

**STANDARD CONSTRUCTION SPECIFICATIONS
FOR SANITARY SEWERS
DIVISION 50
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**STANDARD CONSTRUCTION SPECIFICATIONS
FOR SANITARY SEWERS
DIVISION 50**

SECTION 50.01 GENERAL

Article 1.1 Scope of Work

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 20 - Earthwork.

Article 1.2 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 A48	Specifications for Gray Iron Castings
ASTM A74	Standard Specification for Cast Iron Soil Pipe & Fittings
ASTM 438	Traverse Testing of Gray Cast Iron
ASTM A746	Specification for Ductile Iron Gravity Sewer
ASTM C14 or ASTM C14M [Metric]	Specification for Concrete Sewer, Storm Drain and Culvert Pipe
ASTM C76 or ASTM C76M [Metric]	Specification for Reinforced Concrete Culvert, Storm Drain and Sewer Pipe
ASTM C150	Specification for Portland Cement
ASTM C206	Specification for Finishing Hydrated Lime
ASTM C443 or ASTM C443M [Metric]	Specification for Joints for Circular Concrete Sewer & Culvert Pipe, Using Rubber Gaskets
ASTM C478 or ASTM C478M [Metric]	Specification for Precast Reinforced Concrete Manhole Sections

ASTM C564	Standard Specifications for Rubber Gaskets for Cast Iron Soil Pipe & Fittings
ASTM C923	Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes & Laterals
ASTM D256	Test Methods for D-C Resistance of Plastics and Electrical Insulating Materials
ASTM D2321	Recommended 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 M45	Sand for Cement Mortar
AWWA C104/ ANSI A21.4	Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
AWWA C105/ ANSI A21.5	Polyethylene Encasement for Ductile Iron Piping for Water and Other Liquids
AWWA C110/ ANSI A21.10	Ductile-Iron and Gray-Iron Fittings, 3 in. Through 48 in., for Water and Other Liquids
AWWA C111/ ANSI A21.11	Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings
AWWA C151/ ANSI A21.51	Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids
AWWA C600	AWWA Standard for Installation of Ductile-Iron Water Mains and Their Appurtenances
AWWA C901	Standard for Polyethylene (PE) Pressure Pipe and Tubing, 1/2 in. Through 3 in., for Water Service
AWWA C900	Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 inch through 12 inch for Water Transmission and Distribution
AWWA C905	Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 inch through 48 inch for Water Transmission and Distribution
UPC	Uniform Plumbing Code, latest edition adopted by the City, and current local amendments

Article 1.3 Surveys

Survey shall be performed by the Contractor per Division 65 - Construction Survey.

Article 1.4 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 30 - Portland Cement Concrete.

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. The use of five (5) minute or fast-cure mortar is prohibited.

Article 1.5 Insulation

Rigid board insulation required for frost protection of sanitary sewer mains and services shall be as specified on the drawings and comply with Division 20, Section 20.26 – Insulation, and Standard Detail 20-9.

Article 1.6 Payment - General

Payment for all Work included in this Division shall be paid for in accordance with Division 10, Section 10.07 - Measurement and Payment and shall include full payment for all Work described.

SECTION 50.02 FURNISH AND INSTALL PIPE

Article 2.1 Description

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

In the case of Owner-furnished pipe, the Owner will allot to the Project pipe to accomplish the project in amounts, exactly matching the Contractor's pay quantities for pipe. Any surplus pipe left over from this allotment at the end of the Project shall be returned from the Contractor's job sites to the Owner's designated pipe yard. If the Contractor withdraws from the Owner's pipe yard more than the amount required to match the payment quantities, the Contractor shall pay the Owner on the basis of the Owner's invoice price for pipe (including freight), plus a ten percent (10%) overhead to reimburse the Owner's invoice price for pipe (including freight), plus a ten percent (10%) overhead to reimburse the Owner for handling, warehouse, inspection, and administration.

Article 2.2 Materials

A. General

All piping shall be in accordance with the Contract Documents conforming to the size and class shown and specified. Changes in class shall be made within one-half of a pipe length of the station indicated on the Drawings. The use of pipe containing asbestos materials shall be prohibited.

Detectable underground warning tape is required for installation of all pipe types. Warning tape must not be less than five (5) mil, foil backed, six inches (6") wide vinyl tape, colored green, with "Caution Buried Sewer Line Below" continuously printed in black along the tape length. The warning tape must be continuously laid with the pipe and be at least eighteen inches (18") above the pipe.

Tracer wire must be installed on all non-metallic pressure sewer main. Tracer wire must be suitable for direct bury and be 10 AWG with 30-mil HDPE jacket colored green. Trace wire must be continuous. When allowed by the Engineer, splices must use copperhead industries connector, part #3WB-01 or equal. Tracer wire must be brought to the surface near sewer structures

B. Ductile Iron Pipe

Ductile iron pipe shall conform to requirements of ASTM A-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 cast iron or ductile iron and all bells conforming to AWWA C-104 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. Cast Iron Pipe

All cast iron pipe and fittings shall be hub and spigot service weight soil pipe meeting the requirements of ASTM A74. Gaskets shall meet the requirements of ASTM C564.

D. Concrete Pipe and Fittings

Reinforced concrete pipe and fittings shall conform to the requirements of ASTM C-76. Non-reinforced concrete sanitary sewer pipe shall conform to the requirements of ASTM C-14.

E. Concrete Pipe Joints

Joints for concrete pipe 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.

F. High Density Polyethylene Pipe (HDPE)

High Density Polyethylene Pipe (HDPE) and fittings shall be manufactured in accordance with AWWA C906. HDPE shall be manufactured from PE4710 polyethylene compounds that meet or exceed ASTM D3350 Cell Classification 445574. All HDPE pipe and fittings shall be certified by the NSF for potable water service. HDPE pipe and fitting material compound shall contain color and ultraviolet (UV) stabilizer meeting or exceeding the requirements of Code C per ASTM D3350. Electrofusion fittings shall comply with ASTM F1055. All fittings shall have pressure class ratings not less than the pressure class rating of the pipe to which they are joined.

The pipe shall be homogeneous 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 with the pipe manufacturer's recommendations 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 pipe supplier shall supply a representative to instruct the Contractor's crew on Butt Fusion and installation and witness the first twenty joints.

Alternate coupling methods for HDPE pipe shall not be used unless accepted by the Engineer in conformance with the requirements of Division 10, Section 10.05, Article 5.7 - Materials. Any request to consider an alternate coupling method in the Work and/or approval of its use, should it be accepted, shall not cause an increase in the cost of the Work to the Owner.

Continuous HDPE pipe supplied in coils may be used for residential sewage pump station force mains under 6-inches diameter.

G. Polyvinyl Chloride Pipe (PVC)

Four inch (4") through twelve inch (12") Polyvinyl Chloride Pipe must conform to the requirements of AWWA C900 and as otherwise required by the Contract Documents. DR 18 pipe must be used for C900 PVC pipe, unless otherwise specified.

Fourteen inch (14") through forty-eight inch (48") Polyvinyl Chloride Pipe must conform to the requirements of AWWA C905 and as otherwise required by the Contract Documents. DR 21 must be used for C905 PVC pipe, unless otherwise specified.

H Copper, Type K pipe

Copper, Type K pipe may only be used on pressure single family residential sewer systems and must be a minimum size of two inches (2").

Article 2.3 Construction

A. Excavation and Backfill

Excavation and backfill for furnishing and installation of sanitary sewer pipe shall be in accordance with Division 20, Section 20.13 - Trench Excavation and Backfill.

The Contractor shall remove and dispose of all sewage-saturated soils encountered within the trench area. All sewage-saturated soils shall be considered unsuitable material. Sewage-saturated soils may not be used as fill material anywhere within the City and shall be disposed of at the City Landfill. There shall be no separate payment for removal and disposal of sewage-saturated soils. Removal and disposal of sewage-saturated soils shall be considered incidental to the pay item: Furnish and Install Pipe

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.

<u>Diameter (Inches)</u>	<u>Allowance Tolerance (Feet)</u>
8	0.03
10	0.03
12	0.03
14	0.04
16	0.04
18*	0.05

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

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 by the Contractor. 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. The Contractor shall notify the Engineer 48 hours prior to taking measurements on newly installed section of line and/or appurtenances for Record Documents.

If the method of transferring grades from the offset hubs to the pipe require batter boards, they shall be at least one by six inches (1" x 6") supported on two by four inch (2" x 4") stakes or approved metal rods and shall be placed every twenty-five feet (25'). At least three boards must be in place at any given time to facilitate checking of line and grade. Both line and grade shall be checked and recorded in a field book 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 observations shall be subject to the approval of the Engineer. If intermittent backfilling is allowed, backfilling shall be accomplished in accordance with Division 20, Section 20.13 - Trench Excavation and Backfill.

C. Pipe Laying

All pipe shall be laid with Class E bedding as outlined in CPSS. Bedding must be laid the full width of the ditch and compacted to a minimum of ninety-five percent (95%) of the maximum density, unless otherwise required by the Contract Documents or directed by the Engineer.

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. Each section of pipe shall be handled carefully and placed accurately; each pipe shall be joined in accordance with the pipe manufacturer's recommended standards. Each section of pipe shall be properly supported to ensure true alignment and an invert which is smooth and free from roughness or irregularity.

The Contractor shall stagger the joints for sanitary sewer pipe such that no sewer pipeline joint shall be closer than nine feet (9') measured horizontally (outside of pipe to outside of pipe) from its intersection with either water mains or water services encountered in the Work.

The Contractor shall take every precaution to preclude foreign debris from entering the sanitary sewer system. Temporary screening techniques of the downstream manholes proposed for use by the Contractor shall first be reviewed and approved

by the Engineer prior to their use in the Work. Contractor shall be responsible for removing and cleaning any foreign debris that enters the sanitary sewer system. All costs associated with the removal of foreign debris from the sanitary sewer system resulting from the Contractor's activities shall be considered incidental to the Contract.

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 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 Owner. Care shall be exercised during construction, flushing, and testing operations of the connecting link to assure that water or any foreign debris 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.

Pipe shall not be laid when the bottom of the ditch or the sides to one foot (1') above the pipe are frozen. Backfill material shall not contain frozen material. The trench shall not be left open during freezing weather so that the temperature of the material near the pipe goes below freezing.

All ductile iron pipe shall be encased in one layer of polyethylene encasement in accordance with Section 50.13 - Polyethylene Encasement.

D. Bedding of Ductile Iron Pipe for Sanitary Sewer Main

Sanitary sewer pipe and sanitary sewer service connection bedding shall extend six (6) inches above the top of the pipe and constructed in accordance with Division 20, Section 20.13 – Trench Excavation and Backfill and Standard Detail 20-8.

E. Laying Instructions for Concrete Pipe with "O" Ring Bell End Joint

To allow a watertight joint and to insure an installation which will allow the pipe to perform as designed, the following recommendations of the pipe manufacturer shall be observed.

1. Spigot groove and bell surface shall be clean and free of foreign material.
2. Apply joint lubricant freely to the bell including the tapered surface and completely coat the rubber gasket.
3. After placing gasket in groove, run a small tool completely around between gasket and groove to equalize gasket stretch.
4. Exercise care at first contact of the pipe. Avoid bumping which may damage spigot. Stop any swaying motion before contact is made.
5. To couple pipe, insert spigot slowly and carefully straight into bell, to allow the gasket to cushion the initial contact and center the spigot as it enters the tapered portion of the bell.

6. Complete joint should have spigot against inside bell shoulder. Inside joint space should not exceed one-half inch (1/2") for straight runs. Pulled joint deflections for alignment change shall comply with pipe manufacturer's recommended deflection limits.
7. Check all around pipe for rolled or "fishmouthed" gaskets after coupling.
8. Do not pick up and drop coupled pipe to adjust grade.
9. Ensure that the pipe is not supported only at the bell nor is the pipe barrel resting on a high spot. The bottom quarter of the pipe shall be uniformly supported through its length in order for the pipe to resist the design loads.

F. Laying Instructions for Other Pipe

All other pipe shall be laid in accordance with the manufacturer's published recommendations.

Article 2.4 Testing

A. General

The Contractor shall clean and flush all sanitary sewer pipe installed prior to testing and substantial completion inspection. Sewer main and service trenches shall be substantially backfilled and compacted.

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 method (air or water) of testing for each section tested.

All wyes, tees, or ends of side sanitary 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 is considered incidental to the Contract.

The Contractor shall take precaution to prevent sewage from entering the new sanitary sewer pipeline until it has been inspected, tested and accepted for operation by the Engineer. The Contractor may request inspection, testing and acceptance of incremental segments of the Work. An incremental segment shall

be considered a mainline sanitary sewer with a completed manhole or cleanout at each end.

B. Exfiltration Test (Using Water)

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

A minimum head of six feet (6') 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 for the actual test of leakage. During this one-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 these requirements and retesting 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.

C. 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. Joints only may be tested in pipe thirty-six inches (36") in diameter, or larger at the option of the Contractor.

The Contractor may desire to make an air test prior to backfilling for his own purpose. However, the acceptance air test shall be made after backfilling has been completed, and compacted.

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 greatest back pressure of any ground water in contact with 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 greatest back pressure of any ground water in contact with the pipe, if:

The total rate of air loss from any section tested in its entirety between manholes or between manholes and cleanout 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 shown:

<u>Pipe Diameter</u>	<u>Allowable Pressure Drop in 10 Minutes</u>
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 1/2 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 10 PSI.

D. 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) gallon 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.

E. Check of Line and Grade

After backfilling 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. 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.

Article 2.5 Measurement

Measurement for all sizes of pipe shall be based on the horizontal distances and will be from center to center of manholes or from center of manholes to center of cleanout bend.

Unless specifically identified for payment under a separate bid item, the unit price bid for Furnish and Install Pipe (size) (shape) (type) (material) (class and/or gage) shall include all labor, equipment and materials to furnish and install a functional sanitary sewer system including, but not limited to, the following incidental items: asphalt surfacing removal and replacement; concrete sidewalk, curb, and or gutter removal and replacement; clearing and grubbing; trench excavation and backfill; excavation dewatering; trench support system; furnishing and installing bedding; compaction; installation of pipe, fittings, adapters, or other necessary appurtenances; polyethylene encasement; surveying; testing; disposal of unusable or surplus material; protection, bracing and or shoring of existing utilities; restoration of existing drainage patterns; removal and replacement of existing culverts, fences, landscaping, and other public or private improvements or natural features impacted by the Work; finish grading; and cleanup.

Article 2.6 Basis of Payment

Payment for this Work shall be in accordance with Division 10, Section 10.07 - Measurement and Payment, and shall include full payment for all Work described in this Section.

Where the Work includes disconnecting existing sanitary sewer services from an existing sewer main and reconnecting them to a new sewer main, the disconnection and reconnection of those existing sewer services will be considered incidental to the installation of the new sewer main.

Unit cost payment shall be made on the following basis:

ITEM	UNIT
Furnish and Install Pipe (Size, Shape, Type Material, Class and/or Gauge)	Linear Foot

SECTION 50.03 SANITARY SEWER MANHOLES

Article 3.1 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.

Article 3.2 Material

Materials used in the construction of manholes shall conform to the requirements of ASTM C-478 (AASHTO-199) and the Standard Details. Cones shall be Type (b), 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 constructed 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, pavement-adjusting rings and covers shall be 30,000 PSI minimum conforming with the requirements of ASTM A-48. The requirement for transverse breaking load shall be 2,000 pounds, conforming with the requirements of ASTM A-438. Frames and covers shall conform to the Standard Details. Where lockable manhole covers are specified, the Contractor shall submit Shop Drawings of the locking device for approval of the Engineer.

Gray iron castings shall have appropriate certifications and be individually marked in accordance with the requirements of AASHTO M-306. Castings which do not possess appropriate AASHTO M-306 certifications and markings shall be replaced by the Contractor at no expense to the Owner.

Each precast concrete barrel section, precast concrete eccentric cone section, concrete adjusting ring and manhole cover/frame shall be set and sealed by use of a rubber gasket manufactured by Kistner Concrete Products, Inc. or a plastic gasket joint sealer, as manufactured by Henry Company, Inc., Ram-Nek Sealant Division, or an approved equal.

All manhole joints shall be sealed with WrapidSeal external joint sealant, manufactured by CCI Pipeline Systems, or CCW MiraDRI 860/861 by Carlisle Coatings and Waterproofing or an approved equal. Seals shall be applied per manufacturer's published recommendations.

All exterior manhole concrete surfaces shall be coated for waterproofing with TUFF-N-DRI[®] brush grade foundation coating, or approved equal, applied per manufacturer's recommendations.

Manholes shall be installed with no less than three (3) layers of 8-mil polyethylene encasement on the outside of the manhole.

Refer to Division 30, Section 30.01, Article 1.6 - Mix Requirements for Classes of Concrete, for specifications pertaining to Class A-3 concrete as required in forming manhole inverts. The use of Transite or Asbestos Cement (AC) pipe to form manhole inverts is prohibited.

Rubber waterstops used in pipe-to-manhole joints, shall be rings of resilient material that will fit snugly over a pipe. The resilient material shall be held firmly against pipe surface by means of a stainless steel mechanical take-up device which, when tightened, will compress the resilient material or, by a stretch, fit. The rubber waterstop shall be designed and installed so that leakage between pipe and manhole is eliminated. Material and manufacture of waterstops shall conform to applicable provision of the ASTM Standard Specifications for Resilient Connectors between Reinforced Concrete Manhole Structure and Pipes, ASTM C923. Waterstops at manhole pipe penetrations shall be sealed with "Z-lok" and "A-lok" manhole pipe connections per the Standard Details, or approved equal.

Reinforcement steel shall conform to the requirements of ASTM A-185, ASTM A-615, Grade 60 steel, or better, and the Standard Details.

Article 3.3 Construction

A. General

Excavation and backfill for furnishing and installing sanitary sewer manholes shall be in accordance with Division 20, Section 20.13 - Trench Excavation and Backfill.

The manhole frames and covers shall be brought to the grades shown on the Drawings. Manhole grade rings shall be set in and made secure by use of butyltight (or equal). (In paved streets, manhole grade rings and frames shall be placed on a full bed of mortar to prevent settlement.) Each manhole must have a minimum of one (1) six inch (6") grade ring and a two inch (2") pavement adjusting ring and will be externally sealed with CCI Pipeline Systems WrapidSeal, MiraDRI or equal

Use of, and installation of, a plastic gasket joint sealer ("Ram-Nek" or equal) 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 portions of precast manholes must be approved by the Engineer prior to installation in the sanitary sewer systems. The precast manhole manufacturer shall provide timely notice (at least two working days in advance) to allow time for the Engineer to arrange for necessary inspections. Installation, of manhole sections will not be allowed prior to the Engineers 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.

Prior to backfilling, the Contractor shall apply TUFF-N-DRI® waterproofing to the exterior of the manhole, MiraDRI, WrapidSeal (or equal) at all manhole joints and three (3) layers of 8-mil polyethylene encasement on the outside of the manhole. NFS material is to be placed a minimum of three feet (3') outside of the manhole and compacted to a minimum of 95% of the modified proctor.

In the case of poured-in-place manhole construction, if the Contractor elects to accomplish the manhole construction utilizing more than one 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 sanitary sewer section. Changes in directions of flow shall be made by forming a smooth radius sized to allow adequate access of a T.V. camera and/or maintenance equipment into the served sanitary sewer pipe. Changes in size and grades of the channels shall be made gradually and evenly. The invert channels may be formed directly in the concrete of the manhole base, or may be formed and poured in place, or may be constructed by laying a full section of sanitary sewer pipe through the manhole and breaking out the top half after the surrounding concrete has hardened. The floor of the manhole outside the channels shall be smooth and shall slope towards the channels at a grade of one inch (1"/ft) per foot. All dead-end sanitary sewer manholes shall have an invert installed through the entire Sanitary Sewer Manhole penetration for insertion of CCTV and/or maintenance equipment.

C. Additional Depth for Manholes

This item consists of the construction of additional depth to manholes over and above the standard depth specified below. Additional depth to manholes shall be constructed as per Standard Detail and designated as to type:

TYPE	DEPTH
"A," "B" & "C"	12 feet

D. Component Part Replacements

The Contractor shall take due care not to destroy or damage existing component parts of manholes that are to remain or be reset in place.

The Contractor shall furnish and install barrel sections and grade rings to adjust the top of sanitary sewer manholes to grade in accordance with Sections 50.18 – Adjust Sanitary Sewer Manhole Cone to Finish Grade and 50.19 - Adjust Sanitary Sewer Manhole Ring to Finish Grade, as shown in Standard Details 50-24 and 50-25. All materials used in the adjustment of sanitary sewer manhole cones

including mortar, steps barrel sections, block, etc., shall conform to the requirements for sanitary sewer manholes as outlined in Article 3.2 - Materials.

Installation of new sections shall be constructed to produce a smooth, regular, watertight surface.

E. Removal of Existing Manhole Component Parts

Upon removal of manhole component parts, the Contractor shall clean and prepare existing component parts prior to installation of replacement parts. This will include, but not be limited to, removing existing grout and Ramnek-type sealant from remaining and connecting component parts.

Materials that can be reused (manhole covers, frames, etc.) shall be salvaged and removed in a workmanlike manner and delivered to the City. The Contractor shall provide a disposal site for non-salvageable materials.

Article 3.4 Measurement

Manholes shall be measured as units complete in place. Depth of manholes will be based upon a measurement to the nearest foot, for payment purposes, from top of casting to the top of the base slab. All depths over the specified standard depth will be paid under "Additional Depth to Manholes."

Article 3.5 Basis of Payment

Payment for this Work shall be in accordance with Division 10, Section 10.07 - Measurement and Payment, and shall include full payment for all Work described in this Section.

Component parts of existing or new manholes shall be included in the unit price for the bid item being constructed, reset, or replaced, and shall be paid for by a cumulative total of each unit constructed.

Any excavation required in the removal or upgrade of sanitary sewer manholes shall be considered incidental to the bid item under construction.

Adjustments to grade in accordance with Sections 50.18 – Adjust Sanitary Sewer Manhole Cone to Finish Grade and 50.19 - Adjust Sanitary Sewer Manhole Ring to Finish Grade shall be incidental to the bid item under construction and no separate payment shall be made.

Related component parts to the bid items under construction (including steps, etc.) as shown in the Standard Details shall be incidental to that bid item.

If, in the opinion of the Engineer, the Contractor was negligent in damaging component parts of existing manholes to remain or be reset in place, the Contractor shall replace them in kind at his expense. If in the opinion of the Engineer, the damage was unavoidable,

replacement component parts may be furnished by the Petersburg Wastewater Utility and the Work paid for at the bid item price.

Payment shall be made on the following basis:

ITEM	UNIT
Construct Sanitary Sewer Manhole (Type, Standard Depth)	Each
Additional Depth to Manhole (Type)	Vertical Foot
R&R Manhole Frame and Cover	Each
R&R Manhole Frame and Cover and Rings	Each

SECTION 50.04 WATERTIGHT MANHOLE FRAMES AND COVER

Article 4.1 General

The Work under this Section consists of providing all operations pertaining to the furnishing and installation of watertight manhole frames and covers.

Article 4.2 Material

Watertight frames and covers for manholes and similar appurtenances shall be of cast iron and conform to the dimension shown in 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.

Article 4.3 Construction

Installation shall be performed in accordance with the manufacturer's written instructions and the Standard Details.

Article 4.4 Measurement

Watertight manhole frames and covers shall be measured as complete units in place.

Article 4.5 Basis of Payment

Payment for this Work shall be in accordance with Division 10, Section 10.07 - Measurement and Payment, and shall include full payment for all Work described in this Section..

Payment is made only for the additional cost of furnishing and installing the watertight frame and cover which exceeds the cost of the standard frame and cover included in the completed manhole unit price.

Payment shall be made on the following basis:

ITEM	UNIT
Watertight Manhole Frame and Cover	Each

SECTION 50.05 CONNECTIONS TO EXISTING SANITARY SEWER MANHOLES

Article 5.1 General

The Work under this Section consists of providing all operations pertaining to the Work required for connections to existing manholes.

Article 5.2 Construction

Excavation and backfill for connections to existing manholes shall be in accordance with Division 20, Section 20.13 - Trench Excavation and Backfill.

Connections to existing manholes shall be made by core drilling the new penetration into the manhole and providing an NPC Kor-N-Seal or approved equal pipe to manhole connector to produce a water tight seal. The use of impact tools to form new penetrations is prohibited.

Connection to existing manholes shall be made in a workmanlike manner, shall be water tight and have smooth flow surfaces and curves. The invert shall be brought into the existing manhole at the elevation shown on the Drawings. The downstream pipe in manholes shall be screened to prevent entry of 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 suitable and adequate debris and sand traps and sumps upstream from the connection. If the connection to existing manhole occurs near the existing ladder rungs of the existing manhole, the Contractor shall remove the existing ladder rungs and install new ladder rungs so that the ladder rungs are not above a pipe penetration. (The Contractor may rotate the barrel sections and cone section of the manhole rather than removing old ladder rungs and installing new ladder rungs.)

Article 5.3 Measurement

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

Article 5.4 Basis of Payment

Payment for this Work shall be in accordance with Division 10, Section 10.07 - Measurement and Payment, and shall include full payment for all Work described in this Section. Where the connection is made to a pipe stubbed out of the existing manhole, payment will not be allowed for the connection.

Payment shall be made on the following unit:

ITEM	UNIT
Connect to Existing Sanitary Sewer Manhole	Each

SECTION 50.06 CONSTRUCT SANITARY SEWER DROP CONNECTION

Article 6.1 General

The Work under this Section consists of providing all operations pertaining to furnishing and installing drop sanitary sewer connections to manholes.

Article 6.2 Materials

Pipe and fittings used in the construction of drop connections for sanitary sewers shall conform to the requirements of AWWA C-151/ANSI A21.51 for Class 50 pipe, and AWWA C104/ANSI A21.4 for fittings, and the Standard Details. Pipe penetrations into the manhole shall comply with Section 50.03, Article 3.2 – Material and Section 50.05, Article 5.2 – Construction. Pipe and fittings shall be restrained through the use of EBAA Iron MEGALUG® fittings or equal on all mechanical joints and U.S. Pipe FIELD LOK® gaskets or equal on all push-on joints.

Article 6.3 Construction

Excavation and Backfill for furnishing and installing drop sanitary sewer connections shall be in accordance with Division 20, Section 20.13 - Trench Excavation and Backfill. Installation of drop sanitary sewer connections shall be in accordance with the Standard Details.

Over-excavation under 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. The lower invert of the exterior drop connect must be bedded and cured in concrete.

Refer to Division 30, Section 30.01 - General for requirements pertaining to Class A-3 concrete.

Article 6.4 Measurement

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

Article 6.5 Basis of Payment

Payment for this Work shall be in accordance with Division 10, Section 10.07 - Measurement and Payment, and shall include full payment for all Work described in this Section.

Payment shall be made on the following basis:

ITEM	UNIT
Construct Sanitary Sewer Drop Connection	Each

SECTION 50.07 CONSTRUCT BEAVER SLIDE

Article 7.1 General

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

Article 7.2 Material

Refer to Division 30, Section 30.01 - General, for requirements pertaining to Class A-3 concrete as required in forming beaver slide inverts.

Article 7.3 Construction

Beaver slides shall be constructed to provide a smooth and continuous channel directed into and with the flow of the receiving sanitary sewer and in accordance with the Standard Details.

Beaver slides are required where the invert of the connecting sanitary 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.

Article 7.4 Measurement

Beaver slides shall be measured as units complete in place.

Article 7.5 Basis of Payment

Payment for this Work shall be in accordance with Division 10, Section 10.07 - Measurement and Payment, and shall include full payment for all Work described in this Section.

Payment shall be made on the following basis:

ITEM	UNIT
Construct Beaver Slide	Each

SECTION 50.08 LATERAL CONNECTION TO EXISTING PIPE

Article 8.1 General

The Work under this Section consists of providing all operations pertaining to lateral connections to trunk and interceptor mains, as approved by the Utility.

Article 8.2 Construction

Lateral connections to existing sanitary sewer pipe shall be water tight and have smooth flow surfaces. The lateral shall be brought into the existing pipe in accordance with the Contract Documents, unless otherwise approved by the Engineer. The connection shall be made in a top quadrant of the pipe, and the lateral shall not intrude past the inside wall of the existing pipe.

Taps to reinforced concrete sanitary sewer pipe shall be made by use of an approved mechanical hole cutter. A tapping saddle shall be installed centered over the hole. Breaking into the pipes by use of a chipping gun, jackhammer, or other similar method will not be allowed.

Article 8.3 Measurement

Lateral connections will be paid for as a complete unit in place which includes all pipe and fittings from the manhole to the existing main.

Article 8.4 Basis of Payment

Payment for this Work shall be in accordance with Division 10, Section 10.07 - Measurement and Payment, and shall include full payment for all Work described in this Section.

Payment shall be made on the following basis:

ITEM	UNIT
Lateral Connection	Each

SECTION 50.09 DEEP SANITARY SEWER SERVICE RISERS

Article 9.1 General

The Work under this Section consists of providing all materials and operations pertaining to deep sanitary sewer service risers. Deep service risers shall be installed where the sanitary sewer is in excess of twelve feet (12') deep and eight feet (8') of cover can be maintained over the service. Deep service risers shall be fully restrained ductile iron pipe to the edge of right-of-way or easement. No more than two sanitary sewer service connections shall be installed on a single deep service riser.

Article 9.2 Material

All deep sanitary sewer service riser connections shall be constructed with the following materials:

- A. Ductile iron pipe with Tyton® joints and Mechanical Joint fittings.
- B. EBAA Iron MEGALUG®, U.S. Pipe Field LOK® Gasket, or approved equal.
- C. PVC Pipe fully restrained.

Article 9.3 Construction

Excavation and backfill for furnishing and installing deep sanitary sewer service risers shall be in accordance with Division 20, Section 20.13 - Trench Excavation and Backfill. Contractor shall construct deep sanitary sewer service risers in accordance with the Standard Detail.

Article 9.4 Measurement

Service risers for deep sanitary sewer connections shall be measured as complete units in place.

Article 9.5 Basis of Payment

Payment for this Work shall be in accordance with Division 10, Section 10.07 - Measurement and Payment, and shall include full payment for all Work described in this Section.

Payment shall be made on the following basis:

ITEM	UNIT
Deep Sanitary Sewer Service Riser (Size)	Each

SECTION 50.10 SANITARY SEWER SERVICE CONNECTIONS

Article 10.1 General

The Work under this Section consists of providing all materials and operations pertaining to the construction required for sanitary sewer service connections.

The Contractor shall notify the Engineer and property owners seventy-two (72) hours prior to any interruption of sanitary sewer service. The Contractor shall provide temporary service during the period of interruption.

If construction activities are to occur in areas other than existing easements and temporary construction permit areas, the Contractor shall secure a written Access Permit from the property owner prior to beginning construction. Such permission shall hold the City of Petersburg harmless from any damage and claims sustained by the Contractor's operations within the permit area.

Article 10.2 Material

All gravity sanitary sewer service connects shall be constructed with class 50 ductile iron Tyton® joint pipe, DR 18 PVC pipe or equal, and/or alternate pipe material approved by the City.

All gravity services with less than three feet (3') of cover shall be insulated with four inches (4") of rigid board insulation in conformance with Section 50.01, Article 1.5 - Insulation.

For gravity sewer services, connection to main shall be made with a Romac style CB Sewer saddle.

All two inch (2") force main sanitary sewers shall be constructed with polyethylene coated Type K copper tubing or HDPE SDR 11 (eleven) per the Standard Detail for this Work. All two inch (2") force main sanitary sewer connections shall use service clamp per the Standard Detail.

All two inch (2") force main sanitary sewers to be installed with minimum of five feet (5') of bury.

Article 10.3 Construction

Excavation and backfill for furnishing and installing sanitary sewer service connections shall be in accordance with Division 20, Section 20.13 - Trench Excavation and Backfill.

The service connections shall be bedded with non-frost susceptible material, with a fine granular texture and containing no material larger than one-half inch (1/2"). For gravity and force main sewers, bedding shall be placed the full extent of ditch and six inches (6") above the pipe.

Construction shall be in accordance with the Standard Details. Multiple connections 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 sanitary 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, wye saddles will be the only saddles allowed on mains smaller than twelve inches (12"). All gravity service connections to sanitary sewer mains shall be approved ductile iron pipe or equal material approved by the City. All two inch (2") force main sanitary service connections to sanitary sewer mains shall be approved Type K copper or HDPE SDR 11 (eleven) pipe.

Saddles for gravity sewer connections shall be placed over a circular hole sawed one-eighth inch (1/8") larger than the inside diameter of the saddle. 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.

All ductile iron pipe shall be encased in one layer of polyethylene encasement in accordance with Section 50.13 - Polyethylene Encasement. Sanitary sewer service connections shall be installed to the edge of right-of-way or edge of sanitary sewer easement of the lot being served and shall be permanently marked by means of a Carsonite (or equal) marker extending three feet (3') above grade, painted green.

Record drawings shall include the pipe station of service connection at the main, service length, service invert elevations at the main and property line and distance to nearest property corner.

Minimum slopes for gravity sewer service connections shall be as follows:

<u>Pipe Diameter</u>	<u>Slope</u>	
4"	2.08%	.0208 feet 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

Upon exposing a stub-out, the Contractor is required to insure that the line has proper slope, bearing, and is free and clear of obstructions prior to connection with the service extension.

If the service line is found to be either plugged or if a gravity sewer service is found to have reverse grade, the Contractor is required to notify the City immediately or be liable for correcting the misalignment or unplugging the line at his expense. At the point of tie-in if No-hub pipe is exposed, a "Romac repair clamp" SC-1-450 or equal shall be used to connect to the on-property service line. If a "Ty-seal" hub is utilized, the use of a "Romac

repair clamp" or equal is not required. When using a bend at the point of tie-in, two (2) "Romac repair clamps" shall be used.

An Inspector for the City shall be present when initial connection or service line extension is made to the Utility line, without exception.

The City will not approve any installation which is not in accordance with the Uniform Plumbing Code and these Specifications. The Contractor shall not start the excavation for main line tap or onsite service until a dig permit is obtained. All permits must be posted on the job at the time of the inspection.

Article 10.4 Measurement

Sanitary sewer service connections shall be measured as completed units in place. This item will include all materials, excavation, installation, compaction, backfill, and installation of bedding material.

Unless specifically identified for payment under a separate bid item, the unit price bid for Sanitary Sewer Service Connect (size) shall include all labor, equipment and materials to furnish and install a functional sanitary sewer service connection including but not limited to the following incidental items: location and verification of customers' existing service locations, disconnection and reconnection of customer's existing services where the Work includes replacement of existing services, clearing and grubbing; trench excavation and backfill; excavation dewatering; trench support system; furnishing and installing Type II-A Classified Fill and Backfill; bedding; compaction; installation of pipe, fittings, adapters, or other necessary appurtenances; sanitary sewer service insulation; polyethylene encasement; when applicable, connection to existing service at edge of right-of-way; disposal of unusable or surplus material; protection of existing utilities; restoration of existing drainage patterns; removal and replacement of existing culverts, fences, landscaping, and other public or private improvements; finish grading; and cleanup.

Where the Work includes disconnecting existing sanitary sewer services from an existing sewer main and reconnecting them to a new sewer main, the disconnection and reconnection of those existing sewer services will be considered incidental to the installation of the new sewer main.

Article 10.5 Basis of Payment

Payment for this Work shall be in accordance with Division 10, Section 10.07 - Measurement and Payment, and shall include full payment for all Work described in this Section.

Payment shall be made on the following basis:

ITEM	UNIT
Sanitary Sewer Service Connect (Size)	Each

SECTION 50.11 REMOVE AND DISPOSE OF EXISTING CESSPOOLS OR SEPTIC TANKS AND CONNECT EXISTING SERVICE

Article 11.1 General

The Work under this Section consists of providing all operations pertaining to removal and disposing of existing cesspools or septic tanks and connection of existing service. If cesspools or septic tanks are encountered during construction, the Contractor shall either defer construction of the sewer main through the cesspools until such time as all downstream construction has been completed, tested and accepted or the Contractor may proceed with construction provided that the waste from the house service connection is accommodated continuously until satisfactory connection to the sanitary sewer main can be made. Such accommodations shall be in a manner approved by the City.

Article 11.2 Construction

Where the Contractor must remove cesspools or septic tanks from the trench area, the following procedures shall apply:

1. The liquid and sludge from the existing structure shall be pumped into a watertight container, and transported to and disposed of at an approved sanitary sewer dump station to be designated by the Engineer. Care shall be exercised in transporting cesspool liquid and sludge so that no spillage occurs during transport and disposal.
2. The Contractor shall then remove the remaining sludge, septic tank, cesspool or privy pit, logs or cribbing, and any saturated gravel remaining in the trench area, and shall dispose of this material at a Contractor provided disposal area approved by the City and the Engineer.
3. The Contractor shall then fill the void created by removal of the cesspool with Type III material in accordance with Division 20, Section 20.13 - Trench Excavation and Backfill.
4. As soon as the downstream portion of the new sanitary sewer has been tested and accepted the Contractor shall replace the existing service to the property line and connect the existing house service to the main. Connection shall be made in a workmanlike manner and at a uniform grade to accommodate the existing service.
5. The contractor shall schedule inspection of the abandoned systems with the City. The abandoned disposal system must be shown on the record drawings.

Article 11.3 Measurement

Removal of existing cesspool or septic tank, replacing the existing service to the property line and connecting existing house service to the new sanitary sewer is to be measured as two pay items as indicated in Article 11.4 – Basis of Payment. Disposal of logs, cribbing, tanks and saturated gravel shall be measured as unsuitable material. Gravel necessary to fill the void after removal of structure shall be measured as Type III per Division 20, Section 20.21 – Classified Fill and Backfill.

Article 11.4 Basis of Payment

Payment for this Work shall be in accordance with Division 10, Section 10.07, - Measurement and Payment, and shall include full payment for all Work described in this Section.

Payment shall be made on the following basis:

ITEM	UNIT
Remove Cesspool or Septic Tank	Each
Connect Existing Service	Each

SECTION 50.12 CONSTRUCT SANITARY SEWER CLEANOUT

Article 12.1 General

The Work under this Section consists of providing all materials and operations pertaining to construction and installation of sanitary sewer cleanouts.

Article 12.2 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, or equal material approved by the City, and AWWA C104/ANSI A21.4 fittings and as shown on the Standard Detail. Fittings to be restrained joint pipe and shall be EBAA Iron MEGALUG®, Romac Industries RomaGrip, U.S. Pipe Field LOK® Gasket, or approved equal.

Article 12.3 Construction

Excavation and backfill for the construction of sanitary sewer cleanouts shall be in accordance with Division 20, Section 20.13 - Trench Excavation and Backfill.

Over-excavation under cleanouts shall require thorough compaction prior to installation of the pipe and fittings.

The cleanout assembly shall be restrained throughout by use of EBAA Iron MEGALUG®, Romac Industries RomaGrip, U.S. Pipe Field LOK® Gasket, or approved equal, and shall be installed in accordance with Standard Detail 50-19.

Article 12.4 Measurement

Cleanouts will be measured as units, complete in place.

Article 12.5 Basis of Payment

Payment for this Work shall be in accordance with Division 10, Section 10.07 - Measurement and Payment, and shall include full payment for all Work described in this Section.

Payment shall be made on the following basis:

ITEM	UNIT
Construct Sanitary Sewer Cleanout	Each

SECTION 50.13 POLYETHYLENE ENCASUREMENT

Article 13.1 General

The Work under this Section consists of providing all labor, materials, and equipment to furnish and install one layer of polyethylene encasement on all ductile iron pipe, metallic fittings and cleanout risers. The polyethylene encasement shall be a linear low-density polyethylene film with a minimum of thickness of 8 mil.

Polyethylene encasement shall be furnished on all ductile iron water mains, sanitary sewer mains, sanitary sewer laterals, sanitary sewer connections, water services, valve boxes, and sanitary sewer cleanouts.

Article 13.2 Material

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

Article 13.3 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 "A Guide for the Installation of Ductile Iron Pipe." The Contractor shall use Method A of ANSI/AWWA C105/A21.5 to install polyethylene encasement.

Bedding and backfill material around pipelines with polyethylene encasement shall be placed using protective measures such as shields, guards, coating systems, and/or other methods as needed to protect the polyethylene encasement from becoming torn, punctured or otherwise damaged during the Work. Damage to the integrity of the polyethylene encasement shall be either repaired or the pipeline removed and the polyethylene encasement replaced as directed by the Engineer. Costs for repair and/or replacement of damaged polyethylene encasement shall be considered incidental to the installation of the polyethylene encasement and/or the installation of the pipeline protected by the encasement.

Article 13.4 Measurement

Polyethylene encasement shall not be measured for payment.

Article 13.5 Basis of Payment

No separate payment shall be made for polyethylene encasement. This Work is considered incidental to the bid item under construction.

SECTION 50.14 BYPASS PUMPING SANITARY SEWAGE FLOWS

Article 14.1 General

The Work under this Section consists of providing all planning, coordination, and operations pertaining to the bypass pumping of sewage flows around those portions of the sewage facilities to be rehabilitated. The existing flows include those from any upstream collection system components that contribute to the subject sanitary sewer mains or manhole facilities. Also, this Work shall include the installation and upgrade of portable sanitary sewer facilities (portable toilets) for use by the affected residents.

Article 14.2 Construction

The sewage flows shall be bypassed around sections of pipe designated for rehabilitation on an as-required basis. The Contractor shall ensure the pumps and bypass lines are of appropriate capacity and size to accommodate the anticipated sewage flows during the duration of all operations requiring such bypass.

The Contractor shall notify the occupants of any affected structure served by sanitary sewer service, in writing, at least seventy-two (72) hours in advance, of any scheduled sanitary sewer service interruption. Services affected shall not be interrupted more than eight (8) consecutive hours or more than once in a twenty-four (24) hour period. Under no circumstances shall the Contractor allow the discharge of sewage into the existing storm drain system or onto the ground. No excavation will be permitted to facilitate this Work, except as indicated on the Drawings.

Prior to construction, the Contractor shall submit to the Engineer a plan detailing the scheduled deployment of pumps, hoses and other equipment necessary to maintain sewage flows during construction. The pumping system shall be such that the hydraulic gradient both upstream and downstream of the piping being bypassed will not reach elevations that will cause damage to the properties being served. This will require close attention to the elevation of the upstream head needed to actuate the pumping cycle and the rate of discharge flow from the pumps. The Contractor shall be liable for all damages which result from sewage flows not properly maintained during the progress of the Work, including all damages to private property which occur as a direct or indirect result of inadequate control of the sewage flow while the sewage bypass operation is ongoing. The Contractor is reminded that after-hours pumping may require a permit to exceed the allowable noise levels. Should such permit not be available for certain locations, such lack of availability shall not cause for claim for additional compensation or time extension.

The installation and maintenance of portable sanitary sewer facilities (portable toilets) shall be one (1) unit per four (4) residences (housing units) and at least one (1) unit on each side of the street. These units shall include hand sanitation devices, shall be properly vented, stocked, cleaned as necessary, or as determined by the Engineer, and overall maintained in a clean working order.

Article 14.3 Measurement

Bypass pumping of existing sewage flows will be paid for on a lump sum basis.

Article 14.4 Basis of Payment

Payment for this Work shall be in accordance with Division 10, Section 10.07 - Measurement and Payment, and shall include full payment for all Work described in this Section.

Payment shall be made on the following basis:

ITEM	UNIT
Pumping and Bypassing Existing Sanitary Sewage Flows	Lump Sum

SECTION 50.15 ON-PROPERTY SANITARY SEWER SERVICE

Article 15.1 Description

The Work under this Section consists of furnishing all material, labor, and equipment necessary for connecting the new sanitary sewer service at property line to the existing sanitary sewer service on property at, or near, the existing sanitary sewer main located on private property.

The exact location, type, and size of existing service connections are unknown. All information provided in the Drawings and Specifications has been taken from maintenance records, record drawings, or field surveys, and represents the City's best indication of the service's location and size. The City shall not be liable for accuracy of information on these drawings. The Contractor shall locate the existing service line prior to installing the new service on property.

The Contractor shall notify the homeowner forty-eight (48) hours in advance of actual construction of the Work.

Article 15.2 Material

All material shall be in accordance with Section 50.02 - Furnish and Install Pipe. The Contractor shall supply all necessary fittings, adapters and other appurtenances to make a complete working system.

Article 15.3 Construction

The Contractor shall perform required trench excavation and backfill and compact to specified density; provide bedding as outlined in CPSS. Bedding must be laid the full width of the ditch and compacted to a minimum of ninety-five percent (95%) of the maximum density, flush and test system; protect/restore existing utilities, driveways, trees, utility markers, survey monuments, fences, retaining walls, buildings, walkways, gardens, landscaping and other private improvements damaged by the Contractor; and provide general cleanup. Prior to beginning Work, the Contractor shall submit to the Engineer in writing for approval, the service line routing, method of construction and schedule for performing the Work. The Contractor shall use appropriately sized construction equipment to minimize the impact to on-lot improvements and vegetation.

All Work shall be done in accordance with Division 20, Section 20.13 - Trench Excavation and Backfill, and this Division.

Article 15.4 Measurement

Locating, furnishing and installing on-property sanitary sewer service lines shall be measured as units, complete in place.

The unit price for furnishing and placing sanitary sewer service connections on private property shall constitute full compensation for all labor, material and equipment required to provide a complete functioning sanitary sewer service connection from the property line to

an acceptable connection point on the existing sanitary sewer service, as determined by the Engineer, and installation of appurtenances.

All excavation, pipe bedding material, pipe fittings, and appurtenances, insulation, backfill, backfill gravel, topsoil and seeding, resetting fences, reconstructing retaining walls, walkways and restoration of property shall be included in this bid item. Asphalt or concrete driveways (where required) shall be paid for under the appropriate bid items for this Work.

Any conflicts with the homeowner concerning the installation of the on-lot sanitary sewer service connection and restoration of the property after construction shall be resolved by the Contractor at no additional cost to the Owner.

Article 15.5 Basis of Payment

Payment for this Work shall be in accordance with Division 10, Section 10.07 - Measurement and Payment, and shall include full payment for all Work described in this Section.

Payment shall be made on the following basis:

ITEM	UNIT
Furnish and Install (Size) On-Property Sanitary Sewer Service	Each

SECTION 50.16 MANHOLE REHABILITATION

Article 16.1 Description

The Work under this Section consists of rehabilitation of existing manholes or adjusting their grade. The Contractor is to provide all labor, materials, and supervision required to furnish and install new manhole components needed to rehabilitate existing manholes.

Rehabilitation of existing manholes can include the following items of Work:

Removal and replacement of manhole covers and frames.

Removal and replacement of grade rings.

Removal and replacement of manhole ladder rungs.

Removal and replacement of cone section.

Removal and replacement of barrel ring/riser section.

Removal and replacement of base section.

Removal and replacement of entire manhole assembly.

The manhole components to be removed and replaced for a specific manhole are identified in the Drawings. The Contractor is to reuse those manhole components that are not to be replaced in assembly of the rehabilitated manhole.

Article 16.2 Material

The replacement component materials of construction to be deployed in the Work are to comply with the requirements of this Division and the Standard Details. The Contractor shall furnish new, unused materials for those manhole components identified in the Drawings to be replaced.

Article 16.3 Construction

A. Work Plan

The Contractor shall prepare and submit a Work Plan to the Engineer that identifies how the manhole rehabilitation effort will proceed without interruption of existing sanitary sewer service. The Plan shall also address maintenance of vehicular traffic and pedestrian traffic. Manhole rehabilitation efforts shall not proceed without the Engineer's approval.

B. Temporary Services

The Contractor shall maintain sanitary sewer service during the execution of the Work. Any sewage pumping, temporary bypass piping, and/or temporary sanitary sewer service required to complete the Work will be considered incidental to the manhole rehabilitation effort and will not be paid for separately.

C. Earthwork

The Contractor shall excavate around the manhole as needed to access the Work. All excavation, shoring, dewatering, backfill and compaction efforts required to access the Work shall be per Division 20 – Earthwork. All importation of fill and/or disposal of unsuitable material, excavation, and backfill efforts shall be considered incidental to the manhole rehabilitation effort and will not be paid for separately.

D. Restoration

Upon completion of the manhole assembly effort, the Contractor shall restore the existing grades and surrounding area to preconstruction conditions. Any pavement, sidewalk, curb and gutter, landscaping, and/or other improvements or natural features disturbed and/or damaged by the manhole rehabilitation effort shall be restored by the Contractor to preconstruction conditions. Restoration of these conditions shall be considered incidental to the manhole rehabilitation effort and will not be paid for separately.

E. Manhole Rehabilitation

The Contractor shall remove and replace those manhole components identified in the Drawings. The rehabilitated manhole shall be configured according to the requirements of this Division and the Standard Details.

The Contractor shall use care in protecting those component parts of the existing manhole that are to be reused in the rehabilitated manhole.

Where the Work requires disassembly and reuse of components that are assembled with grout and/or mastic/sealant/gasket materials, the Contractor shall completely remove these materials from the components and replace them with new materials approved by the City for manhole construction in the reassembly of the rehabilitated manhole.

Where the Work requires the removal and replacement of existing ladder rungs, all ladder rungs within the existing manhole shall be removed and replaced. The Contractor shall cut off existing rungs and grind smooth against the interior wall of manhole. New ladder rungs shall be installed per the Standard Details.

Where the Work requires the removal and replacement of manhole cone section, manhole barrel ring/riser sections, and/or removal and replacement of manhole base section, the completed rehabilitated manhole shall be tested for leakage prior

to backfilling. With the excavation still dewatered, the Contractor shall demonstrate the integrity of the completed rehabilitated manhole using the methods described in Section 50.02, Article 2.4 - Testing. The infrastructure to be tested shall include all components of the rehabilitated manhole and connecting pipes disturbed or otherwise altered in the execution of the Work. If the rehabilitated manhole does not pass the leakage test due to visible defects in the new components and/or materials furnished by the Contractor, the defects shall be corrected and the assembly retested as often as required to pass the leakage test. If the failure of the test is determined by the Engineer to be a result of defects in the manhole components reused in the Work, the Engineer may direct the Contractor to take additional corrective measures on a time and materials basis.

The Contractor shall dispose of manhole components not used in the manhole rehabilitation effort and all other unsuitable or waste materials created in the execution of the Work. Disposal of these components shall be considered incidental to the manhole rehabilitation effort.

Article 16.4 Measurement

Rehabilitated manholes shall be measured as units complete in place with the components identified in the Drawings replaced, tested and accepted by the Engineer.

All effort required to complete the Work, including development of a Work Plan acceptable to the Engineer, temporary bypass piping, temporary sanitary sewer service, excavation, shoring, dewatering, backfilling, integrity testing, restoration of Work area to existing preconstruction conditions, and/or other items of Work needed to complete the manhole rehabilitation effort shall be considered incidental to the completion of the Work and shall not be paid separately.

Article 16.5 Basis of Payment

Payment for this Work shall be in accordance with Division 10, Section 10.07 - Measurement and Payment, and shall include full payment for all Work described in this Section.

Payment shall be made on the following basis:

ITEM	UNIT
Remove and Replace Manhole Cover and Frame (Manhole #)	Each
Remove and Replace Manhole Grade Rings (Manhole #, Number & Height of Grade Rings)	Each
Remove and Replace Manhole Ladder Rungs (Identify Manhole No., Number of Ladder Rungs)	Each
Remove and Replace Manhole Cone Section (Manhole #, Type)	Each
Remove and Replace Manhole Barrel Ring/Riser Section (Manhole #, Type, Number of Rings Replaced, Depth Below Grade measured to bottom of lowest ring to be replaced)	Each
Remove and Replace Manhole Base Section (Manhole #, Type, Depth of Base Section Below Grade measured to the bottom of base section)	Each

SECTION 50.17 RAISE OR LOWER SEWER SERVICE

Article 17.1 General

The Work under this Section consists of all operations pertaining to raising or lowering of existing sanitary sewer services when the grade(s) of such services interfere with a utility under construction. Every effort has been made in the preparation of the Drawings to avoid conflict in grades with existing sewers; however, there may be some locations where conflict occurs.

Article 17.2 Construction

Where a conflict in grade occurs, the Contractor shall be required to excavate the sewer service from the point of interception sufficient distance to raise or lower the sewer service such that the grade conflict will be eliminated. Minimum grade of the sewer service shall be maintained in accordance with Section 50.10, Article 10.3 - Construction. In no case will the length of raising or lowering of the sanitary sewer service exceed fifty feet (50'). All excavation, backfill, and pipe laying shall be performed in accordance with the provisions of this Division and Division 20 - Earthwork.

Article 17.3 Measurement

Raising or lowering sewer services will be measured as units, complete in place.

Article 17.4 Basis of Payment

Payment for this Work shall be in accordance with Division 10, Section 10.07 - Measurement and Payment, and shall include full payment for all Work described in this Section unless otherwise noted.

Any materials needed to complete the raising or lowering of a sewer service shall be provided by the Contractor and considered incidental to the price bid for this item. Compaction, where required, will also be considered incidental to the Contract.

Payment shall be made under the following unit:

ITEM	UNIT
Raise or Lower Sewer Service	Each

SECTION 50.18 ADJUST SANITARY SEWER MANHOLE CONE TO FINISH GRADE

Article 18.1 General

The Work under this Section consists of providing all operations pertaining to the adjustment of existing manhole cones to finish grade. All broken and/or missing manhole components are to be replaced with new materials furnished and installed by the Contractor in accordance with these Specifications.

Article 18.2 Material

All materials used in the adjustment of manhole cones including mortar, steps, barrel sections, premolded plastic gaskets, etc., shall conform to the requirements for manholes as outlined in Section 50.03 - Sanitary Sewer Manholes. Radial concrete manhole blocks may be used for upward adjustments in certain cases if approved by the Engineer.

Article 18.3 Construction

The Contractor shall remove the existing cone and add to or remove portions of the barrel of each manhole requiring a cone adjustment. Each precast concrete barrel and cone section shall be set upon and sealed with a premolded plastic gasket which shall meet AASHTO M-198, ASTM C990, or Federal Specification SS-SS-210. Any damage to manholes resulting from construction under this Contract shall be repaired or the damaged portion replaced at the Contractor's expense. All inverts, benchwalls, and/or catch areas shall be left clean and free from any foreign materials.

Manhole to be made watertight by use of Miradri or WrapidSeal system after adjustment is complete.

Contractor shall adjust the manhole cone to finish grade prior to placement of pavement. Cutting of new asphalt for adjustments is not acceptable. Any adjustment(s) requiring cutting of new asphalt shall not be paid and shall be deducted from the plan quantity.

Article 18.4 Measurement

Manhole cone adjustments shall be measured as units, complete in place.

Article 18.5 Basis of Payment

Payment for this Work shall be in accordance with Division 10, Section 10.07 - Measurement and Payment, and shall include full payment for all Work described in this Section.

Payment for cone adjustments shall include compensation for changes in height per the applicable Standard Details, unless otherwise directed by the Engineer. In no case will payment for both ring and cone adjustments be made for the same manhole.

Payment shall be made under the following unit:

ITEM	UNIT
Adjust Sanitary Sewer Manhole Cone	Each

SECTION 50.19 ADJUST SANITARY SEWER MANHOLE RING TO FINISH GRADE

Article 19.1 General

The Work under this Section consists of providing all operations pertaining to the adjustment of existing manhole rings to finish grade, All broken and/or missing manhole components are to be replaced with new materials furnished and installed by the Contractor in accordance with these Specifications.

Article 19.2 Material

All materials used in the adjustment of manhole rings shall conform to the requirements for manholes as outlined in Section 50.03 - Sanitary Sewer Manholes.

The Contractor may utilize Neenah R-1979 Series Manhole Adjusting Rings, or an approved equal, for adjusting the manhole to finished grade.

Article 19.3 Construction

The Contractor shall adjust the manhole rings in accordance with the applicable Standard Details. The Contractor shall set the adjusting rings in a bed of premolded plastic gasket material that meets AASHTO M-198, ASTM C990, or Federal Specification SS-S-210. The casting can be set in a bed of mortar with steel adjusting shims in the event the grade will not allow the premolded plastic gasket material. The steel shims shall be placed in four locations as a minimum and must be approved by the Engineer. Any damage to manholes resulting from construction under this Contract shall be repaired or the damaged portion replaced at the Contractor's expense.

Milling is an approved method of lowering the manhole grade. A horizontal milling process where as the casting is milled to lower the top to meet the finish grade of the street. This method must be submitted to the Engineer for approval.

Contractor shall adjust the manhole cone to finish grade prior to placement of pavement. Cutting of new asphalt for adjustments is not acceptable. Any adjustment(s) requiring cutting of new asphalt shall not be paid and shall be deducted from the plan quantity.

Article 19.4 Measurement

Manhole ring adjustments shall be measured as units, complete in place.

Article 19.5 Basis of Payment

Payment for this Work shall be in accordance with Division 10, Section 10.07 – Measurement and Payment, and shall include full payment for all Work described in this Section.

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 shall be made under the following unit:

ITEM	UNIT
Adjust Sanitary Sewer Manhole Ring	Each

SECTION 50.20 REMOVE EXISTING SANITARY SEWER MANHOLE

Article 20.1 General

The Work under this Section consists of providing all operations pertaining to the removal and disposal or salvage of existing manholes.

Article 20.2 Construction

Materials that are to be salvaged shall be removed in a workmanlike manner and delivered to a site as directed by the Engineer. A disposal site for non-salvageable materials shall be provided by the Contractor.

Any excavation required in the removal shall be considered incidental to this item. The Contractor shall backfill the excavation with a suitable, non-frost susceptible material and compact it to not less than ninety-five percent (95%) of maximum density as directed by the Engineer. If additional material is required for backfill, it will be paid for under the Item "Furnish Trench Backfill." Existing pipes shall be suitably plugged and abandoned unless otherwise noted.

Article 20.3 Measurement

Removal of existing sanitary manholes will be measured as units.

Article 20.4 Basis of Payment

Payment for this Work shall be in accordance with Division 10, Section 10.07 - Measurement and Payment, and shall include full payment for all Work described in this Section.

Payment shall be made under the following units:

ITEM	UNIT
Remove Existing Sanitary Sewer Manhole	Each

SECTION 50.21 ADJUST CLEANOUT TO FINISH GRADE

Article 21.1 General

The Work under this Section consists of providing all operations pertaining to adjustment of existing cleanouts to finish grade. All broken and/or missing cleanout components are to be replaced with new materials furnished and installed by the Contractor in accordance with these Specifications.

Article 21.2 Material

All materials used in the adjustment of cleanouts shall conform to the requirements for cleanouts as outlined in Section 50.12 - Construct Sanitary Sewer Cleanout.

Article 21.3 Construction

The Contractor may be required to adjust more than one type of cleanout under this Contract. All adjustments will be accomplished as directed by the Engineer. Any damage to cleanouts resulting from construction under this Contract shall be repaired or the damaged portion replaced at the Contractor's expense. All joints and fittings shall be restrained.

Article 21.4 Measurement

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

Article 21.5 Basis of Payment

Payment for this Work shall be in accordance with Division 10, Section 10.07 - Measurement and Payment, and shall include full payment for all Work described in this Section.

Payment shall be made under the following unit:

ITEM	UNIT
Adjust Cleanout to Finish Grade	Each