

ARTICLE 11

SANITARY SEWERS

11.1 GENERAL

11.1.1 DESCRIPTION

The work covered by this section of the specifications consists of the furnishing of all labor, supplies, equipment and materials and performing all operations in connection with the construction of sanitary sewers and appurtenances, as shown on the plans, as herein specified and directed by the City Engineer.

11.1.2 PLANS AND DATA

Profiles of the ground are shown on the plans for the work. The Contractor must satisfy himself regarding the character of the material to be excavated and the work to be done.

11.1.3 SOURCE OF SUPPLY

Materials complying with these specifications will be accepted from any source of supply. The Engineer reserves the right to reject the entire output of any source from which it is impossible to secure a continuous supply of satisfactory material or a source where conditions are such that the use of unfit material can be prevented only by extraordinary methods.

The Engineer may require the taking and testing of preliminary samples of material from any source before that source is approved for delivery.

The Contractor shall be held responsible for the care and storage of materials delivered on the work site or purchased for use thereon. Any material that has been delivered on the work site and has become damaged before actual incorporation in the work may be rejected by the Engineer even though it may have been accepted previously. Stored material will be so located as to facilitate thorough inspection.

Materials which do not meet the requirements of these specifications will be rejected and will be promptly removed from the work site.

11.2 MATERIALS

11.2.1 PIPE MATERIALS

All sanitary sewer mains shall be a minimum of eight inches (8") in diameter. Any sanitary sewer mains less than eight inches (8") will not be approved or accepted.

- (a) POLYVINYL CHLORIDE (PVC) PIPE. Polyvinyl chloride pipe shall be unplasticized polyvinyl chloride manufactured specifically for sanitary sewage and with an integral bell. All PVC pipe with diameters not exceeding fifteen inches (15") will conform to ASTM D3034 Standard Specifications. A minimum wall dimension ratio (ratio of the average specified outside diameter to the minimum specified wall thickness) shall be SDR 35. All PVC pipe with diameters eighteen inches (18") and greater shall conform to ASTM F679 Standard Specifications.

The bell end of all pipes shall contain a confined elastomeric gasket conforming to ASTM F477 and will be tested in accordance with ASTM D3212 Standard Specifications. PVC pipe shall not be exposed to ultraviolet light longer than six (6)

months. Any discoloration of the pipe material will be evidence of ultraviolet damage and may be reason for rejection and removal from the project.

All PVC sewer pipe, eight inches (8") in diameter or larger, shall be an integral green tint in color. Lightly tinted pipe will not be acceptable. Contractors shall install all **PVC pipe in a manner where there are no sags or interruptions in the flow**. All pipe shall have a home mark on the spigot to indicate proper penetration when the joint is made.

Connections to an existing PVC pipe, for extensions or repairs, shall be made with a double bell coupling when a bell end does not exist, (i.e. plain end to plain end connection). After it has been laid and backfilled, and prior to the placing of surface improvements, all PVC pipe shall be tested by the Contractor by means of a certified mandrel (go-nogo device).

(b) CAST IRON PIPE (CIP). Cast Iron Pipe will not be allowed.

(c) DUCTILE IRON PIPE (DIP). Ductile Iron Pipe shall be centrifugally cast, grade 60-42-10 iron conforming to ASTM A746 and ANSI A21.51 Standard Specifications. Thickness class for buried pipe shall be as determined by ANSI A21.51, Tables 51.1 and 51.2. Ductile Iron Pipe shall have rubber gasket push-on joints and shall have a polyethylene lining.

Polyethylene lining material shall conform to ASTM D1248 Standard Specifications, compounded without an inert filler except 3% carbon black to resist ultraviolet rays. The polyethylene shall be chemically bonded to the interior of the pipe. The lining shall have a nominal thickness of 40 mils and a minimum thickness of 35 mils.

Each piece of pipe shall be checked for holidays by the manufacturer. Holiday testing shall conform to ASTM G62 standard specifications.

Field cutting and coating of the cut pipe shall be made in accordance with the manufacturer's recommendations. In no case shall polyethylene-lined pipe be cut with a torch.

An approved pipe bonding and cathodic protection system will be required on all buried ductile iron pipe.

(d) VITRIFIED CLAY PIPE (VCP) - EXTRA STRENGTH. Vitrified clay pipe will be allowed only when prior written approval is obtained from the City Engineer.

11.2.5 CONCRETE MANHOLES

Unless otherwise specified on the plans, or approved by the City Engineer, manholes shall be constructed of precast concrete barrels and cones with cast-in-place concrete bases. Bases may be precast if placed on six inches (6") of compacted gravel bedding extending a minimum of twelve inches (12") around the base or the width of the excavation-whichever is greater. In the event severe groundwater conditions are encountered, the thickness of the gravel bedding below the manhole base shall be increased to twelve inches (12"). Alternate construction methods may be required as approved by the Engineer on a case-by-case basis. The concrete channel and bench within precast bases shall be poured on site after the sewer pipe is set to grade. Where possible, the manhole channel shall be sewer pipe with the upper portion removed. Precast concrete barrels and cones shall conform to ASTM C478 Standard

Specifications except that the wall thickness may be either wall A or wall B as described in ASTM C76 Standard Specifications. Provide eccentric cones for all manholes greater than six feet (6') deep, and flat lids for manholes six feet (6') deep or less as shown on the drawings. Manholes shall conform to the Standard Details shown on the plans. Concrete used in the construction of all sanitary sewer structures shall conform to those portions of *ARTICLE 4 – CONCRETE* and *ARTICLE 5 – STRUCTURAL CONCRETE*, which are applicable.

All joints in the manhole barrel, cone, grade adjustment rings, and flat top sections shall be sealed with a preformed flexible plastic sealing compound conforming to Federal Specification SS-S-00210 (GSA-FS6). All joint surfaces shall be cleaned prior to applying the sealant. The outside of the manhole joints shall be wrapped with a butyl adhesive tape sealant that conforms to Federal Specification SS-S-00210 (GSA-FS6). The eccentric cone section shall be situated so that the slope of the cone section is pointing toward the downstream direction.

All pipe penetrations in cast-in-place concrete bases shall utilize two strips of the above mentioned preformed flexible plastic sealing compound, placed around the pipe, as a water stop. All pipe penetrations in precast concrete bases shall be provided with a resilient rubber connector in conformance with ASTM C923, when connection to an existing manhole is allowed a water stop and non-shrink grout shall be used at all pipe penetrations.

11.2.6 TRENCHLESS MANHOLE REPAIR

Unless specified on plans, materials used shall conform to the following, or be otherwise approved by the engineer:

(a) CEMENTIOUS MATERIAL

DESCRIPTION	METHOD	RESULTS
Compressive Strength, 28-day	ASTM C109	9,000 psi
Flexural Strength, 28-day	ASTM C293	1,000 psi
Bond Strength	ASTM C882	2,000 psi
Freeze-Thaw Durability	ASTM C666	No visible damage after 300 cycles
Shrinkage at 95% Humidity, 28-day	ASTM C596	0%
Sulfide Resistance	ASTM C267	No attack

(b) EPOXY COATING

DESCRIPTION	METHOD	RESULTS
Flexural Strength	ASTM D790	13,000 psi
Compressive Strength	ASTM D695	18,000 psi
Tensile Strength	ASTM D638	7,600 psi
Tensile Ultimate Elongation	ASTM D638	1.5 %
Hardness, Shore D	ASTM D2240	85-89
Taber Abrasion, CS17 Wheel	ASTM D4060, 1,000g load/1,000 cycles	<112mg loss
Adhesion	ASTM D4541, Concrete	Substrate Failure and >250 psi*

*Adhesion Mode of Failure shall be by Substrate Failure mode only with an adhesion value 250psi and greater. Mode of failure categorized as

"Glue Failure or Adhesive Failure Y/Z" below the minimum PSI specified shall be cause for retesting. Mode of failure as noted in ASTM D4541 Section 8.3.1 thru 8.3.3/ASTM D7234 Section 9.3.1 thru 9.3.4 categorized as Adhesive A/B, B/C, C/D etc. or Cohesive B, C, D etc. shall be cause for rejection.

11.2.7 MANHOLE RING AND COVER ADJUSTMENT

- (a) **CONCRETE GRADE RINGS.** Reinforced concrete grade rings may be used in the adjustment of manhole rings. Grade rings shall have a minimum thickness of two inches (2") and maximum thickness of six inches (6"). Total adjustment height shall not exceed the tolerances as shown on the Standard Details.
- (b) **HIGH DENSITY POLYETHYLENE (HDPE) GRADE RINGS.** High Density Polyethylene grade rings may be used in the adjustment of manhole rings. Grade rings shall be rated for HS-20 loading. Total adjustment height shall not exceed the tolerances as shown on the Standard Details.

11.2.8 MANHOLE RING AND COVERS

Iron castings shall conform to the requirements of AASHTO M306. Gray iron used in the casting shall conform to AASHTO M105, Class 35B, unless otherwise specified.

Castings shall be boldly filleted at angles and the risers shall be sharp and perfect. Castings shall be true to pattern in form and dimensions, free from pouring faults, sponginess, cracks, blow holes or other defects in positions affecting their strength for services intended. The ring and covers for manholes and all sanitary sewer appurtenances shall be straight and shall fit properly together so that traffic will not cause them to rattle. Rough spots, which prevent a suitable fitting, shall be removed by grinding. Manhole castings shall be Neenah R-1706, Deeter 1258, East Jordan Ironworks 2430 or approved an equal. Manhole covers shall be lettered "SANITARY". See City Standard Details for additional information.

11.2.9 REINFORCING STEEL

Reinforcing steel shall meet the requirements of *ARTICLE 5 – STRUCTURAL CONCRETE, SECTION 5.3 - REINFORCEMENT*.

11.2.10 BEDDING FOR PIPE

- (a) **CLASS "A" BEDDING** - Class "A" bedding shall be defined as the method of bedding by which additional supporting strength of the pipe is attained by supporting the pipe with a continuous concrete cradle. The lower part of the pipe shall be bedded in a continuous cradle constructed of concrete conforming to those portions of *ARTICLE 4 – CONCRETE* for Caisson Concrete Mix, which are applicable.
- (b) **CLASS "B" BEDDING** - Class "B" bedding shall be a well-graded crushed stone or slag. When tested by means of laboratory sieves it shall conform to the following requirements: (AASHTO M43, NO. 67 gradation)

SIEVE SIZE	PERCENT PASSING
1 in.	100
¾ in.	90
3/8 in.	20 – 55
No. 4	0 – 10
No. 8	0 – 5

When crushed gravel or stone is used, at least 50 percent, by weight, of the particles retained on the No. 4 sieve and above shall have at least two (2) fractured faces.

- (c) **REINFORCED CONCRETE ARCH AND ENCASEMENT** – Concrete and reinforcement for an arch or encasement shall conform to those portions of *ARTICLE 4 – CONCRETE for 6-Sack Concrete Mix* and *ARTICLE 5 – STRUCTURAL CONCRETE*, which are applicable.

11.2.11 TRENCH STABILIZATION MATERIAL

Backfill for unstable subgrade conditions shall be select material as approved by the Engineer. Contractor shall submit a sample and sieve analysis for City Engineer's review and approval prior to the delivery of the materials to the site.

11.2.12 BACKFILL MATERIALS

Subject to the provisions specified herein, the material removed from the project excavations may be used as backfill. All organic material, rubbish, debris, and other objectionable materials shall be removed from the site and shall not be considered acceptable for backfill.

- (a) **INITIAL BACKFILL.** The specified selected material for the initial backfill (from the spring line of the pipe to a plane one foot (1') above the top of the pipe) in the "pipe zone" shall be Class "B" bedding material, unless stated otherwise on the plans. The initial backfill shall be carefully and simultaneously placed on each side of the pipe for the full width of the trench.
- (b) **BACKFILL ABOVE THE PIPE ZONE.** The material for backfill above the pipe zone (from the top of the bedding to a plane two feet (2') above the top of the bedding) shall be free from rocks, stones, concrete, or asphalt greater than three inches (3") in any dimension. If the Contractor cannot prevent rocks from accumulating at the top of the bedding during the backfill operation, then the City Engineer may require an additional twelve inches (12") of Class "B" bedding or select material be provided at no cost to the City. Material for the backfill from a plane two feet (2') above the bedding to the top of ground shall be free from rocks, stones, concrete or asphalt greater than eight inches (8") in any dimension. All Material shall be well graded and consolidated with a minimum of voids.
- (c) **IMPORTED BACKFILL MATERIAL.** When a shortage of satisfactory backfill material occurs from a cause which is not the fault of the Contractor, as verified by the City Engineer, the Contractor shall furnish all necessary suitable material. The imported backfill material shall be inspected and approved by the City Engineer prior to import.

11.2.13 SEWER SERVICE LINES

Sewer service lines shall be four inches (4") in diameter unless otherwise specified on the plans, or by the Engineer. Material for sewer service lines shall be PVC having a minimum wall dimension ratio with an SDR rating of 35, meeting the requirements of ASTM D3033 or D3034 or better. Sewer services shall be connected to the main, not the manhole, and shall be a wye fitting or a tee fitting when the diameter of the service line exceeds one-half ($\frac{1}{2}$) the diameter of the sanitary sewer main. An approved multi-fitting saddle or wye with a lip may be used when the diameter of the service line is less than or equal to one-half ($\frac{1}{2}$) the diameter of the sanitary sewer main.

11.2.14 TRACER WIRE

All tracer wire and tracer wire products shall be domestically manufactured in the U.S.A.
All tracer wire shall have HDPE insulation intended for direct bury, color coated per APWA standard for the specific utility being marked.

- (a) OPEN TRENCH. Tracer wire for open trenches shall be #12 AWG copper clad steel, high strength with minimum 450 lb. break load, with minimum 30 mil HDPE insulation thickness.
- (b) DIRECTIONAL DRILLING/BORING. Tracer wire for directional drilling or boring shall be #12 AWG copper clad steel, extra high strength with minimum 1,150 lb. break load, with minimum 30 mil HDPE insulation thickness.
- (c) PIPE BURSTING/SLIP LINING. Tracer wire for pipe bursting or slip lining shall be 7 x 7 stranded copper clad steel, extreme strength with 4,700 lb. break load, with minimum 50 ml HDPE insulation thickness.
- (d) CONNECTORS. All mainline tracer wires must be interconnected in intersections, at mainline tees and mainline crosses. At tees, the three wires shall be joined using a single 3-way lockable connector (SnakeBite™ or approved equal). At crosses, the four wires shall be joined using a 4-way connector. Use of two (2) 3-way connectors with a short jumper wire between them is an acceptable alternative.

Direct bury wire connectors. Shall include SnakeBite™ 3-way lockable connectors (or approved equal) and mainline to lateral lug connectors specifically manufactured for use in underground tracer wire installation. Connectors shall be dielectric silicon filled to seal out moisture and corrosion and shall be installed in a manner to prevent any uninsulated wire exposure.

Non-locking friction fit, twist on or taped connectors are prohibited.

- (e) TERMINATION/ACCESS. All tracer wire termination points must utilize an approved tracer wire access box (above ground access box or grade level/in-ground access box as applicable), specifically manufactured for this purpose.

All grade level/in-ground access boxes shall include a dual terminal, switchable lid (SnakePit LD14G2T-SW or approved equal), be appropriately identified with "sewer" cast into the cap, and color coded per APWA standard for the specific utility being marked.

A minimum of two feet (2') of excess/slack wire is required in all tracer wire access boxes after meeting final elevation.

All tracer wire access boxes must include a manually interruptible, conductive/connective link between the terminal(s) for the tracer wire connection and the terminal for the ground rod wire connection.

Ground wire shall be connected to the identified (or bottom) terminal on all access boxes.

- (f) Service Laterals on public property. Tracer wire must terminate with a coil of six feet (6') of tracer wire for future extension to the building, located at the edge of the road right-of-way, and out of the roadway. Termination/Access boxes must be installed at the first south or east sanitary sewer service stub located from the downstream manhole for each block in new subdivisions.

(g) Service Laterals on private property. Tracer wire must terminate at an approved above-ground tracer wire access box, affixed to the building exterior directly above where the utility enters the building, at an elevation not greater than five (5) vertical feet above finished grade, or terminate at an approved grade level/in-ground tracer wire access box, located within two (2) linear feet of the building being served by the utility.

(h) Long-runs, in excess of 2,500 linear feet. Tracer wire access must be provided utilizing an approved grade level/in-ground tracer wire access box, located at the edge of the road right-of-way and out of the roadway. The grade level/in-ground tracer wire access box shall be delineated using a minimum 48" polyethylene marker post, color coded per APWA standard for the specific utility being marked or another approved marker by the City of Pueblo.

(i) GROUNDING. Tracer wire must be properly grounded at all dead ends/stubs.

Grounding of tracer wire shall be achieved by use of a drive-in magnesium ground rod with a minimum of 20 feet of #12 red HDPE insulated copper clad steel wire connected to a node (minimum 1.5 lb.) specifically manufactured for this purpose and buried at the same elevation as the utility.

When grounding the tracer wire at dead ends/stubs, the ground rod shall be installed in a direction 180 degrees opposite of the tracer wire, at the maximum possible distance.

When grounding the tracer wire in areas where the tracer wire is continuous and neither the mainline tracer wire or the ground rod wire will be terminated at/above grade, install the ground rod wire directly beneath and in-line with the tracer wire. Do not coil excess wire from the ground rod wire. In this installation method, the ground rod wire shall be trimmed to an appropriate length before connecting to the tracer wire with a mainline to the lateral lug connector.

Where the ground rod wire will be connected to a tracer wire access box, a minimum of two feet (2') of excess/slack wire is required after meeting final elevation.

(j) Prohibited Products and Methods. The following products shall not be allowed or acceptable:

- (1) Uninsulated tracer wire
- (2) Tracer wire insulations other than HDPE
- (3) Tracer wires not domestically manufactured
- (4) Non-locking, friction fit, twist on or taped connectors
- (5) Brass or copper ground rods
- (6) Wire connections utilizing taping or spray-on waterproofing
- (7) Brass fittings with tracer wire connection lugs

(k) Approved Products and Methods. The following products have been deemed acceptable and appropriate. These products are a guide only to help you choose the correct applications for your tracer wire project.

- (1) Copper-Clad Steel (CCS) Tracer Wire or approved equal.
- (2) Open Trench. Copperhead #12 High Strength part # 1230G-HS or approved equal.
- (3) Directional Drilling/Boring. Copperhead Extra High Strength part # 1245G-EHS or approved equal.

- (4) Pipe Bursting/Slip Lining. Copperhead SoloShot Extreme Strength 7 x 7 Stranded part # GPBX- 50 or approved equal.
- (5) Connectors Copperhead. 3-way locking connector part # LSC1230C or approved equal.
- (6) DryConn 3-way Direct Bury Lug: Copperhead Part # 3WB-01 or approved equal.
- (7) Termination/Access
- (8) Non-Roadway access boxes applications: Tracer wire access boxes grade level Copperhead 3-way Direct Bury Lug adjustable lite duty Part # LD14G2T-SW or approved equal.
- (9) Concrete / Driveway access box applications: Tracer wire access boxes grade level Copperhead Part # CD14G2T-SW or approved equal.
- (10) Grounding. Drive in Magnesium Ground Rod: Copperhead Part # ANO-12 (1.5 lb.) or approved equal.
- (11) Manufacturer Product Options: Copperhead products or approved equal.

11.3 CONSTRUCTION REQUIREMENTS

11.3.1 WATER LINE AND STORM SEWER CROSSINGS

Where sanitary sewer mains cross water mains, storm sewers or other non-potable lines, the sanitary sewer pipe shall be a minimum of eighteen inches (18") clear distance vertically below the water main or storm sewer. If this clear distance is not feasible, the pipe section must be designed and constructed so as to protect the water main or storm sewer. Minimum protection shall consist of the installation of an impervious and structural sewer. For example:

- (a) **REINFORCED CONCRETE ENCASEMENT.** The sanitary sewer pipe shall be reinforced with a reinforced concrete encasement. The encasement shall be at least six inches (6") thick and extend a distance of ten feet (10') on either side of the water main or storm sewer. See *Section 11.3.11 - PIPE BEDDING LIMITS, REINFORCED CONCRETE ENCASEMENT.*
- (b) **JOINT CENTERING.** The sewer shall be constructed such that one length of pipe, at least eighteen feet (18') long, shall be centered over the water main or storm sewer. Joints between the sewer pipe and special length pipe (18' section of pipe) shall be encased in a concrete collar at least six inches (6") thick and extending at least six inches (6") on either side of the joint.

In all cases, proper soil compaction, suitable backfill or other structural protection shall be provided to preclude settling and/or failure of either pipe.

11.3.2 RAILROAD AND HIGHWAY CROSSINGS

At all railroad and highway crossings, extreme care shall be exercised to safeguard life and property. All sewer work under and adjacent to railroads and highways shall be accomplished to the satisfaction of a representative of the railroad company and/or the Colorado Department of Transportation (CDOT) and the Engineer. The Contractor shall obtain at his own expense all permits, bonds, and insurances necessary for the execution of this work, and/or required by the appropriate railroad or CDOT. Contractor shall submit a plan for approval for crossing railroads or highways unless otherwise shown on drawings.

11.3.3 EXCAVATION - GENERAL

All excavation for sewer and/or manhole construction will be considered as unclassified excavation. The contractor shall make his own estimate of the type and extent of the various

materials which will be encountered in the excavation.

All excavation shall be done by open cut from the surface except when boring is expressly herein permitted or directed in writing by the Engineer. Trenches shall be excavated along the lines and to the grades established by the Engineer. In no case, without previous written consent from the Engineer, shall more than five hundred feet (500') or one (1) block whichever is less, of trench be opened in one place in advance of the completed and backfilled sewer. All open cuts shall be backfilled and barricaded at the end of each day except the unfinished end of the conduit, which may be left unbackfilled to permit continuation the next working day.

Width of the trenches shall be kept to a minimum, but provide safe and adequate space for workers. Contractor shall be responsible for protecting the existing utilities and property. Contractor shall comply with all Local, State and Federal Health and Safety requirements including but not limited to the deposition of cut, sloping, and/or bracing. The cost to meet these safety requirements shall be included in the respective bid items.

The Contractor shall barricade all excavations and ditch lines as specified in the *Manual on Uniform Traffic Control Devices (MUTCD)*. The Engineer may require additional barricades at their discretion. At the end of each day the Contractor shall remove all excess excavated material from travel ways, and thoroughly clean all streets, alleys, driveways, and sidewalks affected by the excavation. If it becomes necessary to accomplish this, all streets, driveways, alleys (if asphalt), and sidewalks shall be swept or washed as needed.

Excavation shall conform to *ARTICLE 7 – EARTHWORK, Section 7.3.2 General Excavation*.

11.3.4 TRENCH EXCAVATION - WIDTH AND DEPTH

The width of the trench shall provide adequate space for workers to place, joint, and bed the pipe properly.

The minimum width of the trench from a plane six inches (6") below the pipe to a plane twelve inches (12") above the pipe shall be a minimum of nine inches (9") clear on each side from the undisturbed edge of the trench wall to the outside diameter of the pipe. This minimum trench width shall also be used for the measurement of trenches in rock.

To protect the pipe from external loads in excess of those used in the design of the pipe, it is necessary to limit the width of the lower portion of the trench below an elevation 12 inches above the top of the installed pipe to 6" below the invert of the pipe. The trench from a plane six inches (6") below the pipe to a plane twelve inches (12") above the pipe shall be excavated so the trench walls are as close to vertical as possible. The maximum trench width within this zone will not be limited but shall be kept as narrow as possible.

When using a movable trench support, care shall be exercised not to disturb the pipe location, jointing or bedding material. Any voids left in the bedding material by support removal shall be carefully filled with additional bedding material and properly tamped. The width and slope of the trench from a plane twelve inches (12") above the pipe to the top of the ground shall be determined by the Contractor. Considering factors shall include, but not be limited to; all safety requirements; type of material being excavated; equipment used; widths of dedicated right-of-ways; and adjacent structures, properties, and utilities.

The trench bottom shall be constructed to provide a firm, stable and uniform support for the full length of the pipe. Except in ledge rock, water bearing earth, or where a special pipe bedding is called for in the contract documents, the rough excavation of trenches shall extend no less than four inches (4") nor more than six inches (6") below the bottom of the pipe.

Correction of a trench grade that is too low shall be done by compacting select material of the

types designated by the Engineer, over the entire width of the trench to 95% of AASHTO T99. Such work required due to over excavation will not be included for payment.

Trench excavation shall meet the requirements of *ARTICLE 7 – EARTHWORK, SECTION 7.3.2(5) TRENCH EXCAVATION*.

11.3.5 HANDLING EXCAVATED MATERIAL

The material excavated from trenches, which is suitable for backfill, shall be kept so as not to significantly alter drainage flow patterns, endanger the work and to be of as little inconvenience as possible to the traveling public and the occupants of the abutting properties. Free access must be maintained at all times to driveways, fire hydrants, water valves, gas valves, existing manholes, etc., in the vicinity of the work.

Where lines are located in alleys or in any other case where the Contractor proposes to deposit material on private property, written permission shall be obtained from the owner of the property prior to placing any material on the property. The Contractor shall be held responsible for any damage to private property.

Materials encountered during clearing of the right-of-way and excavation of the trench such as rubbish, organic material, abandoned foundations and any other material which are not satisfactory for use as backfill in the opinion of the Engineer, shall be removed from the site and disposed of by the Contractor at his own expense.

11.3.6 UNSTABLE SUBGRADE

Where unstable subgrade conditions are encountered, as determined by the Engineer, the Contractor may be required to excavate below subgrade elevation and backfill the unstable area with material as per *Section 11.2.12 - TRENCH STABILIZATION MATERIAL*. The material approved by the Engineer shall be used to an elevation six inches (6") below the bottom of the pipe. Any extra depth of excavation and backfill shall be as ordered by the Engineer, and only when ordered by the Engineer.

If the unstable condition is a result of the Contractor not properly protecting his work from surface water infiltration, or from sewer or water lines damaged or broken by the Contractor, the cost shall be borne by the Contractor. If the unstable soil condition is the result of ground water infiltration and other causes beyond the control of the Contractor, the extra foundation material ordered by the Engineer will be paid for.

Unstable subgrade shall meet the requirements of *ARTICLE 7 – EARTHWORK, SECTION 7.3.2(5)(c) REMOVAL OF UNSTABLE MATERIAL*.

11.3.7 TRENCHES IN ROCK

Rock will be defined as any naturally occurring or manmade material in such a form that it cannot be readily removed using the equivalent of a 165hp/40,000lb operating weight track-type tractor (bulldozer) with a ripper or a 188hp/63,000lb operating weight hydraulic excavator (crawler mounted backhoe) with "rock teeth" without a significant loss of production. It also includes boulders exceeding one-half (½) cubic yard in volume.

Whenever rock material is encountered in an excavation, the Contractor shall immediately notify the Engineer for field verification. The Engineer shall measure and document the limits of the rock prior to excavation. Any rock removed prior to notification will not be considered for payment. After rock has been measured, trenching shall continue by such means as may be necessary, to a depth of six inches (6") below the outside bottom of the pipe, and to a width in

conformance to *Section 11.3.4 - TRENCH EXCAVATION - WIDTH & DEPTH.*

Blasting for rock excavation will only be allowed with written permission from the Engineer and Fire Chief. The Contractor shall exercise the utmost care to protect the public from harm and to avoid property damage. Blasting shall be done by a State licensed blaster. The Contractor shall comply with all laws, ordinances, insurance, bonding, and applicable safety code requirements and regulations and shall be responsible for all damage caused by the blasting operations. Signals warning persons of danger shall be given before any blast.

Blasting shall be controlled so as to not make any excavation unduly large or irregular. Excessive blasting or overshooting shall not be permitted. The Engineer shall have the authority to order any method of blasting which leads to overshooting or is dangerous to the public or destructive to property or to natural features discontinued. Approved blasting blankets shall be used for all blasting.

11.3.8 QUICKSAND AND GROUNDWATER INFILTRATION

Should running sand, quicksand or groundwater be encountered, the work shall be pushed with the utmost vigor. Groundwater encountered in trench or manhole excavations shall be drained to sumps, through sub-drains, or by other methods to keep the water level below the bottom of the bell of the pipe while joints are being made. Dispose of the water in a manner to prevent damage to adjacent properties. Drainage of groundwater through any sanitary sewer pipeline is prohibited. All dewatering and trench stabilization methods and types of equipment used shall be approved by the Engineer.

If dewatering and trench stabilization is required as a result of the Contractor not properly protecting his work from surface water infiltration, or from sewer or water lines being damaged or broken by the Contractor, the cost shall be borne by the Contractor. In the event such work is required through no fault of the Contractor, it shall be considered extra work and a price shall be negotiated.

11.3.9 EXCAVATION FOR STRUCTURES

Excavation for manholes, and miscellaneous structures shall consist of the removal of all material necessary for construction of the work in conformity with the plans and these specifications.

If rock is encountered, the excavation shall be done in such a manner as to allow the rock to be exposed and prepared for receiving the concrete. All loose and disintegrated rock or thin strata shall be stripped to a clean bed acceptable to the Engineer and in conformance to all applicable items as described in *Section 11.3.7 - TRENCHES IN ROCK.*

Whenever the footing is to rest on any excavated surface other than rock, special care shall be taken not to disturb the bottom of the excavation (subgrade), and the final finishing of the surface shall not be done until just before the footing is to be placed. Correction of any over excavated areas shall be at the Contractor's sole expense.

Whenever the subgrade soil is not sufficiently firm, the Contractor is to furnish and compact, according to the direction of the Engineer, select material, as may be required and in conformance to all applicable items as described in *Section 11.3.6 - UNSTABLE SUBGRADE.*

After each excavation is completed, the Contractor shall notify the Engineer, who shall inspect the depth of the excavation and the character of the foundation material. No concrete shall be placed until after the Engineer has approved the depth of the excavation and character of the foundation material.

An Excavation Permit is required for any underground work within the City of Pueblo. The "for-fee" permit shall be obtained from the City Streets Division at 211 E. "D" Street. Any work placed without the benefit of this permit will not be paid for.

11.3.10 PIPE BEDDING LIMITS

Unless stated otherwise on the plans or details or ordered by the Engineer, all pipe shall be bedded in accordance with Class "B" bedding as described below. All classes of bedding shall be properly tamped around the lower half of the pipe (haunches) and horizontally away from the pipe in both directions to the undisturbed trench walls.

- (a) CLASS "A" CRADLE BEDDING. The lower part of the pipe exterior shall be bedded in Class "A" bedding material having a thickness under the pipe of one-fourth ($1/4$) the outside diameter of the pipe or a minimum of six inches (6"), whichever is greater, and extending up the sides of the pipe for a height equal to one-fourth ($1/4$) of the outside diameter of the pipe. The cradle shall have a minimum width equal to the outside diameter of the pipe plus eight inches (8") and it shall be constructed monolithically without horizontal construction joints. Backfill above the cradle, extending twelve inches (12") above the top of the pipe and the full width of the trench shall be Class "B" bedding material.
- (b) CLASS "B" CRADLE BEDDING. The sewer pipe shall be set on a minimum of six inches (6") of Class "B" bedding material carefully shaped to fit the lower part of the conduit exterior for a width of at least 60% of the pipe breadth and for the entire pipe length. After setting the sewer pipe, Class "B" bedding shall be added and properly tamped around the lower half of the pipe (haunches) for the full width of the trench, and the bedding shall be consolidated carefully without disturbing the pipe alignment or grade. Additional Class "B" bedding material shall be added up to a minimum of twelve inches (12") above the top of the pipe for the full width of the trench.
- (c) REINFORCED CONCRETE ENCASEMENT. Concrete encasement shall have a minimum thickness of six inches (6") around the pipe. This encasement shall be formed on both sides to produce a rectangular shape and shall be reinforced as shown on the Standard Detail. When required, it shall extend a minimum distance of ten feet (10') on each side of a water main crossing or at the location and the dimensions as shown on the plans. Backfill adjacent to the encasement, extending the full width of the trench shall be class "B" bedding.
- (d) REINFORCED CONCRETE ARCH. The pipe shall be embedded in class "B" bedding material having a minimum thickness of six inches (6") between the barrel and the bottom of the trench excavation and extending to the springline (springline means the cross-section, horizontal centerline of the pipe) of the pipe. The top of the pipe shall be covered with a reinforced concrete arch having a minimum thickness of $1/4$ the outside diameter or four inches (4") minimum, measured at the crown of the pipe and having a minimum width equal to the outside diameter plus eight inches (8"). When required, it shall be extended at the location and the dimensions as shown on the plans. Backfill adjacent to the concrete arch, extending the full width of the trench, shall be class "B" bedding.

11.3.11 PIPE LAYING

Pipe shall be protected during handling against impact shocks and free fall. Proper methods shall be used for handling and placing pipe to avoid spalling or breaking and to avoid unnecessary disturbance of the bedding surface in the trench bottom. Pipe shall be kept clean at all times and no pipe that does not conform to these specifications shall be used in the work.

Pipes shall be laid to a true line and at uniform rates of grade between manholes as shown on the plans. The laying of the pipe in prepared trenches shall commence at the lowest point with the spigot ends pointing in the direction of flow. No pipe shall be laid in water or when trench conditions are unsuitable for such work.

The Contractor shall take every precaution necessary to prevent dirt, debris or surface water from entering the existing lines or new construction. Contractor shall exercise reasonable diligence in preventing sewage from seeping into the ground during the removal and replacement of any sanitary sewer main. Best management practices shall be utilized to prevent such seepage of sewer water, which shall include, but are not limited to, the following:

- (1) Minimize the amount of time sewer water is allowed to remain in trench.
- (2) Channel water from the old pipe to the new pipe with a temporary pipe, impervious trough or gutter, whenever practical.
- (3) Hard tie the newly laid pipe and existing pipe during holidays, weekends and nights unless a bypass is used.

All bypass pumping, temporary connections or other work needed to comply with this requirement shall be considered incidental to the sanitary sewer pipe and all costs in connection therewith shall be included in the unit price for the pipe, unless otherwise stated on the plans and specifications.

The Contractor shall submit a plan for handling existing sewage flows while rehabilitating the pipe at the pre-construction meeting for approval by the City. The bypass plan must be designed in accordance with the approved traffic control plans and identify the location of any pumping equipment, temporary discharge piping, pumping and discharge manholes, redundant pumps and piping, the location of nearby waterways or drainages, and the method for diverting runoff around the site. The Contractor shall be responsible to obtain all existing flow measurements in the sewer to determine a bypass plan. Precautions must be taken to ensure that sewage flow control operations do not cause damage to properties being served by the sewers involved. Raw wastewater shall not run freely through any open ditch. Bypass pumping will not be allowed during nonworking hours unless authorized by the Engineer. When 24-hour pumping operations have been approved by the Engineer in residential areas, attenuated pumps will be required to minimize noise disturbance. The Contractor shall provide 100% redundancy on any 24-hour pumping operation, near any waterways or any site deemed necessary by the Engineer. Bypass piping shall be placed in trenches and covered with temporary pavement or metal traffic covers when traffic conditions dictate the need for protection of the piping unless otherwise directed by the Engineer. The Engineer may specify additional design requirements based on specific site conditions.

Each bypass pumping system shall be hydrostatically tested using potable water prior to use. Unless otherwise indicated, water for testing bypass pipelines shall be furnished by the Contractor. The bypass pumping system may require air release valves to release air that may become trapped in the bypass system piping. The bypass pumping system shall be filled at a rate that will not cause any surges or exceed the rate at which air can be released through the air valves. The differential pressure across the orifices in the air release valves shall not be allowed to exceed 5 psi at any time during filling. Once the system has been successfully filled and all air purged, the piping system exclusive of the pump(s) shall be pressurized to 150% of the calculated working pressure, or 40 psi, whichever is greater, measured at the lowest point along the alignment, and hydrostatically tested for a minimum of 30 minutes. During the test, the entire system shall be visually inspected for leaks and monitored for pressure drops. Any leaks encountered shall be repaired at the Contractors cost, and the hydrostatic pressure test restarted until the system successfully passes the test. Potable water used during the test shall be discharged to the wastewater system at a controlled rate to prevent surcharging of the wastewater system and wastewater service lines.

If the City must provide personnel and equipment to minimize damages, in the event of any failure of the Contractor's sewage flow control operations, the Contractor shall be liable for all costs incurred by the City. The Contractor will be charged \$550 per hour that the City of Pueblo crews are onsite, which will be deducted from the amount of the Contractor's final payment.

Service line wyes shall be placed on the sewer main at the points shown on the plans or where directed by the Engineer. The service lines shall be extended to the right-of-way line. All shall be per the requirements of *Section 11.3.14 - SANITARY SEWER SERVICE LINE INSTALLATIONS*.

- (a) **ALIGNMENT.** All pipe shall be laid to the lines and grades given by the Engineer, with joints close and even, butting all around. They shall be carefully centered and shall not deviate more than one inch (1") from line so that when laid, the pipe will form a sanitary sewer with a uniform invert and a straight alignment, unless a specified curve alignment is shown on the plans.

The grade of the pipe shall be obtained by using batter boards and a "top line," batter boards with a double string line having a minimum of four feet (4') separation, a laser beam, or by the use of surveying instruments approved by the Engineer. The grade shall not be obtained by placing a carpenter's level on individual pipes.

If batter boards are used when pipe laying is in progress, the Contractor shall at all times maintain batter boards for a distance covering at least three grade stakes. The elevation of the batter boards shall be determined from the depth of cut as given by the Engineer, and the Contractor shall assign on each crew a person whose duty it shall be to see that the batter boards are in the proper place at all times. It is not intended that these requirements make it necessary for the Contractor to keep a person especially for this purpose, but to provide that a competent person shall be with each crew at all times whose duty it shall be to attend to the placing of the batter boards and the giving of grades to the pipe layer.

If a method other than batter boards is used, the instrument used shall be operated continuously under the supervision of a qualified foreman or superintendent. The pipe grade shall be checked by an alternate method at fifty-foot (50') intervals and upon request of the Engineer.

All PVC pipe shall be tested with a certified mandrel (go-no-go device) prior to construction of surface improvements.

- (b) **VERTICAL TOLERANCE.** All pipe shall be installed within the following range of tolerances. Any pipe not within the specified spot elevation tolerance shall be re-laid.

PIPE GRADE TOLERANCE TABLE		
PIPE DIA. (INCHES)	GRADE (S) (%)	
	S ≤ 0.50	S > 0.50
8	±0.02 Ft	±0.04 Ft
10 – 15	±0.03 Ft	±0.04 Ft
18 or larger	±0.04 Ft	±0.04 Ft

In no case shall a section of pipe be accepted if it does not possess a positive grade (i.e., no flat or adverse sections).

- (c) **JOINTING PIPE.** All pipe joints shall be made in the manner and under the conditions described under the various types of joints for the work. Prior to making pipe joints, all

surfaces of the portion of the pipe to be jointed shall be cleaned. All pipe joints shall be watertight when completed.

- (1) ELASTOMERIC GASKET JOINTS – The assembly of the gasketed joint shall be performed in general conformance with the recommendations of the pipe manufacturer. The Contractor shall provide a suitable method of installation to ensure the pipe being entered is true and concentric with the previously laid pipe so as to prevent injury to the elastomeric gasket. When jointed, the pipe shall form a smooth and true pipeline.
 - (i) Mechanical methods shall be employed, if necessary, to pull or push the pipe together with sufficient force to compress the gasket sufficiently to make a watertight joint.
- (2) SOLVENT CEMENTED JOINTS - Solvent cemented joints are not allowed on eight-inch (8") diameter and larger pipes unless otherwise approved by the Engineer, in writing. If approved, the assembly shall be made in accordance with ASTM D2855 standard practice. Remove dirt and mud from the bell and spigot. Apply primer liberally to the outside of the spigot and inside of the coupling. Immediately apply cement and make joint by shoving home with 1/4 rotation (within a minute).
- (3) OTHER TYPE JOINTS - If any other type of joint is proposed to be used, it shall conform to the requirements of these specifications that apply, and the Contractor shall obtain written approval of the Engineer for its use. Connections to unlike materials must also be pre-approved, in writing, and may require Class "A" bedding (concrete cradle) at the connection joint. When joining pipe sections via a coupler, a Fernco Strong Back RC Series Repair Coupling or an approved equal shielded coupler shall be used to connect the existing to the new sewer pipe.
- (d) TRACER WIRE. The work covered by this section of the specifications consists of the furnishing of all labor, supplies, equipment and materials and performing all operations in connection with the installation of tracer wire and appurtenances, as shown on the plans, as herein specified and directed by the Engineer to comply with Senate Bill 18-167. The bill requires that all new underground facilities, including laterals up to the structure or building being served, installed on or after August 8, 2018, must be electronically locatable when installed per section 9-1.5-103(10), C.R.S.
 - (1) Tracer wire installation shall be performed in such a manner that allows proper access for the connection of line tracing equipment, the proper locating of wire without loss or deterioration of low frequency (512Hz) signal for distances in excess of 1,000 linear feet, and without distortion of signal caused by multiple wires being installed in close proximity to one another.
 - (2) Tracer wire systems must be installed as a single continuous wire, except where using approved connectors. No looping or coiling of wire is allowed. Any damage occurring during installation of the tracer wire must be immediately repaired by removing the damaged wire and installing a new section of wire with approved connectors. Taping and/or spray coating shall not be allowed.
 - (3) Tracer wire shall be installed at the top of the pipe and secured (taped/tied) at 5' intervals.
 - (4) Tracer wire must be properly grounded as specified.

- (5) Tracer wire on all service laterals/stubs must terminate at an approved tracer wire access box located directly above the utility, at the edge of the road right-of-way but out of the roadway. (See *TRACER WIRE TERMINATION/ACCESS*)
- (6) At all mainline dead-ends, tracer wire shall go to ground using an approved connection to a drive-in magnesium ground rod, buried at the same depth as the tracer wire. (See *GROUNDING*).
- (7) Mainline tracer wire shall not be connected to existing conductive pipes. Treat it as a mainline dead-end and ground using an approved waterproof connection to a ground rod buried at the same depth as the tracer wire.
- (8) All service lateral tracer wires shall be a single wire, connected to the mainline tracer wire using an approved mainline to lateral lug connector, installed without cutting/splicing the mainline tracer wire.
- (9) In occurrences where an existing tracer wire is encountered on an existing utility that is being extended or tied into, the new tracer wire and existing tracer wire shall be connected using approved splice connectors and shall be properly grounded at the splice location as specified.
- (10) All service lateral tracer wires must be properly connected to the mainline tracer wire to ensure full tracing/locating capabilities from a single connection point. Lay mainline tracer wire continuously, by-passing around the outside of manholes/structures on the north or east side. Tracer wire on all sewer laterals must terminate at the property line with a coil of 6 feet of tracer wire taped directly to the service lateral at the edge of the road right-of-way or at an approved location.
- (11) The City of Pueblo Wastewater Department must be contacted to inspect tracer wire installation prior to backfilling any infrastructure that connects to the City's sanitary sewer system.
- (12) The following methods shall not be allowed:
 - (i) Looped wire or continuous wire installations, that has multiple wires laid side-by-side or in close proximity to one another
 - (ii) Tracer wire wrapped around the corresponding utility
 - (iii) Wire terminations within the roadway, i.e. in valve boxes, cleanouts, manholes, etc.
 - (iv) Connecting tracer wire to any conductive utilities

11.3.12 BACKFILLING

The line, grade, joints and bedding of the sanitary sewer shall be inspected and approved by the Engineer before backfilling operations commence.

If Class "A" Cradle Bedding or Reinforced Concrete Encasement has been constructed, no backfilling shall commence until the concrete has either attained a compressive strength of 2000 pounds per square inch, or seven (7) days have elapsed.

After the initial backfill (bedding) has been carefully placed in the pipe zone to at least one foot (1') above the top of the pipe, the remainder of the trench shall be backfilled and compacted. Depositing of the backfill material shall be done so that the impact of falling material will not damage the pipe or structures.

Permission to use specific compaction equipment shall not be construed as guaranteeing or implying that the use of such equipment will not result in damage to the adjacent ground, existing improvements, or improvements installed under the contract. The Contractor shall make their own determination in this regard.

The Contractor shall employ whatever equipment and methods are necessary to obtain the

moisture and required density. All soils within the compaction limits shall be compacted to ninety-five percent (95%) of the maximum dry density as defined by AASHTO T99 (Standard Proctor). Moisture content for all compacted soils shall be within plus or minus 2% of the optimum unless field observation verifies that the soils are unstable at lesser moisture contents. In those cases, the Engineer shall establish a minimum moisture content.

On all sewer installations, compaction tests shall be made by an approved, independent testing laboratory and shall identify the location and depth of the test, the date of the test, the maximum Standard Proctor density and optimum moisture content of the soil, and give the percent of compaction and moisture content of the backfill material at the test location. Compaction tests shall be made at a depth of three feet (3') above the top of the pipe and at two-foot (2') intervals in depth, up to and including the surface. Testing shall be done at a minimum of one location for every 250 feet of main line trench or a fraction thereof and at every manhole or similar structure. Where excavations for service lines branch off the main trench, every fourth service line trench shall be tested.

All test locations shall be randomly spaced as directed by the Engineer. These tests shall be made at the expense of the Contractor and are intended to give the Contractor and City an indication of the effectiveness of the compaction procedure and shall not relieve the Contractor of any provisions of this specification. **All Compaction tests shall be submitted and accepted by the City prior to the construction of any surface improvements.**

If any compaction test should fail to meet the requirements of this section, at least two (2) additional locations shall be tested along the trench, at locations designated by the Engineer, to determine the extent of the non-compliance. After the extent of non-compliance has been determined, that section of trench shall be re-compacted and retested at a minimum of two (2) locations as directed by the Engineer. If the failure occurs at a service lateral, another lateral shall be tested in addition to the non-compliance testing requirements.

In the event of settlement or subsidence of a particular excavation or any part thereof, the Contractor shall be responsible for all repaving, overlay and repair costs occasioned thereby for a period of two (2) years after the project/subdivision acceptance date.

If requested by the Contractor/Developer, and written permission is granted by the City Engineer, backfill for utility trenches may be consolidated using water induced settlement techniques (jetting/puddling). This method of trench backfill consolidation shall only be allowed in those special locations where a failure history exists for trenches using conventional engineered controlled fill. As a condition of permission to use jetting/puddling, the Contractor/Developer must agree in writing to provide a full and complete three (3) year warranty from the final acceptance date, that shall include the repair of any surface amenities to the complete satisfaction of the City which may include a full width asphaltic overlay if warranted.

Where backfill for utility trenches within the roadway section are consolidated using jetting/puddling, the moisture and density requirements within the trench compaction limits stated above shall not apply; however, the compaction limits for the finished roadway subgrade as outlined under *ARTICLE 7 - EARTHWORK* shall apply.

11.3.13 MANHOLE CONSTRUCTION AND ADJUSTMENT

Manhole bases and barrels shall be constructed of the material as specified in *Section 11.2 - MATERIALS*, unless otherwise specified on the plans or by the Engineer. Contractor shall wait a minimum of twenty-four (24) hours before setting manhole barrel sections on cast-in-place bases. No backfilling shall commence around the manhole bases until the concrete has either attained a compressive strength of 2,000 pounds per square inch, or seven (7) days have

elapsed.

The flow channel shall be made to conform in slope and shape to that of the sewer pipe and wherever possible, the lower one-half of the sewer pipe shall be used for the invert of the open flow channel. At intersections with other lines, channels shall be formed with a sweeping curve to minimize turbulence.

When branch mains are being connected to a manhole with collector or backbone mains, the smaller pipe diameter, the branch main, invert must be higher than the larger pipe, the collector or backbone main, to avoid any interruption in flow in the branch main, per *City of Pueblo Sanitary Sewer Design Criteria Manual Table 4.3 Design Depth of Flow*. Unless otherwise specified on the plans or specifications, all manhole channels shall be constructed with a minimum elevation drop as shown:

HORIZONTAL DEFLECTION ANGLE OF SEWER PIPE AT MANHOLE	MINIMUM DROP
0°	0.10' *
Between 0° & 45°	0.20'
45° to 90°	0.30'

Changes in direction at the intersections of sewers shall not be greater than 90 degrees.

* The minimum drop at a manhole with a 0-degree pipe deflection can be less than 0.10 feet when the grades of the pipe entering and exiting the manhole are the same and the pipe is laid continuously through the manhole, using the bottom half of the pipe as the channel.

Connection to an existing manhole shall be made so that the inlet flowline is above the existing concrete manhole base. When connection to an existing manhole is allowed, the contractor shall cut into the existing manhole to install the new sewer pipe and provide a water stop and non-shrink grout for a watertight connection. A concrete channel shall be formed within the existing manhole to provide a smooth discharge from the new pipe to the existing channel.

An external drop manhole shall be constructed when the difference between the elevation of the inlet and outlet flowlines is two feet (2') or greater. Internal drop manhole assemblies will not be allowed. See *Manhole Base Section with Drop Assembly Detail, SD24*. Epoxy coating of the manhole may be required at the discretion of the Engineer due to high hydrogen sulfide production from excessive drop distances, per *Section 4.14 of the city of Pueblo Sanitary Sewer Design Criteria Manual*.

When pipe is used as the channel in manholes, no pipe joint shall be allowed in the manhole unless otherwise specified on the plans. Dead end manholes shall have a channel extended a minimum of three feet (3') inside the manhole at the same grade as the sewer pipe.

All manhole ring and covers in streets to be paved shall initially be constructed to a height to the top of the subgrade or twelve inches (12") below the proposed finished pavement grade, whichever is less. When adjusted to a finished pavement grade, the manhole ring and cover shall be constructed so that the top of the manhole ring and cover will be flush ($\pm 1/4"$) with the replacement pavement or the grade established by the Engineer, and shall have at least one (1) four inch (4") thick precast concrete or high density polyethylene adjustment ring. Adjustment rings shall not exceed twelve inches (12") in height. High density polyethylene adjustment rings must be pre-approved by the Engineer before use and be rated for HS-20 loading.

Contractor shall salvage rings and covers removed from existing manholes. Rings and covers

shall become the property of the City.

When connecting to an existing manhole with rebar steps, the steps shall be removed by cutting them flush with the wall of the manhole. Where rebar steps are removed, the exposed rebar ends shall be sealed with a Rustoleum Enamel Paint or an approved equal.

When trenchless methods are used to rehabilitate manholes, the interior surface of the manholes will be coated with 100% solid, self-priming, ultra-high build epoxy applied to a minimum thickness of 125 mils with an airless spray gun applicator. To ensure a 125 mils thickness, a wet film thickness gauge shall be used to verify thickness during the application process. A micro-gauge may be used after application to ensure no shrinkage has occurred after the curing process. The contractor may have an ultrasound on hand to show thickness is being met. Apply epoxy coatings in accordance with the manufacturer's instructions. The epoxy coating shall completely cover all manhole walls and bases to the low flow line of the pipe, unless otherwise directed by the Engineer, to ensure a seal from outside water sources. The Contractor shall sawcut a line, "key", between the metal frame and concrete of the manhole wall. The finished surface on all components of the manhole will be smooth and free of sags, ridges, skips, voids, and pinholes.

A "*Manhole Coating*" form must be submitted for each manhole. The form must be submitted at the Pre-Construction Conference for approval. The Contractor may elect to use a form provided by the City of Pueblo. The report shall be submitted to the engineer within one week of completion of testing or as directed by the City for review of the application process. The coating inspection report shall document: project and manhole identification, coating material, dry film thickness and holiday tests results, adhesion testing results if applicable, and City Engineer's signature to verify test results.

Manholes constructed in areas with excessive groundwater tables or in areas identified as having high concentrations of selenium and/or sulfate in the groundwater, as determined by the City Engineer, will be required to be epoxy coated to eliminate any infiltration.

11.3.14 SANITARY SEWER SERVICE LINE INSTALLATIONS

Service lines shall be installed from the main to the right-of-way line or as shown on plans. Connections to manholes are prohibited unless otherwise approved by the Engineer. Lines shall be inspected and approved by the Engineer or designated entity.

Service lines shall be connected to the sewer main, so that the flowline is at or above the spring line of the pipe for 8" and 10" sewer mains and in the top 1/4 of the pipe for 12" and larger sewer mains. Service lines shall not be connected to the City mainline manholes unless otherwise approved by the Engineer.

Sewer service lines shall not protrude into the interior of the sanitary sewer main. Service lines shall connect to the sanitary sewer main in a manner that creates a watertight joint and provides a smooth, continuous interior pipe surface.

All service lines shall be placed on a slope of one-fourth inch (1/4") per one foot (1') from the main to the property line, unless otherwise specified on the plans, standard details or in writing by the Engineer.

The ends of all service lines shall be plugged and marked for location with a 2" x 4" board or other suitable marker extending two feet (2') above grade and three feet (3') below grade in addition to a three inch (3") wide, green, plastic tape tied to the end of the service line and extending to a point six inches (6") above the ground surface. The Contractor shall assist the

Engineer in measurements and locations of constructed service lines and submit "as built" plans.

When reinstating an existing PVC service via an open trench, the Contractor shall use a hard tie, polyvinyl chloride (PVC) fitting. All other services shall be reinstated using a Fernco Strong Back RC Series Repair Coupling or an approved equal, shielded coupler to connect the existing pipe to the new service pipe. The Contractor shall be responsible for all costs incurred for a service line tap not properly located, to include but not limited to excavation and restoration of the missed service.

Bedding shall meet the requirements of Class "B" as per *Section 11.2.11 – BEDDING FOR PIPE*, and *Section 11.3.10 – PIPE BEDDING LIMITS* and the backfill material shall be similar to that required for sanitary sewer mains as per *Section 11.2.13 – BACKFILL MATERIAL*. All backfill shall be consolidated by the requirements of *Section 11.3.12 – BACKFILLING*.

11.3.15 TESTING AND INSPECTION

No surface improvements shall be constructed over the new sanitary sewer until all testing and televised inspection of the pipe is accepted by the City, unless otherwise authorized by the City. The Contractor shall conduct the testing and be responsible for furnishing all equipment and labor for testing. The Engineer shall verify the accuracy and acceptability of the equipment used and witness all tests.

Any sanitary sewer line where infiltration or exfiltration tests show leakage in the sewer line and/or manholes exceeding fifty (50) gallons per inch diameter, per mile, per day or pipe deflection exceeding five percent (5%) of the inside diameter, will not be accepted. After acceptable backfilling but before construction of surface improvements over any sewer line, tests shall be run to determine whether these limits are exceeded. At the direction of the Engineer, the section between the first two (2) manholes of all projects may be tested before further construction to permit initial observation of the quality of the construction workmanship. Tests shall also be conducted at any time during construction when in the opinion of the Engineer, the quality of the workmanship is questionable. The type of test conducted shall be at the Engineer's discretion. Whenever the rate of infiltration, exfiltration or deflection is found to exceed the allowable amounts, the Contractor shall stop construction. The Contractor may then be required to provide, at their own expense, televised or photographic visual inspection of the interior of the pipe to help determine the reason for failing the testing. The Contractor shall make the appropriate repairs by methods approved by the Engineer and shall retest the sewer until it is satisfactory. No compensation shall be paid to the Contractor for testing, televising, photographing, repairing, or reconstruction to comply with the allowable amounts.

All gravity sewers will be inspected by closed-circuit television, by the City, after other utility installations and acceptance of all testing, but prior to construction of surface improvements over the new sewer unless otherwise authorized by the City. The Contractor shall thoroughly clean all sewers prior to televising by the City. The City requires five (5) working days advance notice for scheduling the televising and will be allowed five (5) working days to complete the television inspection.

- (a) INFILTRATION. In areas where excessive groundwater is encountered or in areas identified as having high concentrations of selenium and/or sulfate in the groundwater, an infiltration test or pneumatic pressure test will be required. An excessive amount of groundwater for testing purposes is defined as the amount of groundwater needed to produce over two feet (2') of hydrostatic pressure on the crown of the pipe along the entire test section. The Contractor will be required to prove this by installing manometer tubes at the ends of the test section in the manholes. The determination of groundwater elevation (installation of manometer tubes) shall be in accordance with *Section 8, of the*

Uni-Bell Plastic Pipe Association - Recommended Practice for Low-Pressure Air Testing of Installed Sewer Pipe (Uni-B-6). If infiltration is less than the allowable amount, the Contractor will still be required to stop any obvious individual leaks that may be observed by the Engineer when so directed.

- (1) **INFILTRATION TEST.** Infiltration tests shall be made by plugging the end of the sewer section being tested at the upper manhole to prevent the entry of water. The amount of infiltration shall then be measured by placing an approved weir in the lower part of the outlet end of the test section. The time for the test shall be of such duration as necessary to achieve stable flow over the weir, but in no case less than two hours. Determination of flow will be made by the direct reading of a calibrated weir or by hydraulic calculations taken at ten-minute intervals beginning after the first hour of lapsed time.

- (2) **PNEUMATIC PRESSURE TEST.** In preparation for a pipe acceptance test using low pressure air, all pneumatic plugs shall be seal tested before being used in the actual test installation. One length of pipe shall be sealed at both ends with the pneumatic plugs to be checked. The plugs, installed in accordance with the manufacturer's recommendations, shall hold against a pressure of five (5) pounds per square inch gauge (psig) without bracing and without movement of the plugs out of the pipe. However, during actual testing, the Contractor should internally or externally brace the plugs as an added safety precaution. Plugs found acceptable by this testing shall be placed in the test installation and low-pressure air introduced into the sealed line until the internal air pressure reaches four (4) psig greater than the average back pressure of any groundwater that may be over the pipe but not greater than nine (9) psig. The level of groundwater back pressure shall be determined by averaging the readings of groundwater manometer tubes installed at the manholes of the section of pipe being tested. The air pressure correction, which must be added to a 3.5 psig test starting pressure, shall be calculated by dividing the average vertical height, in feet of groundwater above the invert of the pipe to be tested by 2.31. At least two (2) minutes shall be allowed for the air pressure to stabilize. After the stabilization period, the air hose from the control panel to the air supply shall be disconnected and the pressure shall be decreased to 3.5 psig (plus any required air pressure correction) for the start of timing. The portion of line being tested shall be termed "Acceptable" if the time shown, for the given diameters in the following table, elapses before the air pressure drops 0.5 psig from the test starting pressure.

PIPE DIA. (inches)	MINIMUM TIME (min:sec)	LENGTH (L) FOR A MINIMUM TIME (feet)	TIME FOR LONGER LENGTH (sec)
8	3:47	298	0.760L
10	4:43	239	1.187L
12	5:40	199	1.709L
15	7:05	159	2.671L
18	8:30	133	3.846L
21	9:55	114	5.235L
24	11:20	99	6.837L
27	12:45	88	8.653L

Contractors testing equipment shall have 3/8 inch standard female fitting to accommodate the City inspector's gauge and a regulator or a relief valve set no greater than nine (9) psig to avoid over-pressurizing.

(b) EXFILTRATION. Except in areas where excessive amounts of groundwater are encountered, the Contractor shall measure the rate of exfiltration by either a hydrostatic pressure test or a pneumatic pressure test (as outlined above).

(1) HYDROSTATIC PRESSURE TEST. The section to be tested shall be prepared by plugging the lower end of the section and the inlet sewer or sewers of the upper manholes and filling the pipe and upstream manhole with water to a depth of two feet (2') above the top of pipe at the upstream manhole of the test section or two feet (2') above the normal ground water level at the upstream manhole of the test section, whichever is greater. The maximum internal pipe pressure at the lowest end shall not exceed twenty-five feet (25') of head of water or 10.8 psi. Only after the test section has been acceptably isolated and filled with water can the test period begin. The period shall be two hours in duration. Leakage by exfiltration shall be determined by measuring the drop in the water level in the upstream manhole at the end of the test period. The exfiltration test time period may be extended beyond the minimum two-hour period when necessary to effectively determine the source of leakage when test results are unsatisfactory.

(c) DEFLECTION TESTING. All PVC pipe less than twenty-four inches (24") in diameter shall be tested for deflection, after backfilling, by the Contractor by means of a certified mandrel (go-no-go device). The diameter of the mandrel shall be five percent (5%) less than the inside diameter of the sewer pipe. The mandrel shall be pulled through all installed pipes. All testing shall be under the direction of the Engineer.

Pipe shall be removed, replaced and retested if maximum deflection exceeds five percent of the pipe's nominal internal diameter. Pipe shall be retested for deflection by the City of Pueblo prior to the end of the two-year warranty period. Any pipe showing a deflection in excess of five percent (5%), after testing by the City, shall be removed and replaced by the Contractor.

(d) ACCEPTANCE. Acceptance of the pipe in the tested section will be granted by the Engineer only after all defects such as poor alignment, misplaced pipe, and broken pipe have been remedied, and prescribed testing satisfactorily completed. Acceptance of the pipe does not relieve the Contractor of responsibilities imposed by all other sections of these specifications.

Work accomplished under this section will not be measured, nor will it be paid for directly. This work will be considered as incidental to the sanitary sewer pipe and all costs in connection therewith shall be included in the unit price for the pipe.

(e) MANHOLE TESTING. After the epoxy coating has cured in manholes, it shall be inspected and tested per NACE (National Association of Corrosion Engineers) RP0188 specifications.

(1) Holiday Testing. Every manhole shall be tested using high voltage holiday detection equipment (a spark tester). An induced holiday shall be made into the coated concrete surface and shall serve to determine the minimum/maximum voltage to be used to test the coating for holidays in that particular area. The spark tester shall be initially set per manufacturer's specification but may be increased if it

is insufficient to detect the induced holiday. All detected holidays shall be marked and repaired per the manufacturer's recommendations.

The Contractor shall submit test results to the Engineer no later than one (1) week after testing the epoxy coating. Approved test results shall include test results, date tested, location of the test and shall be signed by the inspector. No payment shall be made for any manhole prior to manhole forms being submitted.

A failed manhole will have one (1) or more sparks in a single vertical foot. Any pinholes, thin areas, or any other imperfections identified by the holiday test will require a repair per the manufacturer's specifications.

- (2) Adhesion Testing. The Contractor shall conduct adhesion testing in accordance with ASTM D4541 and D7234. Three-20-mm dollies will be placed on the bottom, middle and top of the manhole. Prepare dollies with a 3,500 psi strength 24 -hour adhesive and score around the dolly for the testing process. If results fail to meet the results in the table found in the *Epoxy Coating Table, Section 11.2.6 (b)*, the test will be considered failed. If two out of three tests fail, additional tests will be performed. Testing will include 25% of the manholes in the Project picked at random. During the testing, if more than 50% of manholes fail of those initially tested, ALL manholes in the Project will be subject to testing or as directed by the Engineer. If subsequent tests fail, all manholes could be considered unacceptable and will be subject to removal and reapplication of epoxy. The Contractor shall repair all test sites after adhesion tests have been performed. No additional cost to the project will be paid to perform all adhesion tests and epoxy coating patch due to testing. A Type V automatic self-aligning adhesion tester shall be used per ASTM 4541 specifications.

- (f) TRACER WIRE TESTING. All new tracer wire installations shall be located using typical low frequency (512Hz) line tracing equipment, witnessed by the Contractor and Engineer, prior to acceptance of ownership. This verification shall be performed upon completion of rough grading and again prior to final acceptance of the project. Continuity testing in lieu of actual line tracing shall not be accepted.

11.3.16 CLEANING SEWERS AND APPURTENANCES

The sewers and all appurtenances shall be thoroughly cleaned at the Contractors expense under the direction and to the satisfaction of the Engineer before final acceptance of the work. In the event the City has to perform any cleaning, the Contractor will be charged \$550 per hour for the cost of labor, equipment, and materials.

11.3.17 REPLACING SIDEWALKS, CURB AND GUTTER, BASE COURSE, PAVING, ETC.

Where sidewalks, curb and gutter, culverts, etc., are removed within the limits of the work, the Contractor shall compact the backfill as specified under the applicable Article, and shall then replace sidewalks, curb and gutter, culverts, etc., in accordance with the prevailing City Specifications for the class of work involved. Sidewalk and curb and gutter removals shall be in accordance with *ARTICLE – 4 CONCRETE, Section 4.8.3. and Section 4.8.2.* Where grassed areas are encountered, the Contractor shall replace all sod with sod of similar characteristics to that adjacent.

A Concrete Permit is required for all concrete work within the City of Pueblo. A “no fee” Concrete Permit shall be issued by the City Engineering Division for City funded projects. Any

concrete work placed without benefit of both permit and inspection by Public Works will not be paid for.

11.3.18 GRAVEL SURFACED STREETS OR ALLEYS

When trenches are excavated in streets or alleys which have only a gravel surface, the Contractor shall replace such surfacing on a compacted backfill with gravel conforming to *ARTICLE 6 - AGGREGATE BASE CONSTRUCTION, CLASS 6*, equal in depth to that which originally existed or a minimum thickness of two inches (2"). The surface shall conform to the street or alley grade as set by the Engineer. Where the completed surface settles below the finished grade, additional gravel base course material shall be placed and compacted immediately to restore the roadbed surface to finished grade and to allow drainage.

11.3.19 CONCRETE AND ASPHALT PAVEMENT REMOVAL AND REPLACEMENT

When concrete pavement is removed, the removal shall be to an existing joint or to a sawed joint which is made prior to the removal.

The final edges of the asphalt removed and replaced shall be along a straight line, neatly sawed to a depth which allows the pavement to be removed with no disturbance to the asphalt left in place.

The edges of the pavement (either concrete or asphalt) removal and replacement shall extend one foot (1') beyond the edge of the excavation required for pipe installation. The edges of the pavement shall be clean, straight, and free from jagged intrusions and loose pieces. If the edges of the pavement are not straight, the Contractor shall saw cut back to a point where a straight edge can be maintained or overlay the asphalt patch with a minimum of 3x the nominal aggregate size asphaltic overlay, extending two feet (2') beyond the edges of the asphalt patch. Concrete or asphalt removed from the trench surface shall not be used in the initial backfill, and all pieces exceeding eight inches (8") in any dimension shall be removed from the site.

If the distance from the lip line of the curb & gutter to the trench is less than four feet (4'), all asphalt shall be removed from lip to the trench line.

11.3.20 ASPHALT PAVED STREETS

When trenches for public mains are excavated in streets that have an asphalt surface, the Contractor shall replace such surfacing as follows:

- (a) Place controlled low strength materials (CLSM) (flowable fill) having a minimum thickness of two (2) feet below the hot asphalt bituminous pavement.
- (b) Place hot bituminous asphalt pavement wearing surface having a minimum compacted thickness equal to the original pavement, or four inches (4"), whichever is greater.

All the foregoing materials and methods of application shall comply with *ARTICLE 6 - AGGREGATE BASE CONSTRUCTION and ARTICLE 8 - PAVEMENT*.

Outside of trench areas, the Contractor shall restore damaged bituminous surfaced streets to the condition which existed prior to construction. The Contractor shall make these repairs at their own expense if the damage is a result of their operations.

11.3.21 CONCRETE PAVED STREETS

When trenches are excavated in streets constructed of concrete, the Contractor shall replace said concrete with an equivalent concrete pavement. Said concrete pavement shall have a

minimum thickness conforming to *ARTICLE 8 - PAVEMENT* and shall be placed on six inches (6") of Class 6 base conforming to *ARTICLE 6 - AGGREGATE BASE CONSTRUCTION*.

Outside of trench areas, the Contractor shall restore damaged concrete surfaced streets to the condition which existed prior to construction. The Contractor shall make these repairs at their own expense if the damage is a result of their operations.

11.3.22 CONCRETE CURB AND GUTTER, SIDEWALK, DRIVEWAY, ALLEY PAN AND DIP REMOVAL

Concrete curb and gutter, sidewalks, driveways, alley pans and dips shall be removed to the limits designated by the Engineer. All joints (except expansion joints) shall be saw cut prior to removal unless otherwise directed by the Engineer. Any concrete broken or disturbed by the Contractor outside of the designated limits shall be replaced at the expense of the Contractor at no cost to the project. Sawing shall be considered incidental and subsidiary to the pipeline excavation. See *ARTICLE 4 – CONCRETE* for additional requirements.

11.3.23 CITY RESERVES RIGHT TO DO REPAVING OR RESURFACING OF STREETS

The City reserves the right to do the repaving or resurfacing of the streets even though the Proposal lists quantities for doing such work. The Engineer may direct the Contractor to omit any portion or all repaving or resurfacing, in which case the Contractor shall not be entitled to any adjustment or allowance in contract prices.

11.3.24 ASPHALT OR CONCRETE UNAVAILABLE OR INCLEMENT WEATHER ON COMPLETION OF BACKFILL

Upon completion of backfill operations, if hot bituminous asphalt or concrete is unavailable or the weather is inclement, a temporary asphalt surface - cold mix or other approved material - having a two inch (2") minimum thickness shall be installed immediately on the surface of the trench, cut, or hole in an asphalt or concrete street, walk, curb and gutter, etc. before the Contractor leaves the excavation site or continues the trench to the next block, intersection, or alley, unless otherwise allowed by the Engineer. Cold mix asphalt and its placement shall be furnished at the Contractor's expense and shall not be a pay item.

As soon as hot bituminous asphalt or concrete becomes available, the temporary asphalt surface shall be removed and replaced with permanent asphalt or concrete in accordance with the prevailing City construction and material specifications for the class of work involved by the Contractor. See *ARTICLE 8 – PAVEMENT* for additional requirements.

11.3.25 GREASE AND SAND INTERCEPTORS

Grease interceptors and sand interceptors shall have a minimum of two (2) compartments and shall be capable of the separation and retention of grease and the storage of settled solids. Interceptor design shall conform with the requirements of the *Plumbing Code per Section 16-8-4 of the Pueblo Municipal Code*. A control manhole over each compartment for monitoring purposes shall be required and installed at the owner/operator's sole expense. Covers shall have a gas tight fit. The interceptor shall be designed, constructed and installed for the calculated loading. Flow control devices shall be required where the water flow through the interceptor may exceed its rated flow. Interceptors shall be installed in a location outside the building which is easily accessed at all times for inspections, cleaning and proper maintenance, including pumping.

Grease interceptors and sand interceptors shall be vented in accordance with the Plumbing Code. The vent shall terminate not less than six (6) inches above the flood-rim level or in accordance with the manufacturers' instructions.

Grease interceptor and sand interceptor capacity calculations shall be performed by the food or engine service facility based on the size and type of operation according to the formula contained in the Plumbing Code. Where sufficient capacity cannot be achieved with a single unit, installation of interceptors in a series is required.

Grease or sand interceptors shall be constructed at the Contractor/Developer's expense and shall not be a pay item.

11.4 METHOD OF MEASUREMENT

Method of measurement for sanitary sewer construction shall be as follows:

- (a) Manholes – Each manhole removed and/or constructed of various sizes shall be counted for payment by the contract unit. Each manhole repaired using cementitious material and/or epoxy coating of various sizes shall be measured by the vertical foot from the invert of the manhole to the top rim of the manhole.
- (b) Sanitary Sewer Pipe - The length of sanitary sewer pipe of various sizes and types shall be measured in linear feet along the alignment of the centerline of the pipe from the face of the manhole to face of the manhole unless a connection is made to an existing stub.
- (c) CLSM (Flowable Fill) – Flowfill (when required) will be measured by the individual weigh tickets for each truckload. Weigh tickets shall be from state certified scales, shall be furnished to the inspector, signed by the driver and include the following information:

Date
Time Dispatched
Quantity in Cubic Yard
Project
Destination
Truck No.
Material Type

- (d) Service Lines - The length of service lines of various sizes shall be measured in linear feet along the alignment of the centerline of the pipe for actual pipe installed.
- (e) Reconnect Service Lines - Each service line reconnected to the sanitary sewer main shall be counted for payment.
- (f) Earthwork, Excavation, Trenching and Backfilling - Unless otherwise specified, these items will not be measured for separate payment but will be considered as incidental to the item to which it applies and shall be included in the unit price for that item, unless rock is encountered as described in section 11.3.8 - *TRENCHES IN ROCK*.
- (g) Rock Excavation - Rock excavation shall be measured for payment by the cubic yard. In measuring the number of cubic yards of rock excavation, the width of the trench excavated will be multiplied by the average depth from the surface of the rock to a point six (6) inches below the outside bottom of the sewer pipe. This result multiplied by the length of the trenched rock and divided by twenty-seven (27) will give the number of cubic yards allowed for payment.
- (h) Trench Stabilization Material - Approved material used to stabilize the subgrade shall be measured for payment by the ton as evidenced by weight tickets for each truckload or fraction thereof.

- (i) Imported Backfill Material - Approved backfill material to replace unsatisfactory material shall be measured for payment by the ton as evidenced by weight tickets for each truckload or fraction thereof.
- (j) Class "A" Concrete Cradle Bedding - Concrete cradle bedding shall be measured for payment by the linear foot.
- (k) Class "B" Pipe Bedding - Pipe bedding will not be measured for separate payment but will be considered as incidental to the sanitary sewer pipe and all costs in connection therewith shall be included in the unit price for the pipe.
- (l) Reinforced Concrete Encasement - Reinforced concrete encasement shall be measured for payment by the linear foot.
- (m) Gravel Surface Replacement - Aggregate base to replace the gravel lost during excavation on gravel surfaced streets or alleys will be measured by the individual weigh tickets for each truckload from state certified scales. Weigh tickets shall be furnished to the inspector, signed by the driver and include the following information:

Date
 Time Dispatched
 Gross Weight
 Tare Weight
 Net Weight
 Project
 Destination
 Truck No.
 Material Type
 State allowable Gross Vehicle Weight (GVW)

- (n) Sidewalk and Driveway Replacement - Sidewalk and driveway replacement shall be measured for payment in square feet of concrete of the specified thickness measured in place, completed and accepted.
- (o) Curb and Gutter Replacement - Curb and gutter replacement will be measured for payment in accordance with all applicable items as described in *ARTICLE 4 - CONCRETE, Section 4.8.2 - Method and Payment*.
- (p) Curb and Gutter, Sidewalk, Driveway, Alley Pans, Dips, and Concrete and Bituminous Pavement Removal - The removal and disposal of curb and gutter, sidewalk, driveway, alley pans, dips, and concrete and bituminous pavement will not be measured for separate payment but will be considered as incidental to the pipe and structure items and all costs in connection therewith shall be included in the unit price for that item, unless otherwise noted in the bid schedule.
- (q) Concrete Pavement Replacement - Concrete pavement replacement shall be measured for payment on the linear foot basis of the specified thickness, completed and accepted, measured in place along the centerline of the sewer main or service lines.
- (r) Hot Bituminous Pavement Replacement - Hot bituminous pavement replacement shall be measured for payment on the linear foot basis of the specified thickness, completed and accepted, measured in place along the centerline of the sewer main or service lines.
- (s) Concrete Alley Pan, Dip or Double Gutter Replacement - The replacement of concrete

alley pans, dips, and double gutters shall be measured for payment in square feet of concrete of the specified thickness, measured in place, completed and accepted.

11.5 BASIS OF PAYMENT

All costs in connection with the proper, safe and successful completion of the work, including furnishing all materials, equipment, supplies, and appurtenances; equipment and tools; and performing all necessary labor and supervision to fully complete the work in accordance with these specifications and the standard details, shall be included in the unit and lump sum prices bid. All work not specifically set forth as a pay item in the Proposal shall be considered a subsidiary obligation of the Contractor and all costs in connection therewith shall be included in the prices bid. When there is no unit price shown in the proposal, the price will be negotiated.

Basis of payment for sanitary sewer construction shall be as follows:

- a. Manholes – Constructed manholes will be paid for at the contract unit price per manhole and this shall include the ring and cover castings and adjustment sections, precast sections, and all items incidental to complete the manhole, in accordance with these specifications and the Standard Details. Manholes repaired using cementitious material and/or epoxy will be paid for at the contract unit price for various sizes which are placed, tested and accepted as measured in the field. Payment will only be made after manhole forms have been submitted and approved.
- b. Sanitary Sewer Pipe - Sanitary sewer pipe will be paid for at the contract unit price for the various sizes and types, installed complete in place. Said price shall include all excavation, shoring, bedding, joint materials, plugs, bypass pumping, temporary connections, connection to existing manholes, all other materials, to construct in accordance with these specifications and the *Standard Details and Pavement Impact Fees as outlined in Section 12-6-4.1 of the City Code of Ordinance*. No payment will be made for pipe until backfilling, compaction tests, deflection (go-no-go) test, exfiltration and/or infiltration tests have been accepted by the Engineer.
- c. Tracer Wire – Tracer wire will be paid for at the contract unit price for the tracer wire and appurtenances, installed complete in place. Said price shall include all wire, access boxes, grounding, and all other materials, to construct in accordance with these specifications and the Standard Details. No payment will be made for tracer wire until the tracer wire has been accepted by Engineer.
- d. CLSM (Flowable Fill) - Payment shall be made by the number of cubic yards delivered and placed in accordance with the plans and specifications and accepted by the Engineer. Any material delivered to the site without a weight ticket will not be paid for.
- e. Service Lines and Reinstall Service Lines - Service lines and the reconnection of service lines will be paid for at the contract unit price and shall be full compensation for placed and accepted pipe, including all fittings, plugs and markers in accordance with these specifications.
- f. Rock Excavation - Rock excavation will be paid for at the contract unit price and shall include the payment for any additional foundation or bedding material required and disposal of the rock removed which will not meet the requirements for backfill.
- g. Trench Stabilization Material - Trench stabilization material will be paid for at the contract unit price and shall include all work to furnish the approved material and the disposal of the unsuitable material.
- h. Imported Backfill Material - Imported backfill material will be paid for at the contract unit price and shall include all work to furnish the suitable material and disposal of the unsuitable material.

- i. Class "A" Cradle Bedding - Payment for Class "A" Cradle Bedding, will be paid for at the contract unit price, complete in place.
- j. Reinforced Concrete Encasement- Reinforced concrete encasement will be paid for at the contract unit price, complete in place.
- k. Gravel Surface Replacement – Payment shall be made for by the number of tons delivered and placed in accordance with the plans and specifications and accepted by the Engineer. Material delivered in trucks that exceed the rated GVW (Gross Vehicle Weight) will be used but the excess over GVW will not be paid for. Any material delivered to the site without a weight ticket will not be paid for.
- l. Sidewalk and Driveway Replacement- Sidewalk and driveway replacement will be paid for at the contract unit price, complete in place.
- m. Curb and Gutter Replacement - Curb and gutter replacement will be paid for at the contract unit price, complete in place.
- n. Concrete Pavement Replacement - Concrete pavement replacement will be paid for at the contract unit price and shall include furnishing and placing concrete pavement, and base under the new concrete, if required.
- o. Hot Bituminous Pavement Replacement - Hot bituminous pavement replacement shall be paid for at the contract unit price, complete in place.
- p. Concrete Alley Pan, Dip or Double Gutter Replacement - The replacement of concrete alley pans, dips, and double gutters shall be paid for at the contract unit price, complete in place. Said unit price shall include replacement with the specified thickness of concrete, reinforcing bars and base material, if required.

11.6 PRIVATE SEWERS

11.6.1 DESCRIPTION

Private sanitary sewers are not allowed unless otherwise authorized by the City Engineer, and consistent with the requirements of the Sanitary Sewer Design Criteria and Policies. The information covered by this specification consists of construction standards, inspections, and minimum requirements for "Private Sewers." The term "Private Sewers" as used in these specifications shall mean a building sewer which receives the discharge from more than one (1) building drain and conveys it to a public sewer and is installed and maintained by an approved designated authority. Private sewers are not part of the public sanitary sewer system.

11.6.2 PLANS AND DATA

Profiles of the ground or a detailed utility plan shall be shown on the plans for the work. The Contractor must satisfy themselves regarding the character of the material to be excavated and the work to be done.

11.6.3 MATERIALS

The requirements for *Section 11.2 – MATERIALS* are applicable to private sewers. It is the intent of this section to include Section 11.2 by reference and all provisions are applicable as though they were listed herein, unless specifically excepted or modified. In addition, cleanout covers (when required) shall withstand H-20 loading in traffic areas.

11.6.4 CONSTRUCTION REQUIREMENTS

Many portions of Section 11.3 are applicable to private sewers; however, there are some exceptions and discrepancies. It is the intent of this section to include Section 11.3 by reference and all provisions are applicable as though they were listed herein, unless specifically

excepted or modified. All references to the negotiation of “extra work” are deleted for private sewers.

Section 11.3.08 – TRENCHES IN ROCK is amended to read as follows:

Whenever rock material is encountered, as defined in *Section 11.3.8*, the Contractor shall immediately notify the Engineer. The Engineer will then direct the Contractor as deemed necessary.

Section 11.3.11(b) – CLASS “B” BEDDING is amended to read as follows:

The sewer pipe shall be set on a minimum of four inches (4”) of Class “B” Bedding material carefully shaped to fit the lower part of the conduit exterior for a width of at least 60% of the pipe breadth and for the entire pipe length. After setting the sewer pipe, Class “B” Bedding shall be added and properly tamped around the lower half of the pipe (haunches) for the full width of the trench, and the bedding shall be consolidated carefully without disturbing the pipe alignment or grade. For eight-inch (8”) diameter and larger pipe, additional Class “B” Bedding material shall be added up to a minimum of twelve inches (12”) above the top of the pipe for the full width of the trench.

Section 11.3.16 – TESTING AND INSPECTION, delete all references to the City televising the sanitary sewer main.

11.6.5 PERMITS AND FEES

Prior to installing any private sewer main, the Contractor shall obtain a permit from the Regional Building Authority. An inspection fee shall be assessed to all private sewers. The fee shall be paid prior to the issuance of the permit and the amount shall be in accordance with the fee schedule established by the Regional Building Authority. If a private sewer is installed without obtaining a permit, the Contractor will be required to pay two (2) times the regular fee schedule and/or will be required to pothole the sewer at various locations as directed by the Engineer. Cut sheets shall be submitted for review and approval to the City of Pueblo – Department of Public Works, two (2) working days prior to the start of construction.