

STANDARD CONSTRUCTION SPECIFICATIONS
FOR SEWER SYSTEMS

DIVISION 500

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**STANDARD CONSTRUCTION SPECIFICATIONS FOR
SEWER SYSTEMS DIVISION 500**

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SECTION 501 GENERAL

501.1 General

The work covered by these specifications consists of providing all plant, labor, equipment, supplies, material, transportation, handling and storage, and performing all operations necessary to complete the construction for pipe laying, jointing, and testing of sanitary sewers.

Requirements for earthwork including trench excavating and backfill are specified in *Division 200 Standard Construction Specifications for Earthwork*.

501.2 Applicable Standards

The latest revision of the following standards of the American Society of Testing and Materials (ASTM), the American Association for State highway and Transportation Officials (AASHTO), the American Standards Association (ASA), and the American Water Works Association (AWWA) are hereby made a part of these specifications.

ASTM A-48 AND ASTM A-438	Strength Requirements for Manhole Frames and Covers.
ASTM A-746 / (AWWA C-151)	Ductile Iron Pipe
ASTM C-6	Hydrated Lime
ASTM C-14	Specification for Non Reinforced Concrete Pipe.
ASTM C-76	Specification for Reinforced Concrete
ASTM C-150	Specification for Portland Cement
ASTM C-478 / (AASHTO – 199)	Specification for Precast Reinforced Concrete
ASTM D256	Test methods for D-C Resistance of Plastics
ASTM D2321	Practice for Underground Installation of Thermoplastic Sewer Pipe

ASTM D3034	Specification for type of PSM Poly (vinyl chloride, PVC) Sewer Pipe and Fittings
ASTM D3035	Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Controlled Outside Diameter
ASTM D3350	Specification for Polyethylene Plastic Pipe and Fittings Materials
AASHTO M-45	Sand for Cement Mortar
AWWA C-100	Ductile Iron Fittings
AWWA C-104	Cement Mortar for Ductile Iron Pipe
AWWA C-104 / (ASA A-21.4)	Cement Mortar for Cast Iron Pipe
AWWA C-111	Rubber Gasket Fittings for Ductile Iron Pipe
ASA A-21.10	Cast Iron Fittings
ASA A-21.11	Cast Iron Joints

501.3 **Required Clearance from Water Mains**

During construction of a sewer line, a water main may be encountered and field changes may be necessary to meet the required minimum vertical separation distance of eighteen inches (18”) or a horizontal distance of ten feet (10’). In such cases, refer to *Division 700, Section 705 Sewer Encasement*, and *Section 706 Relocate Water Main*.

501.4 **Surveys**

The Contractor will lay out (in the field) the alignment and grade of work to be done under the Contract. When once laid out, the Contractor shall be responsible for the preservation of all line stakes, grade stakes, and hubs. In the event of their loss or destruction, the Contractor shall pay all costs for their proper replacement. The Contractor shall be responsible for, and pay all costs for the transfer of, the control points from the reference hubs to such hubs or batter boards as required or needed for the prosecution of the work. A ground line profile will be made by the Contractor.

The ground line profile refers to the elevation of the ground directly above the centerline of pipe and the grade line refers to the elevation of the invert of pipe, except where otherwise noted.

The City of Homer will furnish the Contractor with a list of all pertinent bench marks, necessary for control points, and other information for control of the Work. Prior to utilizing information such as bench marks, etc., it shall be the Contractor's responsibility to verify bench mark elevations by checking between at least two (2) bench marks. The Contractor shall protect the bench marks and control points provided by the Engineer and properly reference them off. The contractor shall be responsible for any necessary replacement.

As-built measurements shall be done by the Contractor and, prior to final acceptance, the Contractor will furnish the City of Homer with record drawings and survey notes.

501.5 **Concrete and Mortar**

a. Miscellaneous Concrete

All concrete used in the construction of sanitary sewer systems with the exception of precast manholes, manhole risers, cones, and reinforced concrete pipe shall be Class A-3. Concrete Work shall conform to *Division 300, Portland Cement Concrete* of these specifications.

b. Mortar

Cement for mortar used in the construction of sanitary sewer systems shall conform with the requirements of ASTM C-150, Type II. Sand shall conform with the requirements of AASHTO M-45. The mortar shall be composed of one (1) part cement and three (3) parts sand. The addition of lime is not permitted.

SECTION 502 FURNISH AND INSTALL PIPE

502.1 General

The work under this section consists of the performance of all operations pertaining to furnishing and installing pipe for sanitary sewer systems.

502.2 Material

a. **General:** All piping shall be in accordance with the contract documents and shall conform to the size and class shown and specified.

b. **Ductile Iron Pipe:** Ductile iron pipe shall conform to requirements of ASTM Z-746 (AWWA C-151) and cement mortar shall conform to the requirements of AWWA C-104. Class 50 pipe shall be used unless otherwise required by the contract documents. Fittings shall be ductile iron and shall conform to AWWA C-100 for Class "D" fittings, except that so called "short body" fittings, otherwise meeting AWWA Specifications may be used. Rubber gasket joints for ductile iron pipe fittings shall conform to the requirements of AWWA C-111.

c. **Joints shall conform to the requirements of:** ASTM C-14 and ASTM C-443. Joints shall be of the "O" Ring type and shall be subject to the approval of the Engineer as to configuration. All repair clamps shall be approved stainless steel clamps.

d. **High Density Polyethylene Pipe (HDPE):** The pipe and fitting material shall have a cell classification of 345434C in accordance with ASTM D3350. In addition, the material must exceed 1000 hours when tested in accordance with the Ring Environmental Stress Crack Resistance Test (Radar Ring Test) with fewer than 20 percent failures. Also, the extruded pipe shall have impact strength greater than 3 ft-lbs/inch when tested in accordance with ASTM D256 Izod Impact Test.

The pipe shall be homogenous throughout and free of visible cracks, holes, foreign inclusions, or other injurious defects. It shall be uniform in color, opacity, density and other physical properties.

Butt fusion of the pipe and fittings shall be performed in accordance as to equipment and technique. The fusion operation shall be performed by an individual who has demonstrated the ability to fuse polyethylene pipe in the manner recommended by the pipe supplier. **The individual performing the fusing procedure must hold a current certification for fusing HDPE as stated in Title 49.1 DOT Certification.**

All HDPE mainline shall be installed with No. 6 bare copper locate trace wire. Trace wire will be secured to the top of the pipe with tape or other approved method at minimum ten foot intervals.

502.3 **Construction**

a. Excavation and Backfill: Excavation and backfill for furnishing and installation of sanitary sewer pipe shall be in accordance with *Division 200 Standard Specification for Earthwork, Section 207 Trench Excavation and Backfill*, of these specifications.

b. Pipe Grade and Alignment: Variance of individual pipe sections from established line and grade shall not be greater than those listed in the table below, providing that such variance does not result in a level or reverse sloping invert.

The allowance tolerance is per twenty linear feet.

Diameter Inches	Allowance Tolerance Feet	Diameter Inches	Allowance Tolerance Feet
8	0.03	14	0.04
10	0.03	16	0.04
12	0.03	18*	0.05

*Note: For all pipe sizes over eighteen inches (18") in diameter, variance shall not exceed 0.05 feet.

During the progress of the work, the Contractor shall provide instruments such as transits, levels, laser devices, and other facilities for transferring grades from offset hubs or for setting of batter boards or other construction guides from the control points and bench marks provided to the Contractor by the Engineer. The Contractor shall provide qualified personnel to use such instruments and who shall have the duty and responsibility for placing and maintaining such construction guides.

If the method of transferring grades from the offset hubs to the pipe requires batter boards, they shall be at least 1" x 6" supported on 2" x 4" stakes or approved metal rods and shall be placed every twenty-five feet (25'). At least three (3) boards must be in place at any given time to facilitate checking of line and grade. Both line and grade shall be checked for each piece of pipe laid, except at tunnels where methods acceptable to the Engineer shall be used to carry forward line and grade.

The practice of pushing in uncompacted backfill over a section of pipe to provide a platform for transit and level alignment and grade observation shall be subject to the approval of the Engineer. If intermittent back-filling is allowed, back-filling shall be accomplished in accordance with *Division 200 Standard Construction Specifications for Earthwork, Section 207 Trench Excavation and backfill*, of these specifications. All trench excavation and compaction shall be considered incidental to pipe laying. Imported trench backfill which is requested by the Engineer or called out on the plans will be paid under the appropriate pay item or by letter of agreement.

c. Pipe Laying: All pipe shall be laid with class C Bedding unless otherwise required by the contract documents or directed by the Engineer.

Pipe laying shall not progress ahead of back-filling of ditches more than four hundred feet (400'). Pipe laying shall in all cases proceed upgrade with the spigot ends of the pipe pointing in the direction of the flow. Each pipe shall be laid true to line and grade and in such a manner as to form a close concentric joint with the adjoining pipe. The alignment of the installed pipe shall appear straight to visual observation and shall be such that a full circle of light can be seen between manholes, etc., when sighting along all points of the pipe circumference unless otherwise required by the Contract documents or directed by Engineer. Each section of pipe shall be handled carefully and placed accurately. The spigot end shall be fully inserted. Care shall be exercised to avoid over-insertion.

Each section of pipe shall be properly supported to insure true alignment and an invert that is smooth and free from roughness or irregularity.

At all times, when work is not in progress, open ends of pipe and fittings shall be securely and satisfactorily closed so that no undesirable substance will enter the pipe or fittings.

Where a project outfalls into an existing sanitary sewer, construction of the physical connection to the existing line shall be delayed until all upstream underground construction, including exfiltration testing, is complete and accepted unless special permission is granted by the City. Care shall be exercised during construction, flushing, and testing operations of the connecting link, to assure that water is not diverted into any portion of a sanitary sewer line in service or a sanitary sewer line which is not a portion of the construction project for which the Contractor is responsible.

d. Bedding of Ductile Iron Pipe for Sewer Main: The use of ductile iron may eliminate the need for pipe bedding materials above the spring line of a pipe. Native materials may be used where bedding material above the spring line is eliminated; however, it must be compacted to ninety percent (90%) maximum density.

e. Laying Instructions: All pipe shall be laid in accordance with the manufacturer's recommendations. Pipe shall not be laid when the bottom of the ditch, or the sides to one foot (1') above the pipe, is frozen. Backfill material shall not contain frozen material. The trench shall not be left open during freezing weather in order to prevent the temperature of the material near the pipe from freezing. Caution tape clearly identifying sewer shall be laid in the trench two feet (2') over and centered on the pipe.

f. Testing:

1. General

The Contractor shall clean and flush all sanitary sewer pipe installed prior to testing and final inspection.

All sanitary sewer pipe installed shall be subject to either an infiltration test or an exfiltration test. In those areas where, in the opinion of the Engineer, the water table is high enough to subject the pipe to a satisfactory infiltration test, it is not anticipated that an exfiltration test shall be required. In checking leakage, there will be no allowance made for external hydrostatic head.

Where, in the opinion of the Engineer, the water table is not high enough to provide a satisfactory infiltration test, an exfiltration test shall be required.

The type of test (either infiltration or exfiltration) shall be determined by the Engineer. The Contractor shall have the option of choosing only one (1) method (air or water) of testing for each section tested.

All wyes, tees, or ends of side sewer stubs and service connections shall be plugged or capped, and the plug or cap shall be securely fastened to withstand the internal test pressures. Such plugs or caps shall be readily removable and their removal shall provide a socket suitable for extending the lateral connection.

All testing shall be considered a subsidiary obligation under Furnish and Install Pipe and extra payment will not be allowed for this portion of work.

The lengths of service connections shall be included in the computations to determine the allowable leakage for the test sections.

2. Exfiltration Test (Using Water)

On completion of a section of sanitary sewer between manholes or otherwise, the Engineer shall require the ends of all pipe be plugged, including service connections, and the pipe subjected to a hydrostatic pressure test. Generally all testing is to be conducted after back-filling, prior to resurfacing and after service connections are made.

A minimum head of six feet (6') feet of water above the crown at the upper end of the test section shall be maintained for a period of four (4) hours during which time it will be presumed that full absorption of the pipe body has taken place and thereafter for a further period of one (1) hour period, the measured loss shall not exceed the rate of fifty (50) gallons per inch diameter per mile per twenty-four (24) hours.

The above listed leakage rate shall also be applied to infiltration from ground water and infiltration or exfiltration in greater amounts will be cause for rejection of the sanitary sewer and all repairs necessary to meet theses requirements and re-testing shall be at the expense of the Contractor.

The maximum length of sanitary sewer for the above allowable leakage test shall be one thousand feet (1,000'). If it is not apparent that leakage test results between any two (2) manholes is satisfactory, then the Engineer may require subsequent tests to establish the more exact location of the leakage areas. Any section of sanitary sewer between any two

(2) manholes that does not meet the above requirements shall be rejected and the Contractor, at his expense, shall make the necessary repairs to the sanitary sewer to meet the requirements, and shall make subsequent tests after repairs to assure compliance with the specifications.

3. Exfiltration Test (Using Air)

The Contractor shall furnish all facilities and personnel for conducting the test under the observation of the Engineer. The equipment and personnel shall be subject to the approval of the Engineer.

The Contractor may desire to make an air test prior to back-filling for his own purpose. However, the acceptance air test shall be made after back-filling has been completed and compacted. Generally all testing is to be conducted after back-filling, prior to resurfacing and after service connections are made.

Immediately following the pipe cleaning, the pipe installation shall be tested with low pressure air. Air shall be slowly supplied to the plugged pipe installation until the internal air pressure reaches four (4.0) pounds per square inch greater than the average back pressure of any ground water that may submerge the pipe. At least two (2) minutes shall be allowed for temperature stabilization before proceeding further.

The pipeline shall be considered acceptable when tested at an average pressure of four (4.0) pounds per square inch greater than the average back pressure of any ground water that may submerge the pipe, if:

The total rate of air loss from any section tested in its entirety between manholes or between manholes and clean-out structures does not exceed two (2.0) cubic feet per minute, or the following table may be utilized as a guideline for a satisfactory test by air for pipe sizes as shown:

Pipe Diameter	Allowable Pressure Drop in Ten Minutes
8"	2.7 PSI
10"	2.1 PSI
12"	1.8 PSI
15"	1.4 PSI
18"	1.2 PSI
24"	0.9 PSI

Pressure gauges shall be incremented in not more than ½ pound increments for accurate tests.

If the pipe installation fails to meet test requirements, the Contractor shall determine at his own expense the source or sources of leakage, and he shall repair (if the extent and type of repairs proposed by the Contractor are acceptable to the Engineer) or replace all defective materials or workmanship. The completed pipe installation shall meet the

requirements of this test or the alternative water exfiltration test before being considered acceptable.

Safety braces shall be required to hold plugs in place and to prevent the sudden release of the compressed air. Due to the large forces that could be exerted by an escaping plug during the testing of the pipe, workmen shall not be allowed in the manholes in which plugs have been placed while tests are being conducted. The Contractor's testing equipment shall be arranged in such a manner that a pressure relief device will prohibit the pressure in the pipeline from exceeding ten pounds per square inch (10psi).

4. Infiltration Test

Infiltration testing may be allowed at the Engineer's option when the natural ground water table is six feet (6') above the crown of the higher end of the test section. The maximum allowable limit for infiltration shall not exceed the rate of fifty (50) gallons per inch diameter per mile per twenty-four (24) hours.

The Contractor shall furnish all tools, equipment, and labor necessary to complete the tests and shall verify from his own observations, or preliminary tests, that each line conforms with this specification before requesting the Engineer to observe and record the actual leakage.

The Engineer may require the Contractor to repair obvious leaks even though the total length of the test section falls within the maximum allowable leakage for the test used.

5. Check of Line and Grade

After back-filling and cleaning, but before final acceptance, all sections of installed line may be checked for line and grade. Excluding service connections, all size sanitary sewer mains thirty inches (30") and smaller in diameter may be checked for line and grade by closed circuit television. A full circle of light must be seen and no pipe misplaced in line or grade on straight sewer runs. A physical inspection of the interior of all sanitary sewer line thirty inches (30") in diameter and above will be made before acceptance. Any excess deviation in line and grade shall be corrected by the Contractor prior to final acceptance of the project.

502.4 **Method of Measurement**

Measurement for all sizes of pipe shall be based on the horizontal centerline distances and will be from center to center of manholes or from center of manholes to center of clean-out wye.

502.5 **Basis of Payment**

Payment shall be made under the following units:

<u>ITEM</u>	<u>DESCRIPTION</u>	<u>PAY UNIT</u>
502	Furnish and Install Sewer Pipe	Linear Foot

SECTION 503 MANHOLES

503.1 General

The work under this section consists of the performance of all operations pertaining to the construction and installation of sanitary sewer manholes complete with frames and covers.

503.2 Material

Material used in construction of manholes shall conform to the requirements of ASTM C-478-69. Cones shall be Type (A), eccentric, unless otherwise approved.

Cement for mortar used in the construction of manholes shall conform to the requirements of ASTM C-150, Type II. Sand shall conform with AASHTO Specification M-45. The mortar shall be composed of one (1) part cement and three (3) parts sand. The joints shall be made so as to produce a smooth, regular, watertight surface. Only enough water shall be added to provide plasticity in placing the mortar.

The tensile strength of the gray cast iron for manhole frames and covers shall be thirty thousand pounds per square inch (30,000 psi) minimum, conforming with the requirements of ASTM A-48 and the requirements for transverse breaking load shall be two thousand (2,000) pounds, conforming with the requirements of ASTM A-438. Contact surfaces between frames and covers shall conform to the standard details of these specifications. Where lockable manhole covers are specified, the Contractor shall submit Shop Drawings of the locking devise for approval of the Engineer.

Pre-molded plastic gasket for manhole construction shall be as manufactured by K. T. Snyder Company, Inc., Ram-Nek Gasket Division, 2100 Travis Street, Houston, Texas or equal.

Refer to Section 300 General, 301.6 Mix Requirements for Classes of Concrete, for specifications pertaining to Class A-3 concrete as required in forming manhole inverts.

Z-LOK Cast-in Boots shall be installed in all inlets and outlets of manholes for sanitary sewer. Z-LOK Boots are manufactured by A-LOK Products, Inc., 697 Main St., Tullytown Pennsylvania 19007.

The inflow preventer shall conform to the standard detail as shown in these Specifications.

Wrapidseal Manhole Encapsulation System material will be installed at all manhole joints according to manufacturer's installation guidelines.

503.3 **Construction**

a. General

Installation of manholes shall be in accordance with *Division 200 Standard Specifications for Earthwork, Section 207 Trench Excavation and Backfill*, of these specifications.

The manhole frames and covers shall be brought to the grades shown on the drawings. Manhole rings shall be set in and made secure by use of a plastic gasket pipe joint sealer. (In existing paved streets, manhole rings shall be mortared to prevent settlement). Use of, and installation of, pre-molded plastic gaskets for manhole construction shall be strictly in accordance with the manufacturer's printed instructions. Gaskets shall be trimmed on the inside of the manhole to prevent the excess gasket material from entering the sanitary sewer lines.

All exterior joints, including grade rings and surface castings, shall be wrapped with Wrapidseal Manhole Encapsulation System and be installed according to the manufacturer's recommendations.

All portions of pre-cast manholes must be approved by the Engineer prior to installation on the sanitary sewer systems. The Contractor shall provide timely notice (at least two (2) working days in advance of installation) to allow time for the Engineer to arrange for necessary inspections. Installation of manhole sections will not be allowed prior to the Engineer's written approval. This approval does not relieve the Contractor of the responsibility for protection of manholes against damage during handling and installation.

Manholes shall be installed at the locations shown on the drawings such that primary leads enter radially at the invert elevations specified. The base section shall be set plumb on a prepared surface.

Where indicated on the drawings, a stub shall be provided for future connections to the manhole. The stub shall be sized and positioned as indicated. The end of the stub shall be stopped with a wooden plug, concrete biscuit, or other adequate methods to prevent water, earth or other substances from entering the pipe. Manholes shall have a minimum piping stub-out of nine feet (9').

In the case of poured-in-place manhole construction, if the Contractor elects to accomplish the manhole construction utilizing more than one (1) continuous concrete pour, a keyed construction joint shall be used. These manholes shall have poured-in-place bases.

b. Sanitary Sewer Manhole Invert Construction

The invert channels shall be smooth and semicircular in shape conforming to the inside of the connecting sewer section. Changes in directions of flow shall be made by forming a smooth radius sized to allow adequate access of a TV camera and/or maintenance equipment into the served sewer pipe. Changes in size and grades of the channels shall be made gradually and evenly. The invert channels may be formed and poured in place, or may be constructed by laying a full section of sewer pipe through the manhole and breaking out the top half after the surrounding concrete has hardened. The flow of the manhole outside the channels shall be smooth and shall slope toward the channels at a grade of one-inch (1") per foot.

503.4 Method of Measurement

Manholes shall be measured as units complete in place.

503.5 Basis of Payment

Separate payment will not be allowed for frames, covers, and inflow preventer inserts; but shall be included in the unit price for manholes.

Payment shall be made under the following unit:

<u>ITEM</u>	<u>DESCRIPTION</u>	<u>UNIT</u>
503	Construct Manhole	Each

SECTION 504 WATERTIGHT MANHOLE FRAMES, COVERS, AND INSERTS

504.1 General

The work under this Section consists of the performance of all operations pertaining to the furnishing and installation of watertight manhole frames, covers, and watertight inserts.

504.2 Material

Z-LOK Cast-in Boots shall be installed in all inlets and outlets of manholes for sanitary sewer to allow differential settlement of the pipe and manhole wall to take place. Where Z-LOK Boots are used, grout shall only be installed on the inside of the manhole.

Watertight frames and covers for manholes and similar appurtenances shall be of cast iron and conform to the dimension shown on the applicable standard details. The requirement for tensile strength of the gray cast iron shall be 30,000 PSI minimum in accordance with the requirements of ASTM A-48 and the requirement for transverse breaking load shall be 2,000 pounds in accordance with the requirements of ASTM A-438. Contact surfaces between frames and covers shall be machined to provide a uniform contact surface. Manhole covers shall have identification letters as shown on the standard details.

Inflow protection inserts shall be provided for all new manholes in accordance with the standard details of these specifications.

504.3 Construction

Installation shall be performed in accordance with the manufacturers written instructions and the standard details of these specifications.

All exterior joints, including grade rings and surface castings, shall be wrapped with Wrapidseal Manhole Encapsulation System and be installed according to the manufacturer's recommendations

504.4 Method of Measurement

Watertight manhole frames, covers, and inflow protection inserts shall not be measured separately, but shall be considered incidental to *Item 503, Manholes*.

504.5 Basis of Payment

None

SECTION 505 CONNECTIONS TO EXISTING MANHOLES

505.1 General

The work under this section consists of the performance of all operations pertaining to the work required for connection to existing manholes.

505.2 Construction

Excavation and backfill for connections to existing manholes shall be in accordance with *Division 200 Standard Specifications for Earthwork, Section 207 Trench Excavation and Backfill*, of these specifications.

Connection to existing manholes shall be made in a workmanlike manner, shall be tight and have smooth flow surfaces and curves. The invert shall be brought into the existing manhole at the elevation shown on the drawings. An expanding type grout (jet set or equal) shall be used in connecting sewer pipe to existing manhole. The downstream pipe in manholes shall be screened to prevent mortar or other debris from entering the system.

Where a connection is made to an existing sanitary sewer manhole, the base shall be broken out, if necessary, to form a smooth channel in accordance with the construction requirements of a new manhole. Connections to existing sanitary sewer manholes will be allowed only after all portions of the Contractor's work tributary to the connection point has been cleaned and flushed, inspected, and tested. Under certain conditions, connections prior to the completion of the system may be permitted subject to the Engineer's prior written approval and the provision of adequate debris and sand traps, and sumps, upstream from the connection.

505.3 Method of Measurement

Connection to existing manholes shall be measured as complete units in place.

505.4 Basis of Payment

Where the connect is made to a pipe stubbed out of the existing manhole, payment will not be allowed for the connect.

Payment will be made under the following unit:

<u>ITEM</u>	<u>DESCRIPTION</u>	<u>UNIT</u>
505	Connection to Existing Manhole	Each

SECTION 506

CONSTRUCT DROP CONNECTION

506.1 **General**

The work under this section consists of providing all operations pertaining to furnishing and installing drop sewer connections to manholes.

506.2 **Materials**

Pipe and fittings used in the construction of drop connections for sanitary sewers shall conform to the requirements of AWWA C-151 for Class 50 pipe and AWWA C-100 for Class "D" fittings and the standard details.

506.3 **Construction**

Excavation and backfill for the construction of drop connections shall be in accordance with *Division 200 Standard Specifications for Earthwork, Section 207 Trench Excavation and Backfill* of these specifications.

Over-excavation under a drop connection shall require compaction of not less than ninety-five percent (95%) of the maximum density prior to installation of the pipe and fittings, or the concrete cradle.

Refer to *Division 300 Standard construction Specifications for Portland Cement Concrete, Section 301 General* of these specifications for requirements pertaining to Class A-3 concrete.

506.4 **Method of Measurement**

Drop sewer connections shall be measured as units, complete in place.

506.5 **Basis of Payment**

Payment shall be made under the following units:

<u>ITEM</u>	<u>DESCRIPTION</u>	<u>UNIT</u>
506	Construct Drop Sewer Connection	Each

SECTION 507 CONSTRUCT BEAVER SLIDE

507.1 General

The work under this section consists of providing all operations pertaining to the construction and installation of beaver slides in a manhole.

507.2 Material

Refer to *Division 300 Standard Construction Specifications for Portland Cement Concrete Section 301 General*, of these specifications for requirements pertaining to Class A-3 concrete as required in forming beaver slide inverts.

507.3 Construction

Beaver slides shall be constructed to provide a smooth and continuous channel directed into and with the flow of the receiving sewer and in accordance with the standard details of the specifications.

Beaver slides are required where the invert of the connecting sewer is above the crown of the receiving sewer and the drop in the manhole does not exceed the maximum height shown on the *Standard Details* of these specifications.

507.4 Method of Measurement

Beaver slides shall be measured as units complete in place.

507.5 Basis of Payment

Payment shall be made under the following units:

<u>ITEM</u>	<u>DESCRIPTION</u>	<u>UNIT</u>
507	Construct Beaver Slide	Each

SECTION 508 CONSTRUCT SANITARY SEWER CLEANOUT

508.1 General

The work under this section consists of providing all materials and operations pertaining to construction and installation of cleanouts.

508.2 Material

Material used in the construction of sanitary sewer cleanouts shall conform to the requirements of AWWA C-151, for Class 50 ductile iron pipe and AWWA C104 / ANSI A21.4 fittings and as shown in the standard detail of these specifications.

508.3 Construction

Excavation and backfill for the construction of sewer cleanouts shall be in accordance with *Division 200, Section 207 Trench Excavation and Backfill*, of these specifications.

508.4 Measurement

Cleanouts will be measured as units, complete in place.

508.5 Basis of Payment

<u>Item</u>	<u>Description</u>	<u>Unit</u>
508	Construct Sanitary Sewer Cleanout	Each

SECTION 510 SANITARY SEWER SERVICE CONNECTIONS

510.1 General

The work under this section consists of providing all operations pertaining to the construction required for sanitary sewer service connections.

510.2 Materials

All sanitary sewer service connects shall be constructed with the following materials:

- a. Cast iron with “Ty-seal” joints.
- b. Cast iron with “no-hub” joints, joined only with a “Romac repair clamp” style LSS1 six inches (6”) or longer or equal.

All services with less than five feet (5’) of cover shall be insulated with sufficient two inch (2”) DOW Styrofoam “HI” to provide an equivalent of five feet (5’) of soil cover. The insulation shall be two feet (2’) in width and shall be placed no closer than six inches (6”) above the pipe and no further than one foot (1’) above the pipe, centered.

IFCO 725-P saddle or equal shall be secured with a double strap or a single stainless steel band of two and one-half inches (2-1/2”) inches or more in width.

510.3 Construction

Excavation and backfill for sanitary sewer service connections shall be in accordance with *Division 200, Standard Specifications for Earthwork, Section 207, Trench Excavation and Backfill*, of these specifications.

The service connections shall be bedded with non-frost susceptible material, with a fine granular texture containing no material larger than one and one-half inches (1-1/2”). The bedding shall be laid the full extent of ditch and up to the spring line of the service connect. Piping may be bedded with native soils if approved in advance by the Engineer.

Construction shall be in accordance with the standard details of these specifications. Multiple connections to the sewer main shall not be made any closer together than three feet (3’). The terminus of the house connection shall be sealed with a suitable stopper. Taps, where allowed for installation of saddles on to sewer pipes, shall be made with a mechanical hole cutter as manufactured by the Pilot Manufacturing Company or equal. Tee and wye saddles will be allowed on mains twelve inches (12”) and larger. Tee saddles will be the only saddles allowed on mains smaller than twelve inches (12”). All service connections to sanitary sewer mains shall be approved cast iron or “Ty-seal” pipe. Saddles shall be placed over a hole sawed no larger than one-eighth inch (1/8”) larger than the inside diameter of the service line. The strap(s) shall be tightened in accordance

with the manufacturer's instructions and centered over the hole sawed in the pipe being tapped. The hole shall be made above the spring line of the main being tapped.

Sanitary sewer service connections, shall be installed to the edge of right-of-way or the edge of the permanent easement of the lot being served and shall be permanently marked by means of a two by four (2" x 4") board installed vertically from the end of the service stubout and extending three feet (3') above grade, painted white and stenciled with the word "Sewer" in white, two-inch (2") high letters. A minimum 1/2"x 2' long stick of rebar shall be installed alongside the 2x4 board as shown in the standard details.

As-built measurements shall be the station of the service connection at the main plus a minimum of two (2) ties to prominent features and when possible ties to property corners. An as-built elevation of the stub end invert is required.

Minimum slopes shall be as follows:

4"	2.08%	.0208	feet per foot (1/4" per foot)
6"	1.00%	.0100	feet per foot
8"	0.40%	.0040	feet per foot
10"	0.28%	.0028	feet per foot
12"	0.22%	.0022	feet per foot

510.4 **Method of Measurement**

Sanitary sewer service connections shall be measured as completed units in place. This item will include all materials, excavation, installation, compaction, and installation of Class "B" bedding. Imported backfill will be paid separately as a bid item or by letter of agreement.

510.5 **Basis of Payment**

Payment shall not be made for any service which does not include the as-built stub end elevation and horizontal location as stipulated above.

Payment shall be made under the following units:

<u>ITEM</u>	<u>DESCRIPTION</u>	<u>UNIT</u>
510	Sanitary Sewer Service Connection (size)	Each

SECTION 511 **ADJUST MANHOLE CONE**

511.1 **General**

This item consists of furnishing all labor, equipment, and materials necessary to adjust existing manhole cones to finish grade as shown on the plans and in accordance with the applicable standard details of these specifications.

511.2 **Material**

All materials used in the adjustment of manhole cones shall conform to the requirements for manholes as outlined in the standard construction specifications for sanitary sewer systems and storm drain systems, unless otherwise approved by the Engineer.

511.3 **Construction**

The Contractor shall adjust the manhole cones in accordance with the applicable standard detail or as called out on the plans. Any damage to manholes resulting from construction under this item shall be repaired or the damaged portion replaced at the Contractor's expense.

All exterior joints, including grade rings and surface castings, shall be wrapped with Wrapidseal Manhole Encapsulation System and be installed according to the manufacturer's recommendations

511.4 **Method of Measurement**

Manhole cone adjustments will be measured per unit, complete in place.

511.5 **Basis of Payment**

Basis of payment for this item shall be in accordance with *Section 10.07 Measurement and Payment*, and shall include full payment for all work described in this Section and all work outlined on the applicable standard detail, unless otherwise noted.

Payment for cone adjustment shall include full compensation for changes in height. In no case will payment for both ring and cone adjustments be made for the same manhole.

Payment will be made under:

<u>ITEM</u>	<u>DESCRIPTION</u>	<u>UNIT</u>
511	Adjust Manhole Cone	Each

SECTION 512 ADJUST MANHOLE RING

512.1 General

This item consists of furnishing all labor, equipment and materials necessary to adjust existing manhole rings to finish grade as shown on the plans and in accordance with the applicable standard details of these specifications.

512.2 Material

All materials used in the adjustment of manhole rings shall conform to the requirements for manholes as outlined in the standard construction specifications for sanitary sewer systems and storm drain systems, unless otherwise approved by the Engineer.

512.3 Construction

The Contractor shall adjust the manhole rings in accordance with the applicable standard detail in these specifications. Any damage to manholes resulting from construction under this item shall be repaired or the damaged portion replaced at the Contractor's expense.

All exterior joints, including grade rings and surface castings, shall be wrapped with Wrapidseal Manhole Encapsulation System and be installed according to the manufacturer's recommendations

512.4 Method of Measurement

Manhole ring adjustments will be measured per unit, complete in place.

512.5 Basis of Payment

Basis of payment for this item shall include full payment for all work described in this Section and all work outlined on the applicable standard detail, unless otherwise noted.

Payment for ring adjustment shall include full compensation for changes in height. In no case will payment for both ring and cone adjustments be made for the same manhole.

Payment will be made under:

<u>ITEM</u>	<u>DESCRIPTION</u>	<u>UNIT</u>
512	Adjust Manhole Ring	Each

SECTION 513 ADJUST CLEANOUT

513.1 General

This item consists of furnishing all labor, equipment, and materials necessary to adjust existing sanitary sewer cleanouts to finished grade as shown on the plans.

513.2 Construction

All cleanout adjustments shall be accomplished as directed by the Engineer. Any damage to the cleanout or sewer main resulting from work under this item shall be repaired or replaced at the Contractor's expense.

513.3 Method of Measurement

Cleanout adjustments shall be measured per unit, complete in place.

513.4 Basis of Payment

The contract unit prices per each for cleanout adjustments shall be full compensation for furnishing all equipment and labor necessary to complete the work as specified. Materials required to adjust cleanouts shall be incidental to this item.

Payment will be under:

<u>ITEM</u>	<u>DESCRIPTION</u>	<u>PAY UNIT</u>
513	Adjust Cleanout	Each

SECTION 514

POLYETHYLENE ENCASEMENT

514.1 **General**

The work under this section consists of providing all operations pertaining to the furnishing and installation of one layer of polyethylene encasement on all ductile iron pipe, if required in the plans and specifications.

514.2 **Material**

The polyethylene encasement material for pipe shall be 8 mils thick and conform to the most current edition of AWWA C105/ ANSI A21.5.

514.3 **Construction**

The polyethylene encasement shall be installed in strict conformance to the methods described in the most current editions of AWWA C105/ ANSI A21.5 and the Ductile Iron Pipe Research Association's "Installation Guide for Ductile Iron Pipe."

514.4 **Method of Measurement**

Measurement on all sizes of polyethylene encasement for pipe shall be the same as the measurement of the pipe installed.

514.5 **Basis of Payment**

Payment for this item shall be in accordance with *Section 10.07*, and shall be full payment for the work described in this section.

Payment will be made under:

<u>ITEM</u>	<u>DESCRIPTION</u>	<u>PAY UNIT</u>
514	Polyethylene Encasement	Linear Foot