(5) Generator set shall operate at a voltage of four-hundred sixty (460) volts AC, three (3) phase, four (4) wire, sixty (60) Hz.

(6) The standby power system shall include an automatic transfer switch.

(7) Generator set shall have fuel storage capacity for at least twenty-four (24) hours.

4) **Tracer Wire**

A) Provide tracer wire for all PVC and HDPE pipe

B) All tracer wire shall be 10 AWG solid copper wire coated with 45 mil Type HMW – PE green insulation compliant with ASTM D1351 specifically designed for direct burial in corrosive soil or water

C) UL listed

5) **Tracer Wire Test Station**

A) Four (4) inch with locking lid

B) Manufacturers:

(1) CP Test Services

(2) Glenn Series "Glenn-4"

(3) Or accepted substitution

III) EXECUTION

1) **Depth**

A) Pipe shall be installed a minimum of six (6) feet from top of pipe to proposed grade.

B) Manholes shall be located so that they are not in drainage areas.

C) All sewer mains must be located within Town right-of-way.

2) **Sewers**

A) The design shall include a manhole at any sewer main change in direction or grade or at a maximum of five hundred (500) feet from the adjacent manholes.

B) A manhole is required at the commencement of a sewer main.

C) A stub out in a manhole may be required if deemed necessary for future expansion.

3) **General**

A) No pipe shall be laid when, in the opinion of the Town or their representative, trench conditions are unstable.

B) All pipe and fittings shall be carefully lowered into the trench by means of a hoist, ropes, or other suitable tools or equipment in such a manner as to prevent damage to the materials, protective coatings and linings.

C) A horizontal clearance of at least ten (10) feet shall be provided between water lines and sewer lines. At crossings, maintain a minimum of eighteen (18) inches vertical separation between the bottom of the water line and the top of the sewer line. See Section 300, III.13. for further requirements. Any instance where this is not possible will require approval by the Director of Public Works.

D) Trees shall not be planted closer than twenty (20) feet, and shrubs/hedges not closer than five (5) feet, from a new or existing sewer line. Also, in the event that excavation for future repairs to the underground utility lines become necessary, the Town will not fund for removal, relocation, disposal, or replacement of any affected planting.

E) All sewer lines shall be identified with buried warning and identification tape.

F) Since PVC is not resistant to ultraviolet light, the Contractor is required to properly protect PVC pipe staged at the job site.

G) Structures (including, but not limited to, buildings, backflow preventers, transformer pads, mechanical equipment, and anchor walls) shall not be built over new or existing sewer lines. As a general rule-of-thumb, consider a 1:1 depth-to-width sewer line elevation clearance. For structures that can transmit live loads to the foundation (e.g. flag poles, utility poles, etc.), a structural or soils engineer should establish the appropriate horizontal setback distance. In no instance shall any structure be located closer than three (3) feet from any sewer line.

H) Under no circumstances shall sanitary sewer lines materials be dropped or dumped into the trench.

I) All pipe and fittings shall be carefully examined for cracks or other defects immediately before installation in final position.

J) Every precaution shall be taken to prevent foreign material from entering the pipe while it is being installed.

K) During laying operations, no debris, tools, clothing, or other material shall be placed in the pipe.

L) Pipe shall be laid upgrade from structure to structure, with bell end upgrade unless otherwise directed or permitted by the Engineer.

M) As each length of pipe is placed in the trench, the spigot end shall be centered in the bell and the pipe forced on and brought to correct line and grade.

N) The cutting of pipe for inserting valves, fittings, or closure pieces shall be done in a neat and workmanlike manner without damage to the pipe and so as to leave a smooth end at right angles to the axis of the pipe.

O) Wedging or blocking of the bell or pipe is not permitted for achieving slope before backfilling.

4) **Warning Ribbon**

A) All utility installations must have warning ribbon placed in the trench, eighteen (18) inches above the utility. The color of the tape shall conform to APWA standards.

5) **Tracer Wire**

A) Tracer wire shall be installed along all pipe, main and service, and across all fittings and appurtenances.

B) Tape wire on each side of fittings and at ten (10) foot maximum spacing on center along the top of pipe.

C) Tracer wire shall be terminated or provide a test station at the following: the end of each pipe run, long runs of pipe two thousand five hundred (2,500) feet or greater, within manholes, at valve boxes not in roadways, and fire hydrants.

(1) Include a minimum of two (2) feet of excess/slack wire at all termination/access points

(2) Tracer wire shall not be terminated within a valve box with access to a valve actuator.

(3) When terminating tracer wire anywhere beside manholes, tracer wire shall be terminated at designated termination stations

(4) When terminating tracer wire in manholes, secure wire to the inside of the manhole in such a fashion that makes it accessible to an operator without entering the manhole.

D) Splice connections shall be fastened in such a way that continuity is ensured, the connection is secured, no uninsulated wire is exposed, and corrosion is mitigated.

(1) At tees use a single three-way direct bury wire connector

6) **Air Release Valves**

A) Appropriate air release provisions shall be installed at all high points in the pressure main where air can accumulate.

7) **Force Main Cleanouts**

A) Installed such that the cleanout flange face is parallel to the finish grade, twelve (12) inches below grade and within a manhole structure.

8) **Manholes**

A) Manholes and valve structures shall be located in roadway areas or in serviceable vehicle corridors. This is to ensure that maintenance vehicles are not forced to drive

over grassed lawns or landscaped areas. Adequate clearance between the edge of a building (wall and roof line) and other structures should be provided to enable repair of the lines by use of heavy equipment.

B) All influent pipe connections to manholes shall be made at the properly channelized invert of the manhole, whether it is a direct connection or a drop connection. "Waterfall" type connections are substandard and will not be permitted.

C) Drop manholes are to be avoided to the extent practicable.

(1) See Standard Drawings for drop manhole detail.

D) All pipe penetrations shall be made perpendicular to the circumference of the manhole – angled deflections at existing flow channels shall not be permitted.

E) Manhole frames shall be firmly (structurally) affixed to the top of the manhole cone and grouted around the ring of the frame. Standard sized frames and covers shall be specified as depicted in approved standard details.

F) Manholes shall not be situated in sump depressions or drainage swales where rainfall or snow melt runoff can accumulate. The designer should carefully check finish grades to ensure that this situation does not occur. The intent is to minimize direct inflow for all new manhole installations.

G) Changes in direction of flow through the manhole shall be made with a smooth, curved channel having as large a radius as possible. The change in size of channels shall be made gradually and evenly and shall be formed directly in the concrete. The floor of the manhole outside of the channel shall be finished to a smooth surface and shall slope to the channel. The minimum thickness of the base shall not be less than eight (8) inches under the invert of the manhole channel.

H) If a cast-in-place manhole is deemed necessary by the Town, the foundation shall be laid and carried up approximately to the center of the pipe. After the manhole is built, the upper half of the pipe shall be cut out and the bottom finished.

I) Pipe shall not extend more than one inch inside the manhole wall.

J) Sewer pipe connection to existing manholes where there is no existing pipe stubbed out shall be made in such a manner that the finished work will conform as nearly as practicable to the essential requirements specified for new manholes. The contractor shall core as small an opening in the existing manhole as necessary to insert the new sewer pipe. The existing concrete foundation bench shall be shaped to the cross-section of the new pipe in order to form a smooth continuous invert.

Cement grout shall be used as necessary to smoothly finish the new invert and to seal the new line so the junction is watertight.

K) No service laterals shall be tied into any manhole without Town approval.

9) **Service Lines**

A) A Contractor must get approval before tapping a sewer main by means of the Town Right-of-Way Permit.

B) Before tapping, the Contractor must have identified the material of the main and have the proper saddle.

C) Holes for saddle connections shall be made by mechanical hole cutters and shall be the full diameter of the service line. Holes shall be deburred and carefully beveled to provide a smooth hole shaped to conform to the fitting. Service connections shall be made in the top quarter (¼) of the main.

D) The Contractor shall provide the Town with measurements of the distance between the new service tap and the upstream and downstream manholes.

E) For all building sewers, including housing units, a sanitary cleanout shall be installed within five (5) feet from the building line. Additional building sewer cleanouts shall be installed at intervals not to exceed one-hundred (100) feet in straight runs and at each horizontal change in direction in a sewer service lateral

F) No service shall feed directly to a Town owned or maintained lift station.

10) **Lift Stations**

A) No services may be connected to the influent line to the lift station until final approval.

IV) QUALITY CONTROL AND TESTING

1) **General**

A) All pressure and leakage testing shall be performed by the Contractor under direct control of the Town or an approved representative.

B) No testing shall occur without a representative from the Town present.

C) All new sewer mains including those with pre-taps shall be air tested.

(1) In the event that service taps are pre-tapped, all testing and inspection shall be performed after the last pre-tap has been made.

D) All new manholes shall be hydraulically or vacuum tested.

E) All new sewer mains shall be deflection tested. Maximum deflection for pipe joints shall be limited to eighty percent (80%) of the deflection recommended by the manufacturer.

F) The final testing and approval will only occur after backfilling and compaction. The Contractor may request that a preliminary test be performed prior to backfilling.

G) On contracts that involve the construction of new sewer mains (manhole-to-manhole), the replacement of sewer main pipe with new sewer pipe (manhole-to-manhole), or for projects where subsequent heavy grade compaction is performed after the laying of sewer collection mains, the Contractor shall provide a video inspection of the interior of the constructed sewer main. The video shall include a progressive video recording of the main section using standard pipeline video equipment. The equipment used to video-document the interior of the main shall either be equipped with an inclinometer indicator that portrays the slope of the main on the video recording, or the video shall be recorded with partial flow in the main (or with a fully wetted invert) such that an assessment can be made of the trueness of grade (workmanship). The video shall also clearly depict all pipe joint sections and service taps along the entire length of pipe in a continuous recording sequence.

H) The Contractor shall provide a five (5) day window for inspection and testing to occur.

I) A visual inspection by the Town is required before any sewer line or manhole is covered.

J) The Town may require secondary testing if further construction is performed on the line or adjacent lines that is judged to have weakened the integrity of the tested line.

K) Trench backfill compaction testing shall be performed according to Section 200 – General Earthwork Specifications – IV. Testing.

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SECTION 500

STORM DRAINAGE SYSTEM SPECIFICATIONS

I) SCOPE

The purpose of the Storm Drainage System Specification is to set forth the criteria to be used in the construction of storm drainage mains, manholes, inlets, and culverts for approval and acceptance by the Town of Crested Butte. Construction of new storm drains shall conform to all relevant current CDOT M & S details specifications.

All requests for information on the Town's storm drainage system shall be made via the Streets Division. The Town makes no representation that released documents and files (e.g. record drawings, maps, reports, studies, etc.), hard copy or otherwise, or the information they contain, are accurate, current, or complete.

II) MATERIALS

1) **Pipe Materials**

A) General: Provide pipes and fittings of one of the following materials, of weight/class indicated. Provide pipe fittings and accessories of same material and weight/class as pipes, with joining method as indicated

B) Reinforced Concrete Pipe: ASTM C76,

(1) 12-inch RCP Class V, with modified tongue-and-groove compression gasket joints complying with ASTM C443.

(2) 15-inch RCP Class IV (Class V when specified on plans), with modified tongue-and-groove compression gasket joints complying with ASTM C443.

(3) 18-inch thru 24-inch RCP Class III (Class IV or V when specified on plans), with modified tongue-and-groove compression gasket joints complying with ASTM C443.

(4) 24-inch thru 36-inch RCP Class II (Class III, IV or V when specified on plans), with modified tongue-and-groove compression gasket joints complying with ASTM C443.

C) Polypropylene Pipe:

(1) Smooth interior, corrugated exterior piping conforming to ASTM D 3212, AASHTO specifications M330, ASTM F2881

(a) ADS HD Storm Dual Wall Pipe

(b) Town Approved Alternative

D) HDPE Sewer Pipe:

(1) Smooth interior, corrugated exterior piping conforming to ASTM D 2412, ASTM D 3212, AASHTO specifications M252 and M 294, joints to conform to ASTM F 477.

(a) ADS N-12 Dual Wall Pipe

(b) Town Approved Alternative

2) **Other Materials**

A) Plugs and Caps: Use pipe plugs or caps provided by the pipe manufacturer and approved by the Town for pipe stub outs.

B) Cleanouts: Provide as indicated, pipe extension to grade with ferrule and countersink cleanout plug. Provide round cast-iron access frame over cleanout, with heavy duty secured scoriated cover with lifting device cast with the word "STORM".

C) Reinforcement

(1) Reinforcing Steel: ASTM A615 Grade 60

(2) Welded Wire Fabric: ASTM A185

D) Concrete:

(1) Minimum compressive strength: 4500 psi at 28 days

(2) Cement: ASTM C150, Portland Cement, Type II

(3) Aggregates: ASTM C33, free of deleterious substances

(4) Reinforcing Fiber Mesh

E) Gaskets: ASTM C923

(1) Mastic: FS SS-S-210A, "RAM-NEK" or accepted substitution

(2) Rubber: Neoprene, 40± 5 hardness when measured by ASTM D2240, Type A durometer

F) Inlet Gratings and Manhole Rings and Covers

(1) Cast iron, heavy duty traffic type, ASTM A48, Class 35B. Grind bearing surfaces to ensure flat, true surfaces

(2) Provide bike/pedestrian-safe grates where such traffic is anticipated

(3) Set grate on frame such that openings maximize inlet intake

(4) Covers to seat at all points on ring

(5) Covers to be cast with "STORM" in 2" tall flush letters

(6) Manhole covers to receive asphalt varnish coating hot dip applied at foundry, 6 mils thick

G) Manhole Height Adjustment: Use precast concrete grade rings

H) Rock Subbase: 1-1/2 inch minus, well-graded angular gravel over compacted subgrade

I) Water: Clean and free of deleterious substances

J) Grout:

(1) Non-Shrink, Non-Metallic Grout: Factory premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents, capable of developing minimum compressive strength of 4000 psi in one day and 8000 psi in 7 days

(2) Epoxy Grout: Three Component Epoxy Resin System

(i) Two liquid epoxy components

(ii) One inert aggregate filtered component

(iii) Each component furnished in separate package for mixing at job site

3) **Concrete Catch Basins and Manholes**

A) Precast Concrete Units:

(1) Manufacturers: Valley Precast, Oldcastle Infrastructure, Forterra, Amcor Precast, or accepted equal

(2) Specification: ASTM C478 and C789, wall “B”

(3) Minimum wall thickness: greater of 6 inch 1/12 of internal diameter

(4) Reinforced

(5) Grade rings as required

(6) Cast rungs into units.

B) Precast Units or Cast-in-place as shown. Use concrete that will attain a 28-day compressive strength of not less than 4,000 psi with a cement content of not less than 6 sacks per cu. yd. Openings to be precast per plan or sawcut in field.

C) Manhole Steps: Steel bar, 1/2 inch Grade 60, drop-front type, with polypropylene coating applied by manufacturer,

(1) Type MA Industries, Inc. "PS2-PF" or approved equal

4) **Concrete Fabrication**

A) Vault/Manhole Sections

(1) Precast concrete dimensions will vary based on application.

(2) Minimum manhole inside diam: 48 inches

(3) Precast lid and Cones: Same or greater reinforcement and wall thickness as vault or manhole section with capability for H20 loading

(4) Vault Joints: Shiplap or tongue and groove with double mastic gaskets, each joint to set equally and tightly

(5) Manhole Joints: Keylock type with double mastic gaskets, each joint to set equally and tightly

(6) Access opening: Minimum 24 clear or as indicated

(7) Pipe connections and knockouts: As indicated on Drawings

(8) Precast concrete base is standard, cast-in-place to be allowed with Town approval on a case-by-case basis.

(9) Manhole rungs: 12 inches on center, vertical alignment above largest bench or open area

B) Grating and Metal Frame: As specified on drawings

5) **Soil Materials**

A) Furnish pipe bedding and cover as specified in Section 200.1.

B) Riprap Materials:

(1) Hard, dense, durable stone, angular in shape and resistant to weathering

(2) Minimum specific gravity of 2.5

(3) Material may be approved by Town, if by visual inspection, the rock is determined to be sound and durable

(4) Town may require Contractor to furnish laboratory test results if the material appears to be marginal or unacceptable

(5) Tested material shall meet the following requirements for abrasion resistance or compressive strength:

Test	Test Method	Requirement
Abrasion Resistance by Los Angeles Machine	**ASTM C 535**	**50% loss, max**
Unconfined Compressive Strength of Drilled Core Specimen	**AASHTO T 24**	**2500, min**

(6) Contractor shall provide a five-ton sample of riprap indicating the compliance to required material soundness and gradation specifications if requested by the Town.

(7) Gradation:

Riprap Designation	% Smaller Than Given Size By Weight	Intermediate Rock Dimension (Inches)	Mean Particle Size,d50 (Inches)
Type L	70-100 50-70 35-50 2-10	15 12 9 3	9
Type M	70-100 50-70 35-50 2-10	21 18 12 4	12
Type H	70-100 50-70 35-50 2-10	30 24 18 18 6	18

C) Bedding:

(1) Minimum 6 inches deep, unless specified otherwise

D) Drainage Fabric: Nonwoven geotextile, specifically manufactured as a drainage geotextile; made from polyolefins, polyesters, or polyamides; and with the following minimum properties determined according to ASTM D 4759 and referenced standard test methods:

(1) Grab Tensile Strength: 110 lbf (490 N); ASTM D 4632.

(2) Tear Strength: 40 lbf (178 N); ASTM D 4533.

(3) Puncture Resistance: 50 lbf (222 N); ASTM D 4833.

(4) Water Flow Rate: 150 gpm per sq. ft. (100 L/s per sq. m); ASTM D 4491.

(5) Apparent Opening Size: No. 50 (0.3 mm); ASTM D 4751.

III) EXECUTION

1) **Pipe Preparation**

A) Shape trench and place bedding as specified in Earthwork Section and as shown on the drawings.

(1) Do not support pipe on blocks or mounds of earth.

(2) Provide uniform and continuous bearing and support for full length of pipe between bell holes

(3) Minor disturbance over a maximum length of 18 inches near the middle of each length of pipe will be permissible by the withdrawal of pipe slings or other lifting tackle

B) Alignment and Grade

(1) Except as indicated on the Drawings, lay all pipe straight and at a uniform grade.

(2) Use batter boards to determine and check pipe subgrades.

(3) Other methods of maintaining alignment and grade may be acceptable if approved by the Town.

2) **Pipe Installation**

A) Inspect pipe and accessories for defects before lowering into trench.

B) Replace any defective, damaged or unsound pipe.

C) Carefully lower pipe, fittings, and accessories into the trench with derricks, ropes, and other suitable equipment to prevent damage. Do not dump or drop pipe or accessories into trench.

D) Pipe embedment shall be as specified in Earthwork Section for pipe.

E) Protect from lateral displacement by placing the specified pipe embedment material.

F) Do not lay pipe in water, under unsuitable weather conditions or under unsuitable trench conditions

G) Joint to form true and smooth line.

H) Remove any pipe not making a good fit.

I) Begin pipe laying at the lowest point unless reverse laying is accepted by Town.

J) Utilize implements, tools and facilities as recommended by the manufacturer and/or catch basins if required to remove debris.

K) Keep pipe clean during and after laying.

L) During construction, close all open ends with watertight expandable type plugs.

(1) At the end of each day's operations.

(2) Whenever pipe ends are left unattended.

(3) Deposit adequate backfill on pipe to prevent flotation.

(4) Do not use wood, burlap or other similar temporary plugs.

M) Remove and re-lay any pipe which has floated.

N) Place Manhole at every horizontal change of direction in pipe.

3) **Warning Ribbon**

A) All utility installations must have warning ribbon placed in the trench, eighteen (18) inches above the utility. The color of the tape shall conform to industry standards.

4) **Tracer Wire**

A) Tracer wire shall be installed along all pipe, main and service, and across all fittings and appurtenances.

B) Tape wire on each side of fittings and at ten (10) foot maximum spacing on center along the top of pipe.

C) Tracer wire shall be terminated or provide a test station at the following: the end of each pipe run, long runs of pipe two thousand five hundred (2,500) feet or greater, within manholes, at valve boxes not in roadways, and fire hydrants.

(1) Include a minimum of two (2) feet of excess/slack ware at all termination/access points

(2) Tracer wire shall not be terminated within a valve box with access to a valve actuator.

(3) When terminating tracer wire anywhere beside manholes, tracer wire shall be terminated at designated termination stations

(4) When terminating tracer wire in manholes, secure wire to the inside of the manhole in such a fashion that makes it accessible to an operator without entering the manhole.

D) Splice connections shall be fastened in such a way that continuity is ensured, the connection is secured, no uninsulated wire is exposed, and corrosion is mitigated.

(1) At tees use a single three-way direct bury wire connector

5) **Precast Structure Preparation**

A) Verify structures are properly sized and located

B) Verify that built-in items are in proper location, ready for roughing into Work

C) Excavation and Backfill: Refer to Section 200 General Earthwork Specifications for requirements

D) Coordinate placement of inlet and outlet pipe or duct sleeves required by other sections

E) Rock Subbase: Remove water, excavate, and place 1 1/2 inch rock, 6 inch minimum depth below bottom of structure

6) **Catch Basins**

A) Construct catch basins to the sizes and shapes indicated, and to conform to requirements of authorities having jurisdiction.

(1) For precast units, set in place to accurate elevations on firm, solid bed, plumb and level.

(2) Pipe openings, elevations and alignment per plans

(3) Seal and grout all pipe penetrations

(4) Set cast iron frames and gratings to the elevations indicated.

7) **Placing Manhole Section or Base**

A) Place base pad, trowel top surface level to accept manhole section with uniform bearing all around

B) Place sufficient non-shrink grout on base to ensure watertight fit between first manhole section and base or place first manhole section directly in wet concrete

C) Place manhole sections plumb and level

D) Clean ends of sections and place double mastic gasket

E) Fill inside and outside of joint completely with non-shrink grout and trowel smooth

F) Cure non-shrink grout using approved methods

G) Set cover rings and covers level without tipping, to correct elevations or set cover rings and covers with slight tip to match cross slope of finished surface where directed by Town

H) Completed manholes shall be watertight

8) **Preformed Gaskets**

A) Remove and replace manhole sections which have chipped or cracked joints

B) Thoroughly clean section joints

C) Install gasket in conformance with manufacturer's recommendations

D) Only use primer furnished by gasket manufacturer

9) **Manhole Invert**

A) Place concrete in bottom of manhole and form smooth transition. Trowel smooth and brush for non-skid finish. Slope bench 1 inch per foot for drainage to invert.

B) Invert shape to conform to radius of pipe it connects

C) Remove all rough sections or sharp edges which tend to obstruct flow or cause material to snag. Remove all grout droplets from invert

D) Construct in conformance with standard drawings

10) **Manhole Rings and Covers**

A) Place rings in bed of non-shrink grout on top of manholes

B) Ensure no infiltration will enter manhole at this location

C) Carry non-shrink grout over flange of ring

D) Set top of ring flush with all surfaces subject to foot and vehicular traffic

E) Set top of ring 6 inches above surfaces in open, unraveled, non-pedestrian areas

F) Use precast grade rings for height adjustment

11) **Connection To Existing Manholes**

A) Maintain flow at all times

B) Prior approval of proposed method for maintaining flow must be obtained from Town

C) Cover area around new pipe with non-shrink grout and or waterstop gasket to ensure a watertight structure

D) Make connection during low flow periods

12) **Grout**

A) PREPARATION

(1) Non-Shrink, Non-Metallic Grout, General Use

(a) Clean concrete surface to receive grout

(b) Saturate concrete with water for 24 hrs prior to grouting and remove excess water just prior to placing grout

(2) Cold weather conditions

(a) Warm concrete, substrate and base plate to 40 deg F, or above; store grout in warm area

(b) Follow manufacturer's recommendations for cold weather application

(3) Hot weather conditions

(a) Use cold mixing water and cool base plate if possible; store grout in cool area

(b) Follow manufacturer's recommendations for hot weather application

(4) Apply to clean, sound surface

(5) Apply latex bonding agent to hardened concrete, mix-in-grout, or as directed by Town

(6) Epoxy Grout: Apply only to clean, dry, sound surface

(7) Patching cavities in concrete including, but not limited to, tie holes, and structural and equipment support

B) APPLICATION

(1) Non-Shrink, Non-Metallic Grout

(a) Mix in a mechanical mixer

(b) Use no more water than necessary to produce flowable grout

(c) Provide air vents where necessary to eliminate air pockets

(d) Place in accordance with manufacturer's instructions

(e) Where exposed to view finish grout edges smooth

(f) Protect against rapid moisture loss by immediately covering with wet rags and polyethylene sheets or curing compound

(g) Wet cure grout for 7 days, minimum

(h) Maintain the temperature at a minimum of 40 deg F until grout reaches 3000 psi

(i) After placement of grout, eliminate excessive external vibration

(2) Epoxy Grout

(a) Mix and place in accordance with manufacturer's instructions

(b) Completely fill all cavities and spaces around dowels and anchors without voids

(c) Obtain manufacturer's technical assistance as required to insure proper placement

13) **Riprap**

A) Do not place riprap over frozen or spongy subgrade surfaces.

B) Place riprap at pipe outlets and in channels as indicated on plans. Top of riprap to match invert of outlet pipe and channels.

C) Excavate and prepare subgrade.

D) Place geotextile fabric under all bedding. Place bedding and place riprap on bedding per plans.

E) Material may be machine placed and then arranged as necessary by use of a Gradall with multi-prong grapple device or by hand to minimize voids. Dumping alone is not sufficient to achieve properly placed riprap.

IV) FIELD QUALITY CONTROL

A) Field inspection and testing including a CCTV inspection will be performed for every section of pipe after backfill has occurred

(1) Contractor shall furnish suitable assistance to the Town

(2) A minimum of 75% of a true circle will be required to indicate a properly constructed line

(3) Contractor will repair any section not passing the CCTV Inspection.

B) Request inspection immediately after placing cover over pipe.

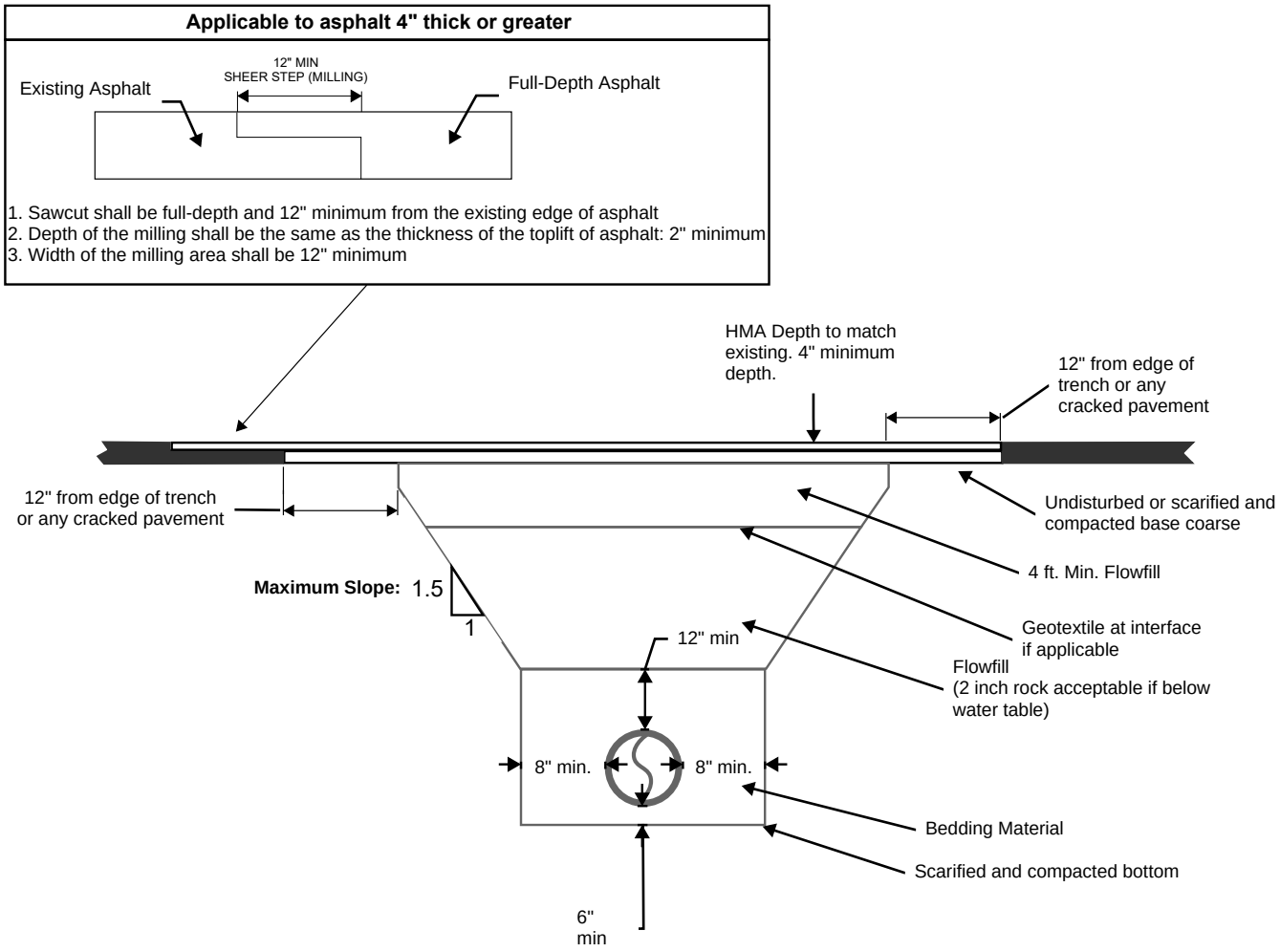
C) Backfilling and testing as required per Section 200 – General Earthwork Specifications.

STANDARD DRAWINGS AND DETAILS

Minimum Testing Requirements

ITEM	TYPE OF TEST	MINIMUM FREQUENCY
All excavation backfill - gas, elec., water, storm & san. sewer, cable TV, phone, etc.	Moisture/Density (Compaction Test)	1 per 150 lineal ft., and within 2 ft. of all structures; minimum 2 tests per lift
Inlets/structures		
Concrete testing	Rebar Inspection	Visual/Documentation
	Air and Slump	1st 3 loads, every 5th load thereafter
	Cylinders	1 set of 4 per 100 yds^3, or fraction thereof
Soil testing	Moisture/Density (Compaction)	minimum 2 tests per lift
Sidewalk, Curb, & Gutter		
Soil testing	Moisture/Density (Compaction)	1 per 150 lineal ft., minimum. 2 tests per lift
Concrete testing	Air and Slump	First truck Every 50 yds^3 after first truck.
	Cylinders	1 set of 4 per 50 yds^3, or fraction thereof
Roadway		
Subgrade testing	Moisture/Density (Compaction)	1 per 300 lane feet, min. 2 tests per lift
	Proof-roll	All subgrade
Base course testing	Moisture/Density (Compaction)	1 per 300 lane feet, min.
	Gradation/Atterberg limits	2 test per lift, 1 per 500 tons
	2 tests per lift 1 per 500 tons	All base course
Concrete testing	Air and Slump	1st 3 loads, if pass, 1 per 50yds^3
	Cylinders	Every load 1 set of 4 per 50 yds^3, or fraction thereof
Asphalt testing	Density	1 per 300 lane feet, min.
	Extraction/Gradation	2 tests per lift, 1 per 500 tons
	Marshall Cores for thickness/density	As directed by the City only, if directed then 3 per 1000 lane feet, or fraction thereof.

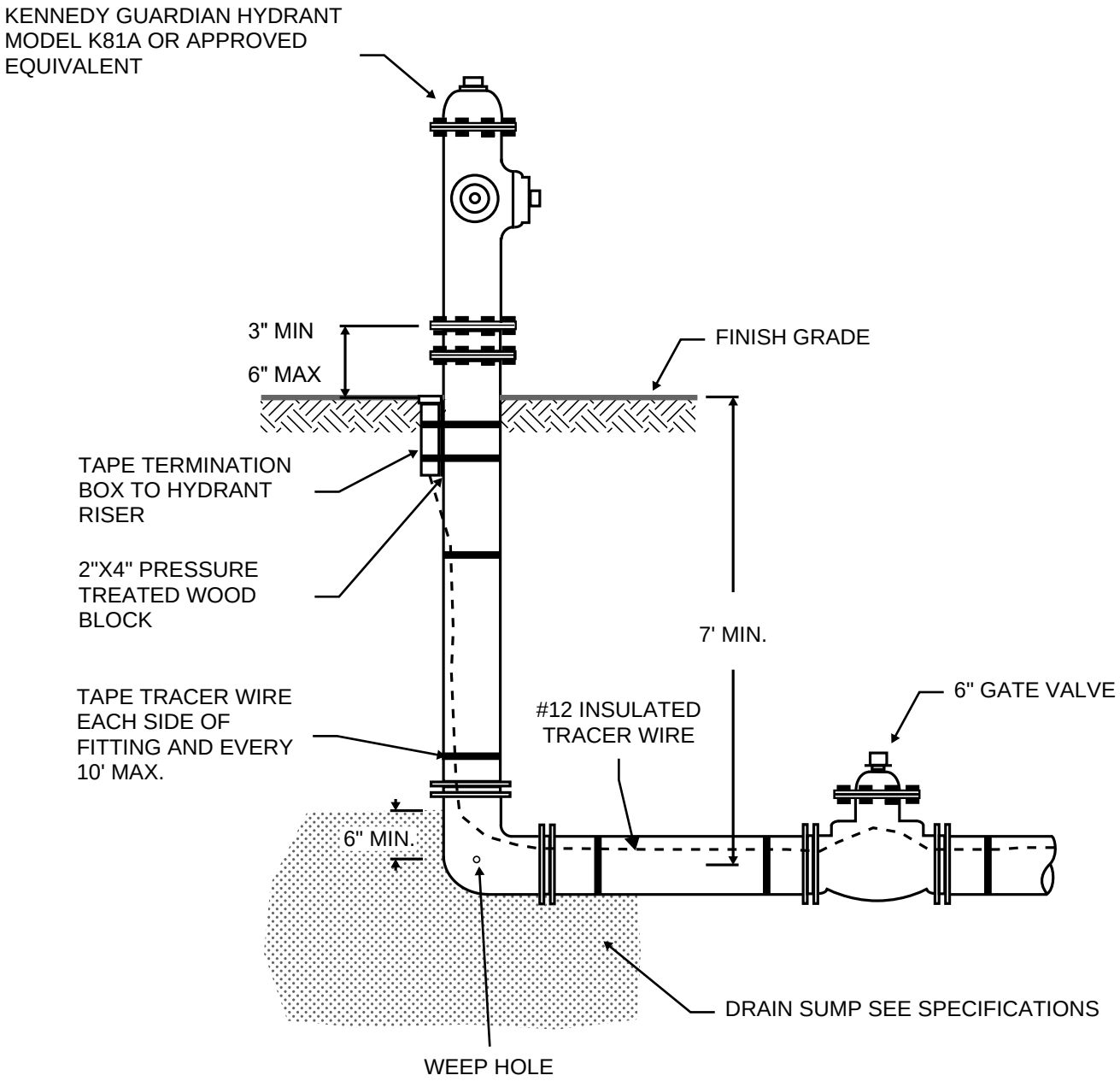
TYPICAL TRENCH AND SURFACE REPLACEMENT



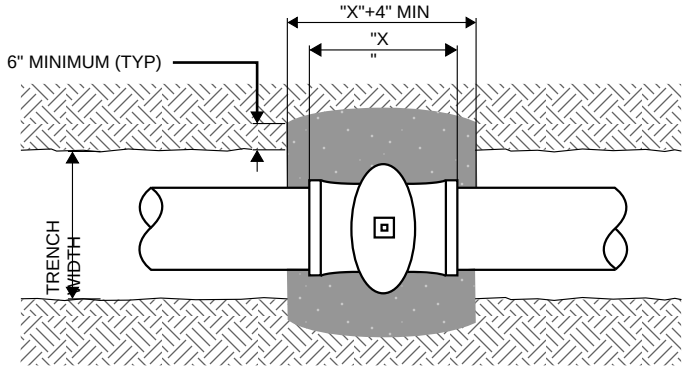
Notes:

1. Trench must be sloped as shown or braced for the safety of construction workers. Trenching will be subject to the most recent OSHA regulations.
2. Existing pavement shall be sawcut and replaced to create the full depth replacement shown.
3. Stress cracking of existing pavement may occur during excavation. If present, the contractor shall sawcut at least 12” beyond the limit of visible cracks and remove all stressed pavement.
4. Hot bituminous patch shall match existing pavement depth with a minimum thickness of 4”. Pavement shall be placed in two lifts.
5. Flexible utilities shall be bedded using granular bedding material in accordance with Section 200.II.1.D or per direction of utility provider.
6. Trench bottom shall be scarified and recompacted after excavation or after dewatering action to ensure adequate support of utility bedding.
7. Milling must occur following backfill and prior to paving.
8. Milling depth shall match the top lift of the existing asphalt or (2” minimum)

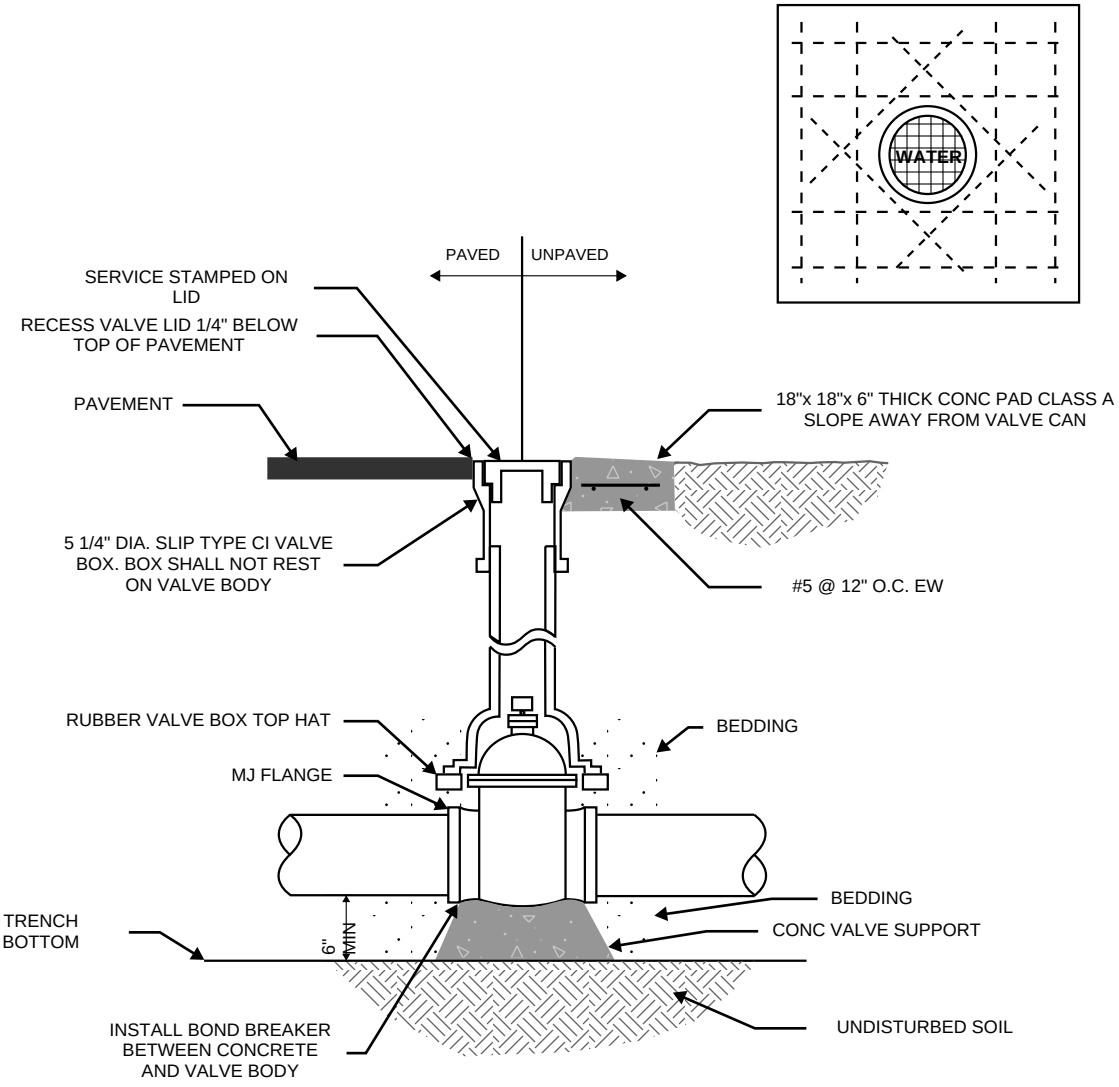
TYPICAL FIRE HYDRANT DETAIL



TYPICAL GATE VALVE INSTALLATION

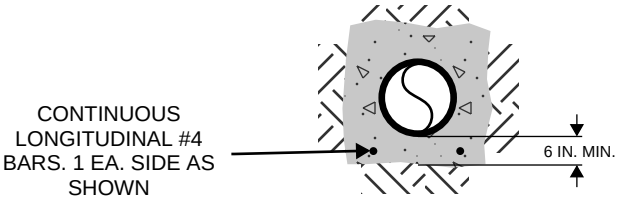


PLAN

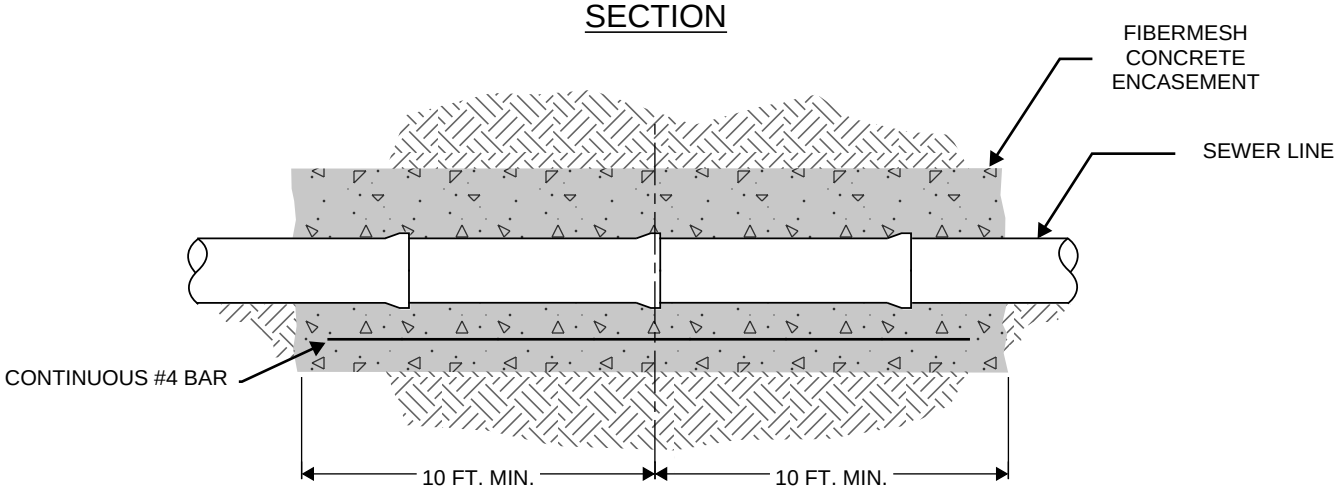


SECTION

WATER LINE BELOW SEWER LINE



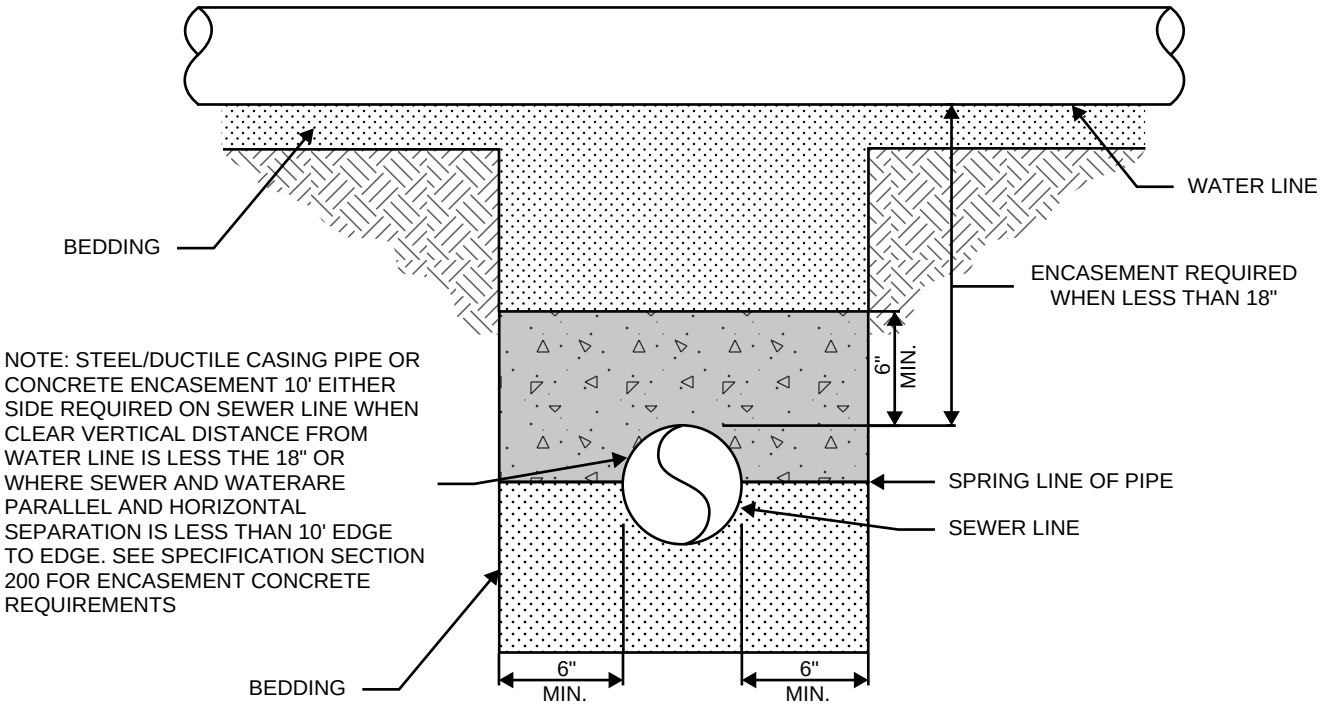
SECTION



STEEL/DUCTILE CASING PIPE OR CONCRETE ENCASEMENT REQUIRED IN ALL CASES WHERE SEWER LINE IS ABOVE WATER LINE OR IS UNDER WATERWAY CROSSING

PROFILE

WATER LINE ABOVE SEWER LINE

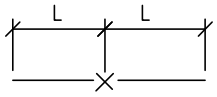


NOTE: STEEL/DUCTILE CASING PIPE OR CONCRETE ENCASEMENT 10' EITHER SIDE REQUIRED ON SEWER LINE WHEN CLEAR VERTICAL DISTANCE FROM WATER LINE IS LESS THE 18" OR WHERE SEWER AND WATERARE PARALLEL AND HORIZONTAL SEPARATION IS LESS THAN 10' EDGE TO EDGE. SEE SPECIFICATION SECTION 200 FOR ENCASEMENT CONCRETE REQUIREMENTS

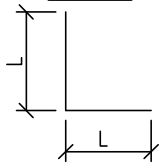
LENGTH OF RESTRAINED PIPE DETAIL

ROD DIAMETER, GRADE & LENGTH OF RESTRAINED PIPE

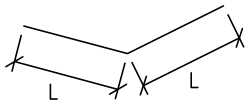
PIPE SIZE	4"			6"			8"			12"			16"			20"			24"		
FITTING	D	L	G	D	L	G	D	L	G	D	L	G	D	L	G	D	L	G	D	L	G
90° BEND, TEE, OR PLUG	3/4"	30'	MS	3/4"	45'	MS	3/4"	60'	MS	3/4"	86'	HS	1"	108'	MS	1-1/4"	132'	HS	—	155'	—
VALVE	—	—	—	—	—	—	—	—	—	—	—	—	1"	108'	MS	1-1/4"	132'	HS	—	155'	—
45° BEND	3/4"	9'	MS	3/4"	13'	MS	3/4"	18'	MS	3/4"	25'	MS	1"	32'	MS	3/4"	39'	HS	—	45'	—
22-1/2° BEND	3/4"	1'	MS	3/4"	4'	MS	3/4"	5'	MS	3/4"	7'	MS	3/4"	8'	MS	3/4"	10'	MS	—	12'	—
11-1/4° BEND	—	—	—	—	—	—	3/4"	1'	MS	3/4"	2'	MS	3/4"	2'	MS	3/4"	3'	MS	—	3'	—



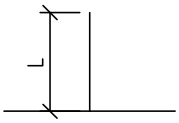
VALVE



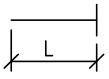
90° BEND



BENDS



TEE

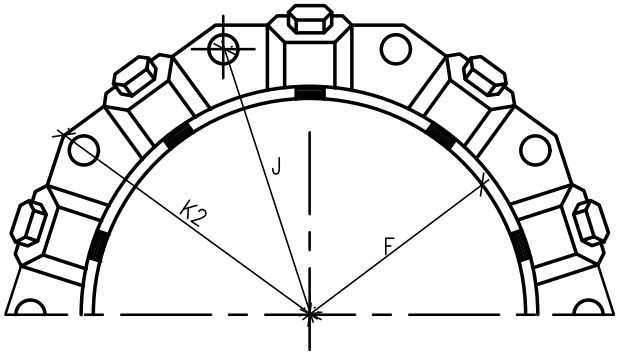


PLUG

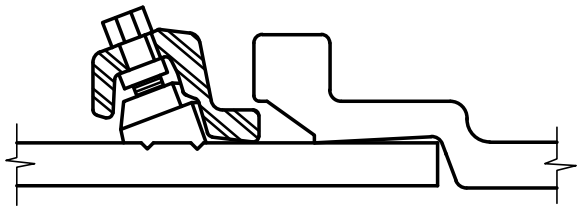
NOTES:

1. LENGTH OF RESTRAINED PIPE MEASURED EACH WAY FROM VALVES AND BENDS
2. CLAMPS, RODS & MEGALUGS NOT ALLOWED FOR 24" & LARGER PIPES
3. D=DIAMETER, L=LENGTH, G=GRADE, MS=MILD STEEL, HS=HIGH STRENGTH
4. MINIMUM 7.0' GROUND COVER REQUIRED
5. MS MEANS MILD STEEL ROD ASTM STANDARD DESIGNATION A-36
6. HS MEANS HIGH STRENGTH ROD ASTM STANDARD DESIGNATION A-193 GRADE B-7
7. NUTS SHALL BE ASTM STANDARD DESIGNATION A-307 GRADE A OR B HEXAGON HEAVY SERIES. HIGH STRENGTH NUTS SHALL CONFORM TO MS-22
8. MEGALUG MECHANICAL JOINT RESTRAINT CAN BE USED IN LIEU OF TIE RODS FOR DIP OR PVC MAINS
9. LENGTH REFERS TO THE AMOUNT OF PIPE WHICH MUST BE RESTRAINED TOGETHER AND IS NOT NECESSARILY THE LENGTH OF THE RODS
10. LENGTH OF RESTRAINED PIPE CHART IS ALSO FOR THE LENGTH OF JOINT RESTRAINT FOR MEGALUGS
11. CROSSES MUST BE RESTRAINED IN ALL APPLICABLE DIRECTIONS
12. 12" AND SMALLER IN LINE VALVES AND TEES SHALL HAVE A MECHANICAL JOINT RESTRAINT DEVICES ON EACH SIDE OF THE FITTING OR VALVE. MECHANICAL JOINT RESTRAINT DEVICES SHALL BE PER MS-2 OF THE ENGINEERING STANDARDS.
13. A SECOND VALVE WILL BE REQUIRED TO BE CLOSED WHEN EXCAVATING NEXT TO AN EXISTING VALVE

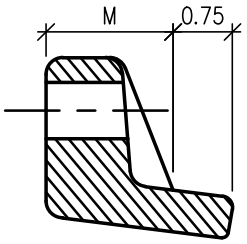
MECHANICAL JOINT RESTRAINT DETAIL



MECHANICAL JOINT RESTRAINT



WEDGE DETAIL



BOLT HOLE DETAIL

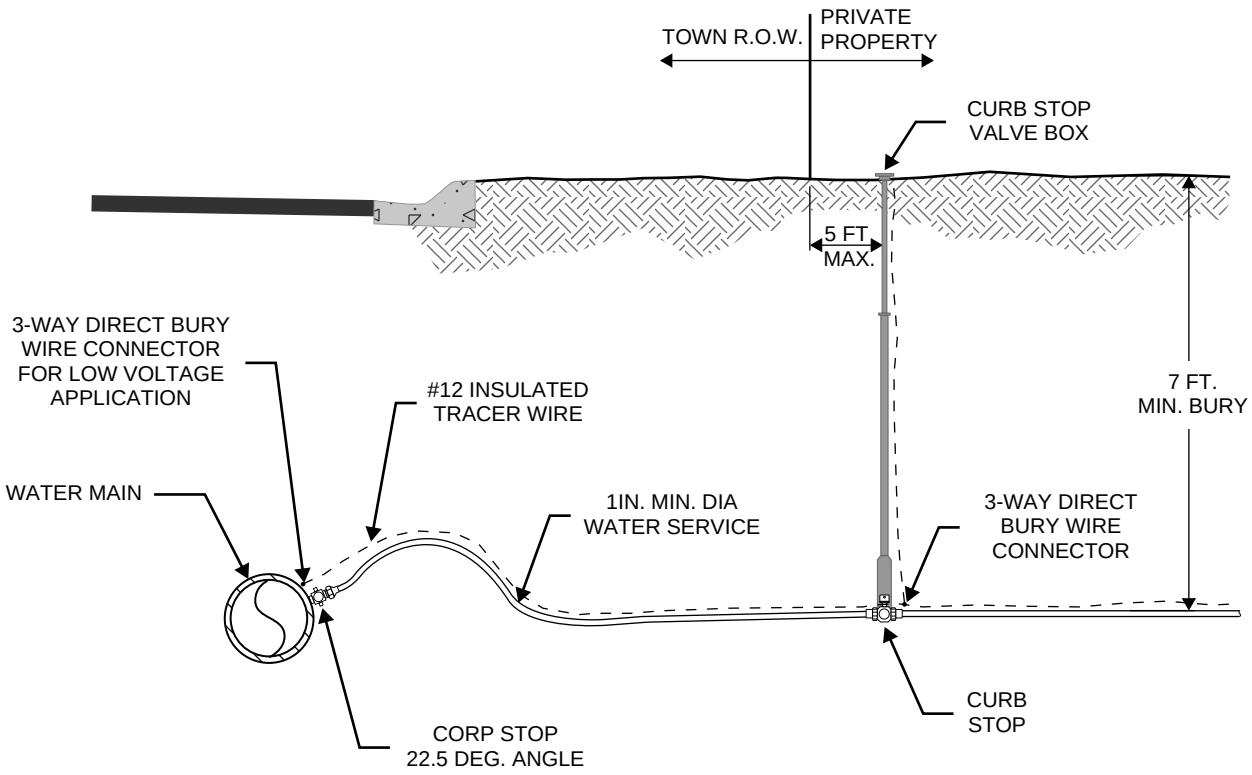
DIMENSIONS

	NOMINAL PIPE SIZE	NO. OF BOLTS	NO. OF WEDGES	K2 INCHES	J INCHES	F INCHES	M INCHES	
PVC	4"	2	2					PVC
	6"	6	3	11.12	9.50	7.00	0.88	
	8"	6	4	13.37	11.75	9.15	1.00	
	10"	8	6	15.62	14.00	11.20	1.00	
	12"	8	8	17.88	16.25	13.30	1.25	
DI	4"	4	2					DI
	6"	6	3	11.12	9.50	7.00	0.88	
	8"	6	4	13.37	11.75	9.15	1.00	
	10"	8	6	15.62	14.00	11.20	1.00	
	12"	8	8	17.88	16.25	13.30	1.25	
	16"	12	12	22.50	21.00	17.54	1.56	
	20"	14	14	27.00	25.50	21.74	1.69	

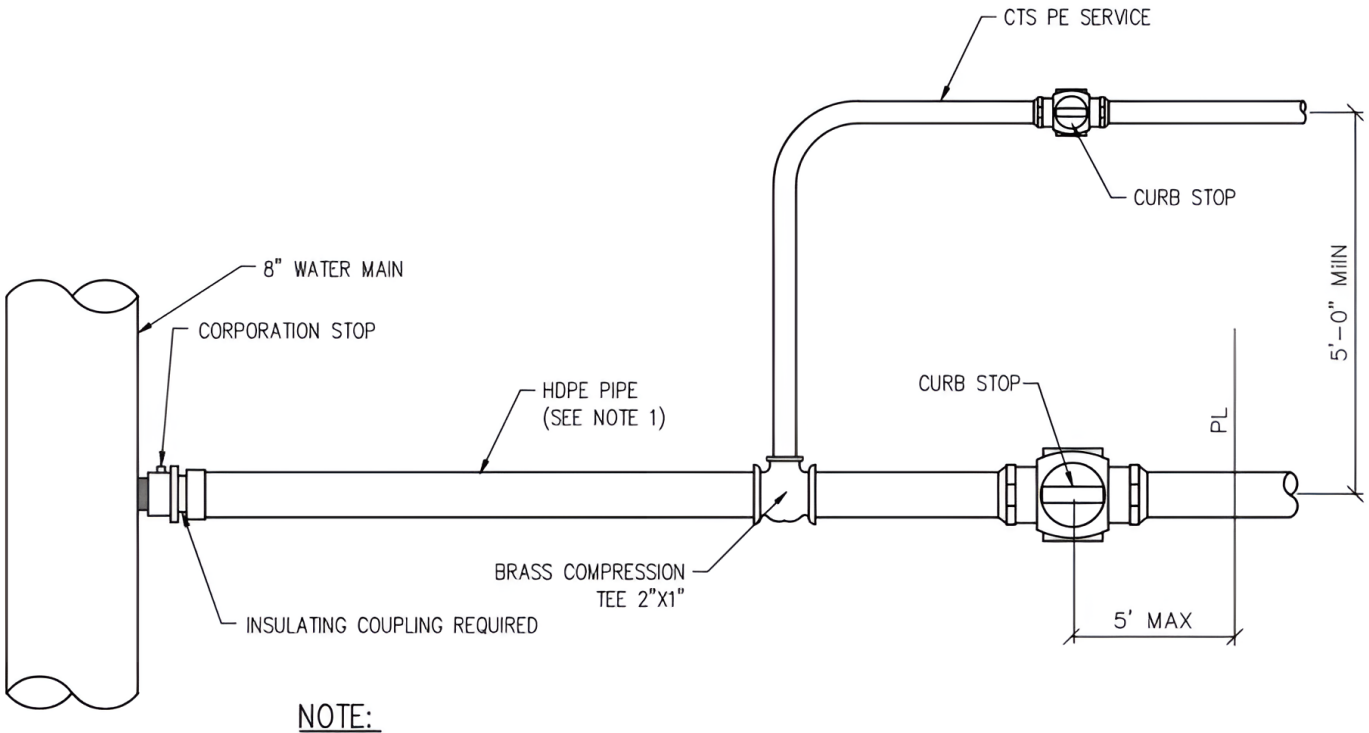
NOTE:

1. BASED ON "MEGA LUG" PIPE RESTRAINT SYSTEM BY EBAA IRON
2. OTHER MECHANICAL JOINT RESTRAINT DEVICES MUST BE APPROVED BEFORE INSTALLATION.

WATER SERVICE CONNECTION



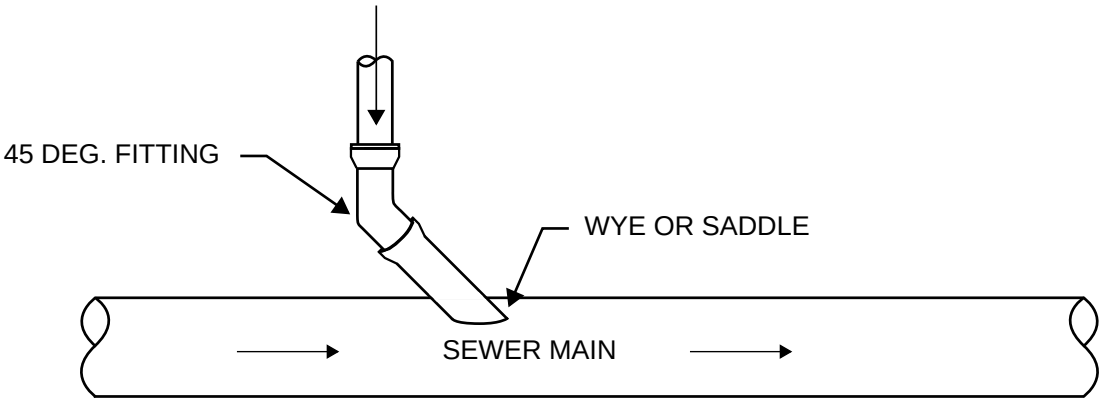
FIRE AND DOMESTIC COMBO SERVICE CONNECTION



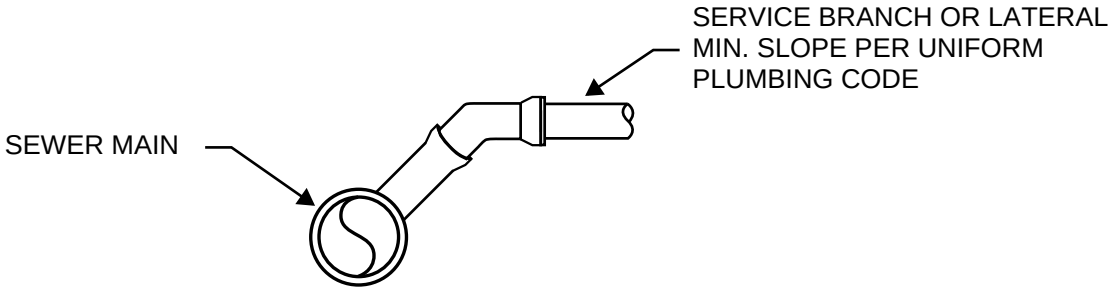
NOTE:

1. INSULATION REQUIRED ON ALL SERVICE LINES PER TOWN STANDARDS
2. LOCATING WIRE REQUIRED ON ALL SERVICE LINES PER TOWN STANDARDS
3. CENCORE OR PURECORE HDPE PIPE (OR APPROVED EQUAL) FOR SERVICE LINES – PRESSURE RATING 250PSI
4. BRASS COMPRESSION FITTINGS OF EQUAL OR GREATER PRESSURE RATING TO SERVICE LINES IS REQUIRED
5. COMBINATION CONNECTIONS TO MEET ALL REQUIREMENTS SHOWN ON DOMESTICS SERVICE CONNECTION DETAIL #7

SEWER SERVICE CONNECTION

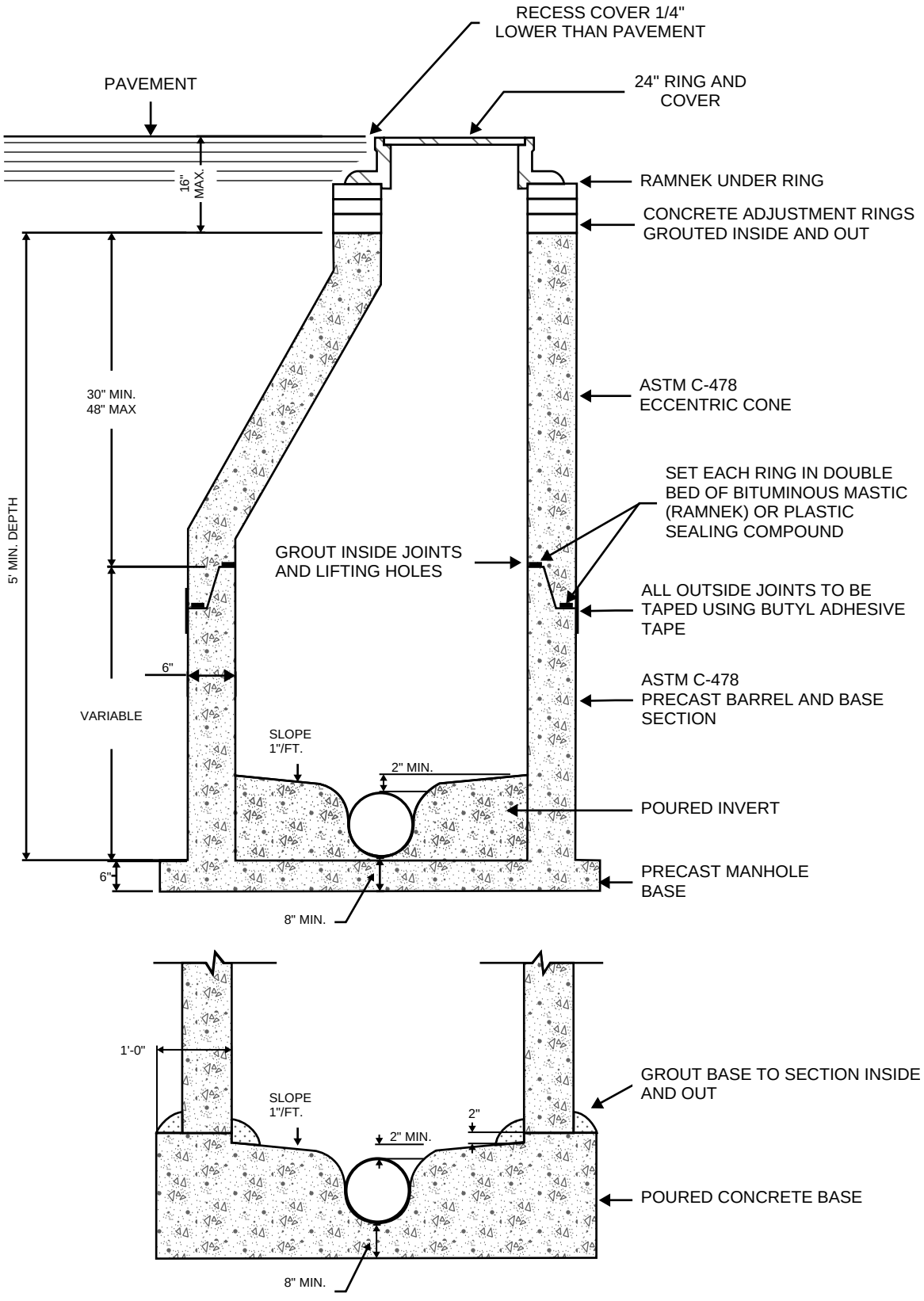


"Y" TYPE PLAN

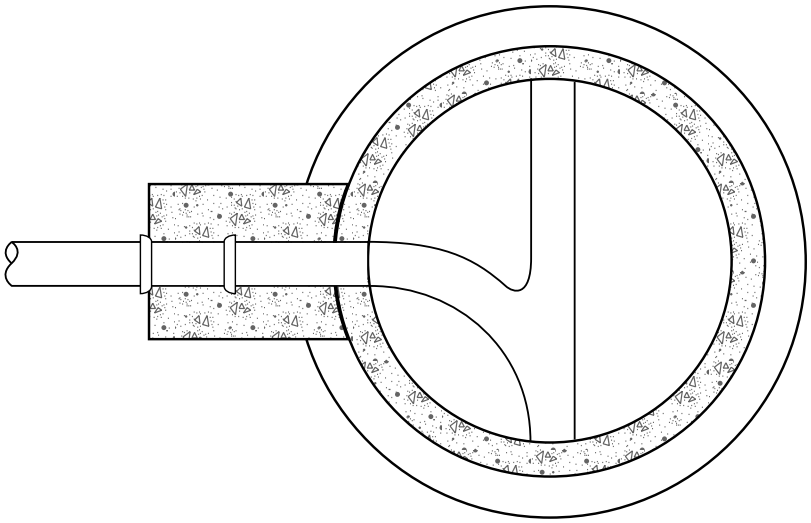


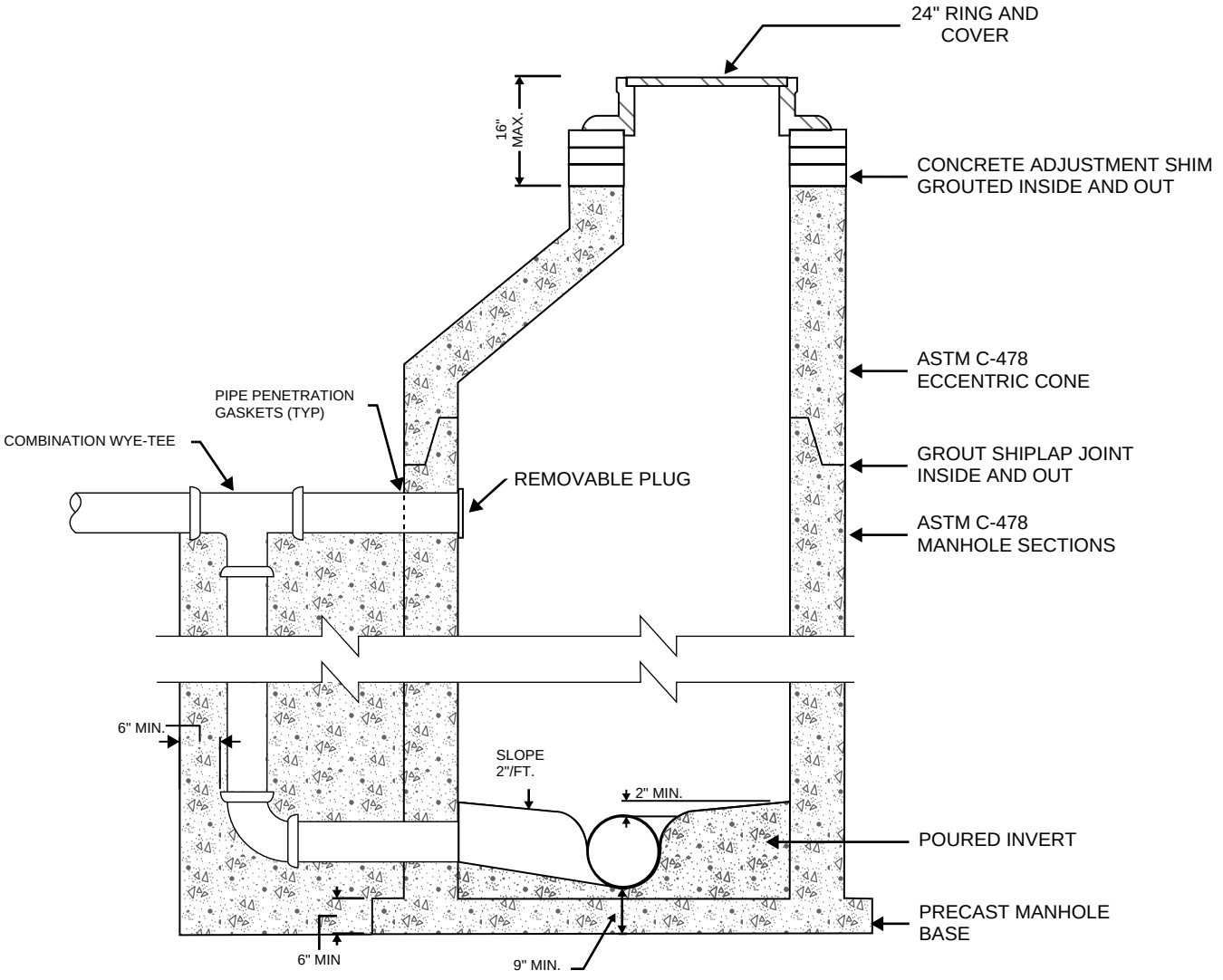
"T" TYPE ELEVATION

STANDARD MANHOLE

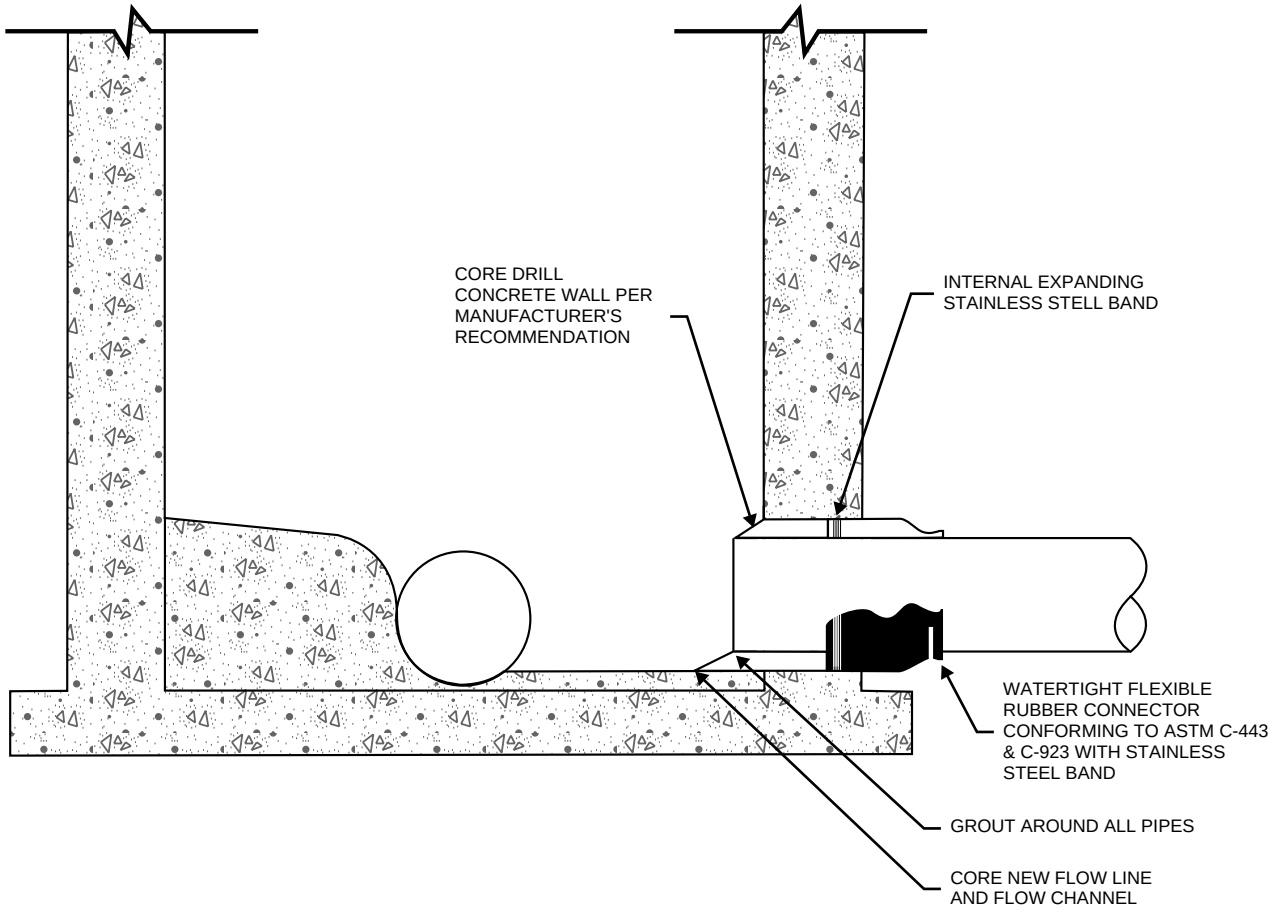


DROP MANHOLE

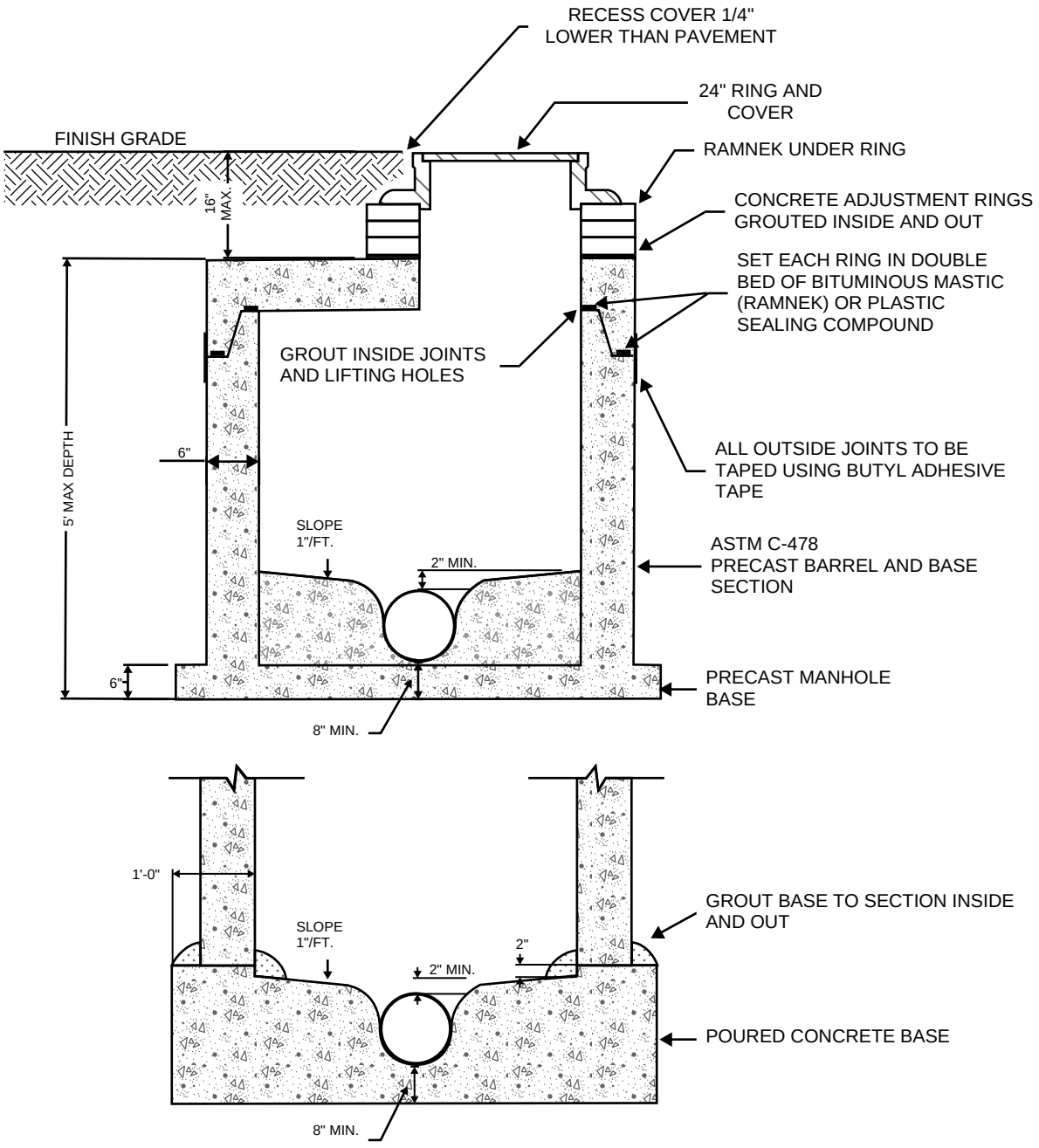




PIPE INSTALLATION INTO EXISTING MANHOLE

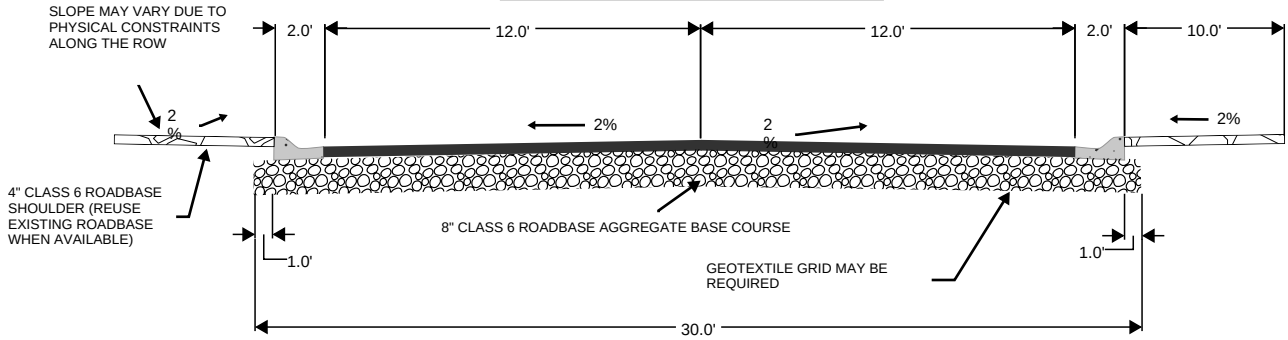


FLAT-TOP MANHOLE

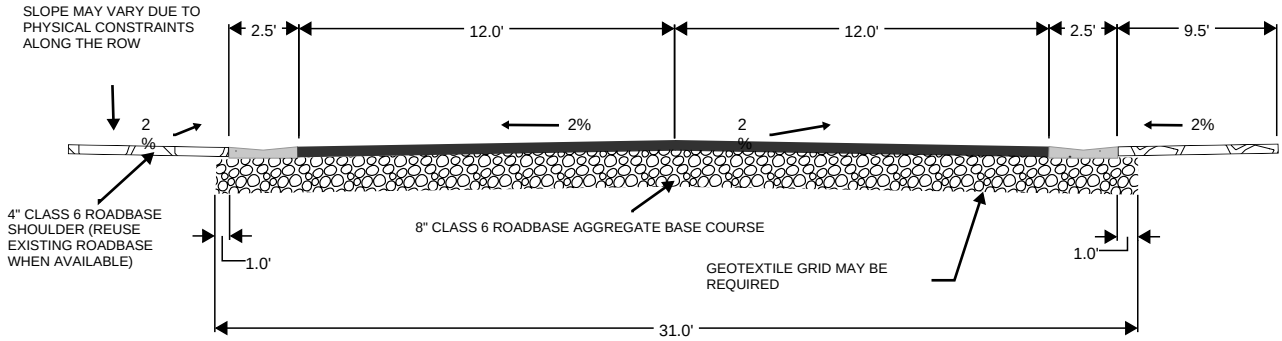


STREET STANDARDS

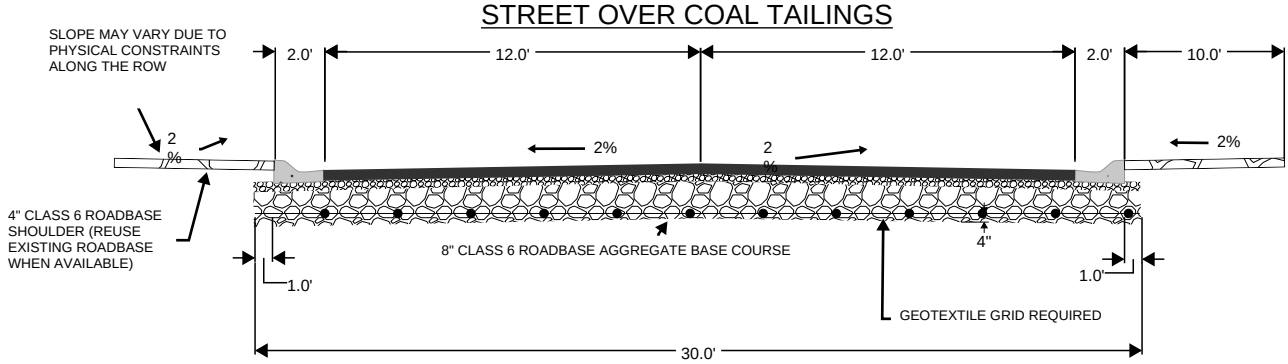
STREET W/ CURB & GUTTER



STREET W/ EDGE PAN

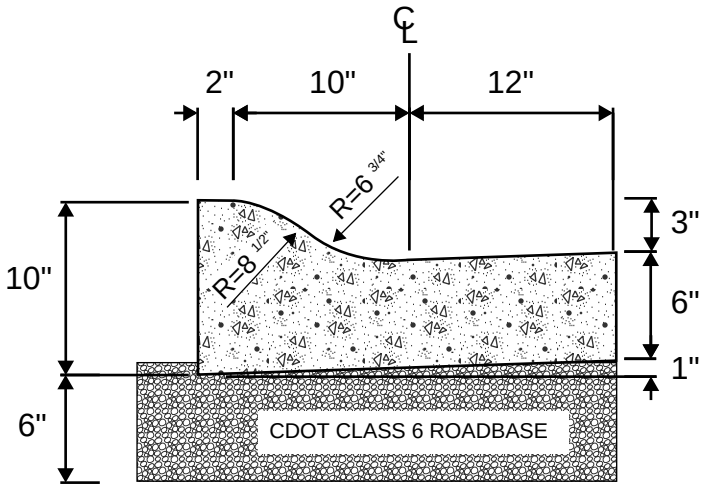


STREET OVER COAL TAILINGS

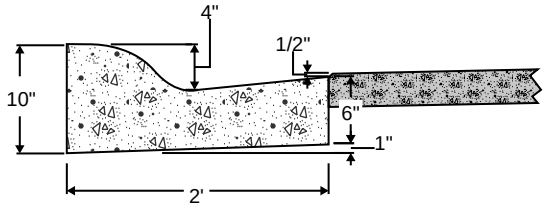


ASPHALT WIDTH	24 FEET	ASPHALT SHALL BE A MINIMUM OF 1/2
MINIMUM ASPHALT THICKNESS	4 INCHES	INCH ABOVE THE LIP OF THE GUTTER
MINIMUM BASE	6 INCHES	OF A CATCH CURB AND GUTTER AND
MINIMUM STRUCTURAL NUMBER	2.1	PANS.
ROADWAY CROWN	2.0%	
MAXIMUM GRADE	6.0%	ASPHALT SHALL BE EVEN WITH THE
MINIMUM GRADE	0.6%	LIP OF THE GUTTER OF A SPILL CURB
CURB RETURN RADIUS (BACK OF CURB)	15 FEET	AND GUTTER.

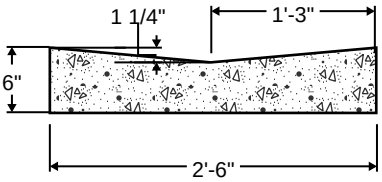
CURB AND PAN STANDARDS



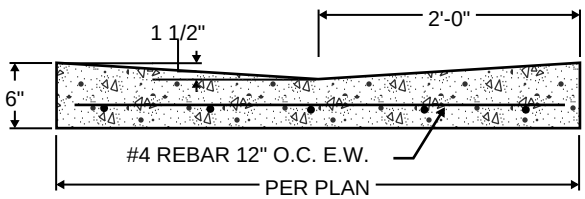
TYPICAL CURB AND GUTTER DETAIL



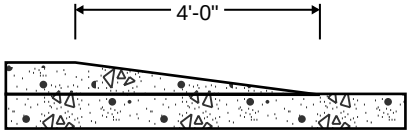
TYPICAL CURB AND GUTTER



TYPICAL EDGEPAN



TYPICAL CROSSPAN



TYPICAL CURB TRANSITION