SECTION 02720 - SANITARY SEWER COLLECTION SYSTEM

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SECTION 02720 - SANITARY SEWER COLLECTION SYSTEM

PART 1 – GENERAL

1.01 WORK INCLUDED

A. Furnish and install all piping as shown on the drawings, described in the specifications, and as required for a complete and operable system. The work includes abandoning and plugging of existing main sanitary sewers, construction of new service mains and laterals, construction of new manholes, appurtenances, demolition and backfilling of existing manholes, verification of rim and invert elevations, as built drawings, piping for recycled water, use of approved confined space equipment, trench shoring per OSHA requirements, and compliance with San Francisco Bay Area Sanitary Sewer Overflow Monitoring and Reporting Program requirements.

B. Any and all work to be performed on the Collection System shall be inspected by the City's Project Inspector. The City's Project Inspector shall obtain required approvals from DWWR representative for all submittals and inspections.

C. In addition, any and all work performed on the collection systems shall conform to the North San Mateo County Sanitation District code of requirements.

D. Stormwater Pollution Prevention Requirements - The contractor shall comply with the City's NPDES Stormwater Waste Discharge permit #CA0029921, as updated, for discharges to the storm drain system, including adherence to all applicable Best Management Practices to prevent pollutants, including sediment, from entering the storm drains.

The developer/contractor shall provide an adequate Stormwater Pollution Prevention Plan (SWPPP) for all applicable projects prior to commencing any phase of construction. The SWPPP shall comply with the current General Permit for Construction Activity from the California Regional Water Quality Control Board and/or current San Mateo Countywide Water Pollution Prevention Program permit.

1.02 RELATED REQUIREMENTS

A. Section 01340, *"Submittals"*

B. Section 02221, "Trench Excavation and Backfill"

C. Section 03300, "Minor Concrete"

1.03 REFERENCE STANDARDS

A. ASTM C 12	*"Standard Practice for Installing Vitrified Clay Pipe Lines"*
B. ASTM C 301	"Standard Test Methods for Vitrified Clay Pipe"
C. ASTM C 425	"Standard Specification for Compression Joints for Vitrified Clay Pipe and Fittings"
D. ASTM C 700	"Standard Specification for Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated"
E. ASTM C 828	"Standard Test Method for Low Pressure Air Test of Vitrified Clay Pipe Lines"
F. ASTM C 896	"Standard Definitions of Terms Relating to Clay Products"
G. ASTM C 1091	"Standard Method for Hydrostatic Infiltration and Examination Testing of Vitrified Clay Pipe Lines"
H. ASTM C 900	All Standard Applicable for SDR35, SDR26, SDR21 AND ASTM C 900 Pipe and Fittings.
I. ASTM C 581	Standard Practice for Determining Chemical Resistance of Thermosetting Resins Used in Glass-Fiber-Reinforced Structures Intended for Liquid Service.
J. ASTM D 3212	"Standard Specification for Drain and Sewer Plastic Pipes Using Flexible Elastromeric Seals"
K. ASTM D 1784	"Standard Specification for Rigid PVC and CPVC Compound"
L. ASTM D 2321	"Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and other Gravity-Flow Application"
M. ASTM D 3034	"All Standards Applicable for SDR35, SDR26, SDR21 Pipe and Fittings"
N. ASTM D 3350	"Standard Specification for Polyethylene Plastic Pipe and Fitting"
O. ASTM D 3035	"Standard Specification for Polyethylene Plastic Pipe (SDR-PR). Based on controlled outside diameter."
P. ASTM D 2412	Standard Test Method for Determination of External Loading Characteristics on Plastic Pipe by Parallel Plate Loading.
Q. ASTM D 3262	Standard Specification for Fiberglass (Glass-Fiber-Reinforced Thermosetting Resin) Pipe and Fittings.

R.	ASTM D 3567	Standard Practice for Determining Dimensions of Fiberglass (Glass-Fiber-Reinforced Thermosetting Resin) Pipe and Fittings.
S.	ASTM D 3681	Standard Test Method for Chemical Resistance of Fiberglass (Glass-Fiber-Reinforced Thermosetting Resin) Pipe in a Deflected Condition.
T.	ASTM D 4161	Standard Specification for Fiberglass (Glass-Fiber-Reinforced Thermosetting Resin) Pipe Joints Using Flexible Elastomeric Seals.
U.	ASTM D 1784	Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
V.	ASTM D 3034	Standard Specifications for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
W.	ASTM D 3212	Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
X.	ASTM D 2321	Standard Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe
Y.	ASTM D 2657	Standard Practice for Heat-Joining Polyolefin Pipe and Fittings
Z.	ASTM D 3350	Standard Specification for Polyethylene (PE) Plastic Pipe and Fittings Materials
AA.	ASTM F 1803	Standard Specification for Poly (Vinyl Chloride) (PVC) Closed Profile Gravity Pipe and Fittings Based on Controlled Inside Diameter
BB.	ASTM F 679	"All Standards Applicable for SDR35, SDR26, SDR21 Pipe and Fittings"
CC.	ASTM F 477	"Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe"
DD.	ASTM F 714	"Standard Specification for Polyethylene Plastic Pipe (SDR-PR). Based on Outside Diameter"
EE.	ASTM F 477	Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
FF.	ASTM F585	Standard Practice for Insertion of Flexible Polyethylene Pipe into Existing Sewers
GG.	AWWA C950	Fiberglass Pressure Pipe.

1.04 QUALITY ASSURANCE

A. All materials and equipment furnished under this Section shall:

1. be of a manufacturer who has been regularly engaged in the design and manufacture of the materials and equipment for at least five (5) years; and

2. be approved by the City's Project Inspector before installation. The inspector shall verify that the quality is equal to the materials and equipment made by those manufacturers specifically named herein, if an alternate product manufacturer is proposed.

B. The Contractor's attention is directed to Article 8 of the City's General Conditions (Section 00700). To validate that specified final elevations have been provided, the Contractor shall provide to the City applicable grade certificates as required by Article 8. No separate payment will be made for providing such certification. All costs therefore shall be included in the various work item(s) requiring certification.

1.05 MEASUREMENT AND PAYMENT

A. The lengths of the various types and sizes of sewer pipes will be measured and paid for by the linear foot of horizontal length actually installed. Pipe lengths between manholes will be measured and paid only between interior faces of manholes.

B. Unless otherwise specified in the Special Provisions, no separate payment will be made for bends, wyes, tees and other fittings. All associated costs therefore shall be included in the unit price for pipe requiring the fitting.

C. Laterals will be determined and paid for as unit installed in place for the different sizes of laterals or as specified in the Special Provisions. Laterals designated for transfer from an existing sewer main to a new sewer main will be paid as units.

D. Manholes, including frames and covers, will be measured and paid for as unit price each. Existing manhole covers shall be salvaged and delivered to the City as directed by the City's Project Inspector unless specified to be reused in the project.

E. Potholing will be determined and paid for as unit price each, unless otherwise specified in the Bid Schedule.

F. The above prices and payments shall include full compensation for furnishing all labor, materials, tools, equipment, confined space equipment and use thereof, testing, inspections, including probing and locating other utilities, excavation, backfill, aggregate base, pavement restoration, sidewalk restoration, sheeting and shoring, ditching, diking, pumping, bailing, draining, furnishing and maintaining services and equipment for traffic safety and dewatering, and incidental work for properly and safely constructing, replacing, or upgrading sewers, complete in place and fully functional, as shown on the plans and as specified in these specifications.

1.06 SUBMITTALS

A. Shop Drawings: Submit data to show that the product conforms to the specification requirements.

B. Materials List: Submit a list of all materials proposed to be used on the project, showing manufacturer's name, product trade name, type, grade, and weight. Materials list shall be submitted and approved before any installation occurs.

C. Manufacturer's Warranty: Submit manufacturer's warranty on the product and a certificate showing compliance with applicable ASTM Standards.

PART 2 - PRODUCTS

2.01 GENERAL

A. Pipe sizes are nominal inside diameter unless otherwise noted.

B. All materials delivered to the job site shall be new, free from defects, and shall show manufacturer's name, trade name, type, grade, weights, and other identifying data.

C. Acceptance of materials shall be subject to strength and quality testing, in addition to inspection of the completed product. Acceptance of installed piping systems shall be based on inspection and testing as specified hereinafter.

D. The City's Project Inspector will review and approve before installation each pipe length, fittings, joints and materials to be used. Additionally, the inspector shall also verify that all needed equipment and reasonable spare parts are on site before allowing cuts or service disruptions in the existing system.

E. All pipe installed above or below ground that are designed to convey recycled water shall be the color purple or distinctively wrapped with purple tape.

2.02 DUCTILE IRON PIPE

A. Pipe and fittings shall be ceramic, epoxy lined, ductile iron pipe with elastomeric gaskets and fittings, "Protecto 401," as manufactured by US Pipe and Foundry, or equal. Elastomeric Gaskets shall be sewage and grease resistant.

2.03 POLY-VINYL CHLORIDE (PVC) & HIGH DENSITY POLYETHYLENE (HDPE) PIPE AND FITTINGS

A. All PVC pipe shall at a minimum conform to ASTM D 3034 or ASTM F 679. Rubber gaskets shall be factory installed and conform to ASTM F 477. Pipe joints shall conform to ASTM D 3212. Pipe shall be made of PVC plastic having a cell classification of 12454 or 12364 as defined in ASTM D 1784. Gravity pipe shall have an SDR of 35 or 26 and will be determined by the City's Project Inspector. Forced main pipe shall meet ASTM C 900, Class 150, DR 18.

B. All pipe, fittings, gaskets, joint lubricants and cements/solvents, shall be supplied by the manufacturer, or per manufacturer's specification

C. Joints shall all be push on, elastomeric gasket type and conform to ASTM F 477/D 3212.

D. Lateral connections to PVC mains shall be made using a saddle tee or saddle wye or City's Project Inspector approved equivalent and approved through the submittal process.

E. Pipe shall be installed in accordance with ASTM D 2321 and the manufacturer's specifications. Bedding material shall provide adequate and uniform support under the pipe.

F. HDPE pipe and fittings may be used only where recommended by DWWR. Specifications are to be determined per application. Repairs to HDPE must be done with electrofusion couplings.

G. All High Density Polyethylene (HDPE) pipes to be used on gravity sewers shall not be black or any dark color on the interior, or orange, red, magenta or blue in color on the exterior of the pipe. Pipe shall be SDR 11 or 17.

H. Repairs to PVC pipe – repairs to existing PVC pipe can be performed in the following manner:

1. Repairs of less than three (3) feet – Insert new section of PVC pipe and use the appropriate Mission MR series couplings or equivalent to make the connections.

2. Repairs of greater than three (3) feet – Insert new section of PVC pipe using a double push-on type coupler on one side and the appropriate Mission MR series coupling or equivalent on the other side of the repair.

2.04 VITRIFIED CLAY PIPE (VCP)

A. Pipe and Fittings

1. Vitrified clay pipe shall not be used for new main or lateral construction without prior approval from the City's Project Inspector.

   Vitrified clay pipe shall not be used to convey recycled water.

   Vitrified clay pipe and fittings shall meet all requirements of ASTM C 700, "Vitrified Clay Pipe, Extra Strength, Standard Strength and Perforated." Pipes shall be bell and spigot or plain ends.

B. Joints Gravity Mains and Laterals

1. VCP pipe joints shall be of a mechanical flexible compression type. Joints for bell and spigot pipe shall be made of plasticized polyvinyl chloride compound, bonded to the pipe, molded, and cured to uniform hardness to form a tight coupling when assembled. Pipe joints shall be speed-seal as manufactured by Gladding McBean, Pacific Clay Products, Mission Clay Products, or equal.

2. Joints for plain end VCP pipe shall be banded rubber couplings secured with stainless steel bands such as manufactured by Mission Clay Products, Gladding McBean, or equal, and conform to the requirements of ASTM C 425 "Compression Joints for Vitrified Clay Pipe and Fittings." . All couplings shall be Mission MR56 ARC couplings or equal. Stainless steel sheer bands are to be used on all couplings. Connections from cast iron, PVC or HDPE to VCP are to be of Mission MR02 ARC couplings or equal. Connection to SDR 35 PVC will require the proper solvent weld adaptor.

3. Deflection of pipe is to cause no more than 1/8 inch gap between pipe faces.

4. Repair banded couplings shall be with adjustable stainless steel shear ring for sizes six (6) inches through twenty seven (27) inches.

2.05 TRAPS/ INTERCEPTORS/SEPARATORS

When in the judgment of the North San Mateo County Sanitation District, waste pretreatment is required, an approved type of grease trap and/or grease interceptor and/or separator complying with the current provisions of the California Plumbing Code as adopted by the City of Daly City with emphasis on Section 1009.0, 1011.0,1012.0 and 1014.0 and Appendix H, is required. Grease interceptors for commercial kitchens shall use DWWR/NSMCSD Standard Drawing number SS-6A, Grease Interceptor Sizing Worksheet, for the proper sizing of the interceptor. The calculations along with the manufacturers engineered drawings shall be submitted for review and will be approved on a case by case basis. An effluent sampling box is required on all interceptors and separators.

2.06 MANHOLES

A. Pre-Cast Concrete Manholes

1. All pre-cast concrete manholes shall conform to the details shown on the applicable City Standard Drawings for sewer manhole. Pre-cast manhole sections shall be manufactured in accordance with ASTM C 478, "Precast Reinforced Concrete Manhole Sections." Sewer manholes shall be without rungs or steps. Manholes shall be leak free structures. Structures constructed with precast sections shall be so constructed using a single manufacturers products and /or with products as may be recommended by the precast section manufacturer.

2. Manhole Sizes:

Manhole Diameter	Clay Pipe Main Diameter	Cover Diameter
48 inches	21 inch and smaller	24 inches
60 inches	24 inch and 27 inch	36 inches
72 inches	30, 33 and 36 inch	36 inches

B. Manhole Bases

1. Precast manhole bases shall be installed unless otherwise noted on the plans. Precast bases shall be manufactured in accordance with the requirements of ASTM C478.

   Cast in place manhole bases may be used if approved by the DWWR prior to installation.

C. Work on Existing Manholes:

1. When work is performed on existing manholes, plywood shall be used to cover entire channel and a drop cloth shall be used to cover the entire base. This precaution shall be taken to prevent debris from entering the Collection System. Non-compliance will result in the suspension of that portion of the Contractor's work for the day until the precautionary measures are put in place. No contract time extensions will be granted due to said suspension of work. Repairs to brick manholes are to be made using bricks conforming to ASTM C 32 "Sewer and Manhole Brick," grade MS.

D. Joint Sealer

1. Joints in precast manhole sections shall be made of "Ram-Nek" preformed flexible plastic joint sealant.

2.07 MANHOLE FRAMES AND COVERS

A. Manhole frames and covers shall conform to applicable City Standard Drawings. Non-pressure type manhole frames and covers shall be D&L A-1000, or equal. Pressure type manhole frames and covers shall be D&L A-1000 (bolt down), or equal. Both manhole frames and covers shall meet all requirements of ASTM A 159, "Automotive Gray Iron Castings."

B. Manhole covers shall be labeled "Sanitary Sewer".

C. Manhole covers shall have at least one pick hole and one edge pry hole.

2.08 ADJUSTING RINGS FOR MANHOLE FRAMES AND COVERS

A. Shall not be used on any sewer manhole. Frames must be raised in accordance with Section 02720 - 3.13.

2.09 ANCHOR BOLTS

A. Anchor bolts shall be fabricated as specified by the equipment manufacturer and, unless otherwise indicated, shall be stainless steel. Cone shall be drilled to accept ¾ inch stainless steel inserts. Manhole rim is to be bolted down prior to the pouring of the concrete cap.

2.10 IRON CASTINGS

A. Iron castings shall be made from properly prepared patterns and molds and shall conform to ASTM A 48, "Gray Iron Castings," Class 40C. Small castings shall be galvanized. Large castings shall be galvanized only if specifically required.

2.11 SANITARY SEWER CLEANOUTS

A. Bends and Fittings

1. Bends and fittings for sanitary sewer cleanouts shall conform to the requirements of applicable City Standard Drawings. Cleanouts shall be installed as part of all lateral repairs or replacements.

B. Concrete Boxes and Covers

1. Concrete boxes and covers for cleanouts shall conform to applicable City Standard Drawings.

C. Riser Pipe

1. Cleanout risers shall be the same material that is being used for the lateral repair/replacement and shall extend to within six (6) inches of the underside of the cleanout lid.

2. Risers for cleanouts shall be continuous pipes (no joints) of the same material as the cleanout.

D. One-way directional cleanout

1. One-way directional cleanout shall be located two (2) feet minimum from the face of the building. Cleanout shall incorporate a cleanout body with threaded cap.

2.12 BACKWATER VALVE

A. Backwater valve shall be of the no-hub type, with bolted cover and furnished with a brass flap, and shall be of the Tyler #8270 Four (4) inch model or approved equal conforming to the California Plumbing Code.

B. Backwater valves are to be installed on all sewer laterals with less than 2% grade or when the lowest fixture in a building is lower than the rim of the next downstream manhole. Backwater valve shall be placed in an appropriately sized vault to allow for routine maintenance by the owner.

2.13 RECYCLED WATER VALVES AND VALVE BOXES

A. Valves

1. General

- All valves shall be non-rising stem (NRS), opening left (counter-clockwise), and the stem shall be fitted with a two-inch (2") square operating wrench nut. The operating nut shall be within eighteen inches (18") to twenty-four inches (24") below the final grade utilizing stem extensions, as required.

- All valves used must be properly coated and materials must be suitable for use in sewage applications.

- Valves in pump stations and other special facilities shall be equipped with hand wheels.

- Each valve shall have the maker's initials, pressure rating, and year of manufacture cast on the body. Furnish affidavit of compliance.

- Bolts, nuts and T-bolts for connecting valves to pipe shall be the same as for pipe and fittings.

- In addition to thrust blocks, all mechanical joint fittings shall be restrained with an approved joint restraint device, "Mega lug" by EBBA or approved equal, that has a pressure rating suitable for the thickness of pipe specified.

2. Control Valves:

   All valves for use in any part of the collection system must be submitted for approval to the City's Project Inspector prior to installation.

3. Check Valves:

   - Swing-type, gravity-operated check valves shall comply with the applicable parts of AWWA C 508, "Swing-Check Valves for Waterworks Service, two (2) through twenty four (24) inches NPS (National Pipe Straight Threads)". Check valves shall have bronze disc facing, iron body, bronze mounted, and O-ring sealed stuffing box. Valves two and one half (2-1/2) inches through twelve (12) inches shall be rated for one hundred seventy five (175) psig maximum working pressure, have flanged ends, and be installed only in a horizontal position.

   - Check valves shall be the following:

     1) Mueller #A-2600-6 2-1/2" to 16"

     2) Stockham #931 2" to 16"

     3) American-Darling #52SC 2" to 16"

B. Valve Boxes

1. Each valve shall be equipped with a valve box, complete with cover. Boxes shall be extension type with a slide type adjustment. The word "RECYCLED WATER" shall be cast on the cover and the cover shall be cleaned, primer-painted and coated with Dunn Edwards #265 U permanent magenta paint.

   The boxes shall be adapted with full extension to the depth of cover required over the pipe at the valve location. Christy #G-5 traffic valve box shall be used in streets and sidewalks and #FL8 curb valve box with #FL8C "Concrete" lid shall be used in other locations.

2. Valve boxes for identification of horizontal alignment changes (bends) shall be ten and one quarter (10 ¼) inches inside diameter with triangular cover. The word "RECYCLED WATER" shall be cast on the cover. The cover shall be cleaned, primer-painted and coated with permanent magenta paint. The boxes shall be adapted with full extension to the depth required over the pipe at an elbow location. Boxes shall be Brooks Products, Inc. #4-TT Series or Christy Products, Inc. #G-4.

3. Sleeves or tubes for all valve and valve box identifications shall be eight (8) inch PVC, Schedule 40, and shall rise to six inches (6") below strut sidewalk or finish grade.

2.14 BACKFILL MATERIALS

Unless otherwise specified, trench backfill material shall be as provided under Section 02221 - "Trench Excavation and Backfill," of these specifications, applicable City Standard Drawings and the following:

A. Initial backfill material in ground saturated by water shall be granular material, clean and free of clay, silt or organic matter, and shall be Class 1, Type B, conforming to the requirements of Section 68-1.025, "Permeable Material," of the State Specifications.

B. The minimum depth of cover for any public sewer shall be three feet (3'). Sewer shall be encased in concrete, shall be of ductile iron pipe, or shall have a six-inch (6") concrete cap, as approved by the City's Project Inspector, should it be impossible to obtain the specified minimum cover.

2.15 MINOR CONCRETE

A. Concrete for minor structures such as cast-in-place manholes, manhole bases, pipe encasements, pipe supports, replacement and repair of curb and gutter, sidewalks, and other concrete work, when designated as minor concrete on the plans, shall conform to the provisions of Section 03300 - "Minor Concrete," of these specifications.

PART 3 – EXECUTION

TRENCH EXCAVATION AND BACKFILL

GENERAL

Trench excavation and backfill shall be in accordance with Section 02221 - "Trench Excavation and Backfill," of these specifications and applicable City Standard Drawings and Specifications, and the following:

Cover on sewer main shall not be less than thirty inches (30") or greater than sixty inches (60"), unless shown on the Plans or approved by the City's Project Inspector.

3.01 TRENCH EXCAVATION

A. All pipe materials and accessories shall be on site prior to excavation. Unless otherwise specifically approved by the City's Project Inspector, the length of open trench shall not exceed one hundred (100) feet ahead of pipe laying and no more than twenty five (25) feet of excavated trench shall remain unbackfilled at end of day.

Excavations in public streets shall be coordinated so as to minimize traffic interference. Trenching in paved areas shall be saw cut or scored and broken ahead of trenching operations and shall be cut or trimmed to a neat edge after backfilling. Any pavement damaged outside of the cuts shall be saw cut and restored prior to final paving.

B. Roots four inches (4") or greater found during excavation shall be exposed but not severed and shall be wrapped in burlap to protect them while exposed. Roots two to four inches (2"-4") in diameter that are severed in the course of construction shall be neatly trimmed and coated with a heavy coat of tree seal. In the event major roots of smaller trees are damaged or severed, the City's Project Inspector may require the contractor to consult with a qualified arborist to determine the proper method to protect the trees.

Trenches must be kept free from water while the pipe or structures are being installed, concrete is setting and until backfill has progressed to a sufficient height to anchor the work against possible flotation or leakage.

C. Trench Width

Trenches shall be excavated to the widths shown in plans with full depth vertical sides where possible.

D. Shoring

Shoring shall be removed only during backfill operations and shall be done without moving the surrounding ground, piping or structure. Shoring can be left in place with the approval of the City's Project Inspector.

3.02 INITIAL BACKFILL

A. Sanitary sewers shall be laid on a firm bed of material shaped and compacted as shown or noted on the plans and detail drawings or herein specified.

B. Bedding material shall be accurately shaped to the line and grade called for on the plans.

3.03 COMPACTION

Compaction shall be in accordance with Section 02221 - "Trench Excavation and Backfill," of these specifications.

3.04 PIPE INSTALLATION

A. Pipe and appurtenances shall be installed in accordance with the best practice, and in conformance with the applicable requirements of ASTM C 12 "Standard Practice for Installing Vitrified Clay Pipe Lines" and/or, ASTM D 2321" Standard Practice for Underground Installation of Flexible Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications" and these specifications. Pipe laying shall start at the low end of each section and proceed upgrade. All bell and spigot pipes shall be laid with the bell end upgrade. Excavate bell holes for each pipe joint. All pipes shall be laid on a bed prepared by handwork, dug true to line and grade, to furnish a true and firm bearing for the pipe throughout its entire length. Adjustment of pipes to line and grade shall be made by scraping away or filling in and tamping material under the body of the pipe throughout its entire length, not by blocking or wedging.

B. For vitrified clay pipe with flexible compression joints, the mating surfaces shall be wiped clean of dirt and foreign matter, and an approved lubricant as recommended by the pipe manufacturer shall be applied to the joint surfaces. The spigot shall then be positioned inside the bell and the joint shoved home. For small diameter pipe, this operation may be done by hand, but on large diameter pipe, a lever attachment or a bar cushioned with a wooden block shall be used to shove the joint into place.

C. Mission MR Series ARC rubber-couplings or equivalent shall be used to make connections on plain end pipe in accordance with the manufacturer's instructions.

D. After each pipe had been brought to grade, aligned, and placed in final position, initial backfill is to be placed in accordance with section 02720 - 3.08 "Trench Backfill".

E. Vertical deflections in the pipe shall not exceed one quarter (¼) inch. If upon inspection vertical deflections/bellies/sags exceed the one quarter (¼) inch tolerance, the pipe shall be adjusted or replaced accordingly.

F. Mandatory use of shoring at designated locations shall not relieve the Contractor of the responsibility to install shoring at other locations required by the City's Project Inspector or where necessary for safety of workers or the general public.

G. Shoring shall be withdrawn only after backfill above pipe has proceeded to a height equal to or greater than three-quarters (3/4) of the excavation depth. Bottom cross bracing and wallers may be left in place upon removal of the sheathing. Backfill shall be brought to the level of the cross-braces before these are removed. Shoring shall be cut above the pipe and left in place only when so required on the plans.

H. The Contractor is solely responsible for installing and extracting the shoring in a manner that will not disturb the line, grade, backfill compaction, or operation of the utility being installed or adjacent utilities and facilities.

I. Ductile iron pipe and fittings shall be prepared, sealed and cut in accordance with the manufacturer's recommended procedures.

J. Place pipe that is to be bedded in concrete cradle or encased in concrete in proper position on temporary supports. When necessary, rigidly anchor or weight the pipe to prevent flotation as concrete is placed. Place concrete for cradles, arches or encasement uniformly on each side of the pipe and deposit at approximately its final position. Concrete placed beneath the pipe shall be sufficiently workable so that the entire space beneath the pipe can be filled without excessive vibration.

K. The minimum horizontal centerline to center line separation between sewer and water mains or laterals shall be ten feet zero inches (10'-0") to conform to sewer separation guidelines. Vertical clearances shall be as directed or shown on the project plans. In any case, a minimum clear space separation of twelve (12) inches shall be provided, with sewer line on lower level than water line.

L. At the end of each workday, all open ends of pipe installed shall be plugged to the satisfaction of the City's Project Inspector.

3.05 SEWER SLIPLINING

A. Intent

It is the intent of this portion of the Specification to provide for rehabilitating sewer lines via the installation of a fiberglass, high density polyethylene (HDPE) or polyvinyl chloride (PVC) sliplining pipe.

B. Scope of Work

Shall be per the design submittal and the contract documents.

C. Materials

1. Fiberglass pipe shall be centrifugally cast with glass fiber reinforcement in a cured thermosetting resin manufactured in accordance with ASTM D3262, cell classification Type 1, Liner 2, Grade 3. Pipe stiffness shall meet the design requirements in the following Section 4.2. Fiberglass liner shall be shown by tests to be resistant to long-term corrosion. Testing shall be performed in accordance with ASTM D3681 using 1.0N sulfuric acid for sanitary sewage, and ASTM C581 for industrial sewage.

2. PVC pipe shall have a minimum cell classification of 12364 B or C as defined in ASTM D1784. Pipe shall be closed profile. The joint shall be designed so that

neither the outside diameter of the pipe is increased, nor the internal diameter of the pipe is decreased at the joint. The joint shall meet the requirements of ASTM D3212. PVC liner pipe shall have a minimum pipe stiffness of 46 psi when tested in accordance with ASTM D2412.

3. Polyethylene pipe and fittings shall be manufactured from high density compounds in accordance with ASTM D3350. All HDPE pipe shall be closed profile and have a minimum SDR rating of 35 and a minimum pipe stiffness of 46 psi.

4. All pipe shall be provided with joints designed so that neither the outside diameter of the pipe is increased nor the internal diameter of the pipe is decreased at the joint.

5. Cellular concrete grout for annular space provided under this Specification shall have the following characteristics:

   a. 250 psi, 28-day compressive strength; 100 psi, 24-hour compressive strength, minimum.

   b. Foam concentrate: ASTM C869.

   c. Cement: ASTM C150.

   d. Fly ash: ASTM C618, Class F, except loss of ignition shall not exceed 5%.

   e. Water: Potable.

   f. Admixtures: Only as approved by foam concentrate manufacturer and the City's Project Inspector.

6. All connectors provided for reinstatement of laterals shall be as follows:

   a. All connectors shall be composed of synthetic rubber based compounds formulated to resist acids, alkalis, solvents, and greases encountered in sanitary and storm sewer and shall contain no reclaimed rubber. CONTRACTOR shall submit evidence of satisfactory testing in accordance with ASTM D543 with no weight loss in 1.0N sulfuric acid, 1.0N hydrochloric acid or 1.0N nitric acid. Materials shall show no etching, blistering, distortion or other evidence of chemical attack. Ultimate tensile strength shall exceed 750 psi at 80 degrees F and elongation shall exceed 150%. Water absorption shall not exceed 4% when tested in accordance with ASTM D570 and hardness shall not exceed 55 in a 5 second reading interval when tested in accordance with ASTM D2240, Type A Hardness.

   b. All compression bands shall be Series 316 Stainless Steel. All nuts and bolts shall be Series 305 Stainless Steel.

c. The completed joint shall comply with ASTM C425 for resilient sewer pipe joints.

D. Design Requirements

1. Conveyance Capacity

a. Sliplining pipe provided under this Specification shall provide the maximum conveyance capacity possible and in no case shall provide less capacity than currently exists. The actual pipe diameter installed may be less than the desired pipe diameter only if satisfactory documentation is submitted to the DWWR which demonstrates that it is impossible or impractical to construct the project with standard, commercially available pipe diameters and dimensions.

2. Design Criteria

a. Slipliner structural properties shall be calculated and provided to the City's Project Inspector prior to construction based upon the following:

i. All existing pipelines shall be considered (the City's Project Inspector shall specify state of deterioration of existing pipe, either fully deteriorated or partially deteriorated).

ii. Water table shall be located (the City's Project Inspector shall specify location of water table to establish hydrostatic pressure criteria).

iii. New pipe shall be assumed to have 5% ovality and be allowed 5% deflection at end of installation.

iv. Maximum depth to invert of existing pipeline shall be (the City's Project Inspector shall specify).

v. Safety factor of 2.0 for bending and wall crush, and 2.5 for buckling.

vi. Modulus of soil reaction shall be (the City's Project Inspector shall specify).

vii. Soil weight shall be (DWWR/Engineer shall specify).

E. Submittals

In addition to the requirements for submittals set forth in the construction contracts and the requirements for submittals contained in companion sections of these specifications, CONTRACTOR shall submit the following:

1. Manufacturer's literature for materials used in liner, gaskets and fittings.

2. Proposed grout mixture and pressures.

3. Test results and certification of compliance for materials.

4. Proposed plan for bypassing sewage during liner installation, if applicable.

5. Manufacturer's design analysis.

6. Proposed method of reconnecting service laterals, if applicable.

7. Details identifying proposed installation method, equipment, and location of access shaft, pit or approach tunnel.

F. Installation

1. Cleaning

   a. Prior to the installation of the slipliner pipe, CONTRACTOR shall thoroughly clean the sewer designated to receive the liner. Cleaning shall constitute removal of all debris, solids, roots, deposits, and other matter which would preclude the installation of the slipliner into the sewer line. Sewer cleaning requirements are contained in Section 02720 - 3.18 - Cleaning Sanitary Sewers.

2. Inspection of Pipelines

   a. Prior to the installation of slipliner, CONTRACTOR shall inspect the sewer designated to receive the liner. Sewer line inspection requirements are contained in Section 02720 - 3.21 - Closed Circuit Television Inspection of Sewer Lines.

3. Sewage Flow Control

   a. CONTRACTOR shall provide for maintenance of flow in the affected portions of the sewer system during installation of the slipliner. Requirements for sewage flow control and bypass pumping are contained in Section 02720 - 3.26 - Bypass Pumping/Sewage Flow Control.

4. Installation

   a. Unless otherwise specifically required, CONTRACTOR shall locate excavation(s) for insertion of slip liner to cause the least disruption to existing utilities, traffic and area business. The existing sewer line shall be exposed for the length necessary to accommodate the maximum length of liner pipe and for equipment. If CONTRACTOR locates insertion pit at an existing precast concrete manhole location, CONTRACTOR shall remove manhole frame, cover, cone, riser and manhole sections as necessary and store for reinstallation upon completion.

   b. Sections of liner shall be field connected above the insertion pit using low profile bell and spigot joints, butt-fused joints or jacking pipe sleeve joints. Bell and spigot and jacking pipe sleeve joints shall be equipped with an elastomeric gasket meeting the requirements of ASTM F477 to provide a watertight seal at each joint. Maximum allowable deflection shall be two degrees. CONTRACTOR shall take precautions to prevent ragged edges of broken sewer pipe from scoring slip liner as it is being pushed/ pulled into sewer.

   c. CONTRACTOR shall seal the annular space between the slip liner and the existing sewer pipe with cellular concrete as specified. CONTRACTOR shall take appropriate precautions to avoid over pressurization, buckling and floating of the slip liner pipe during the grouting process. CONTRACTOR shall comply with pipe manufacturer's recommendations for grouting procedures and with the grout manufacturer's procedures for placement of grout, grout pressures and grout quantity. Multiple grout lift installations may be required to avoid buckling of the liner pipe. CONTRACTOR shall also take precautions to avoid movement of the liner during the grouting operation. No grout shall be placed until service connections have been restored. Grout placement method and pressure shall be in accordance with manufacturer's recommendations and shall be submitted to the City's Project Inspector prior to the placement of grout.

5. Service Connections

   a. CONTRACTOR shall reconnect all service connections to the sewer unless the City's Project Inspector deems connection to be inactive or abandoned. CONTRACTOR shall machine core through liner at each connection point, and comply with the following connection procedures:

      i. CONTRACTOR shall excavate and install a tee fitting with saddle configured to the outside diameter of the slip liner and of tee length necessary to connect existing service or lateral. CONTRACTOR shall bond saddle to outside of liner pipe per manufacturer's recommendations. A minimum of 90% capacity restoration is required.

ii. To join pipes of dissimilar material, CONTRACTOR shall joint plain ends and connect the existing pipes and services using flexible pipe connectors equipped with stainless steel bands and fastening devices as specified.

6. Manholes

a. CONTRACTOR shall cut the upper half of liner out at manholes, and as required to accommodate lateral and service connections at manholes. CONTRACTOR shall reconstruct manhole benches to match new invert elevations

b. Where existing manhole locations have been used as access pit sites, CONTRACTOR shall reconstruct precast manholes using salvaged materials. If existing manhole materials are not suitable for salvage, CONTRACTOR shall reconstruct manhole utilizing cast-in-place or new precast concrete manhole elements. All construction shall comply with the companion sections of these specifications

G. Testing and Acceptance

1. CONTRACTOR shall employ an independent testing agency to conduct and report compressive strength testing of the grout utilized in the construction. CONTRACTOR shall prepare and submit for testing four cellular concrete cylinders from each day's grouting activities. Testing shall occur at one (1) and twenty eight (28) days. All test results shall be submitted to DWWR/ Engineering.

2. After all work is completed, CONTRACTOR shall provide the City with a videotape or DVD showing both the pre- and post-installation conditions including the restored connections. Televising shall be accomplished in accordance with SECTION 02720 - 3.21 - Closed Circuit Television Inspection of Sewer Lines.

3. All defects discovered during the post-installation television inspection shall be corrected by the CONTRACTOR at his expense before the work under the Contract will be considered for Substantial Completion. After the defects, if any, are corrected, the affected sewer segment(s) shall be video taped again. The post-installation television inspection tape shall be submitted to the City's Project Inspector in sufficient time to allow the City's Project Inspector to review the videotape prior to the Substantial Completion milestone.

H. Measurement and Payment

1. Payment shall include all bypass pumping, cleaning, pre- and post-construction televising, labor, equipment, material, supervision, sheeting, shoring, bracing, installation, manhole reconstruction at access pit locations, safety, dust/erosion control, testing, site restoration and all other work specified or not which is

reasonably required to provide a completed installation. Any item not specified shall be considered incidental to the work. CONTRACTOR shall include all incidental cost in the unit price for the slip liner.

2. CONTRACTOR shall receive payment for building sewer lateral reinstatement on a unit price basis per lateral connection diameter reinstated in accordance with the unit prices contained in the contract documents.

3. CONTRACTOR shall receive payment for Mobilization/Demobilization and Traffic Control on a lump sum basis in accordance with the prices contained in the contract documents.

3.06 PIPE BURSTING

Pipe bursting for sewer main rehabilitation/replacement shall be reviewed by the DWWR on a case by case basis.

Pipe bursting may be used for lateral rehabilitation/replacement and shall conform to the latest editions of the UPC (IAPMO IS 26-2003) and the following requirements.

A. General

1. The Contractor shall be certified by the particular pipe-bursting system manufacturer and personnel shall be certified as fusion technicians by a manufacturer of HDPE pipe. Certifications shall be submitted with the lateral application.

2. The Contractor shall perform a pre-construction Closed Circuit Television (CCTV) inspection to evaluate the condition of the existing pipe and determine whether the pipe-bursting method is a valid alternative for repair. Inspection video shall be made available to the DWWR upon request.

B. Materials

1. Only HDPE and butt fusion joints shall be used for pipe bursting applications.

C. Construction

1. General

a. At a minimum, the Contractor shall adhere to the following requirements during construction:

i. Defects and Obstructions

- Contractor shall perform all necessary point repairs and remove all obstructions when pre-construction CCTV inspection reveal heavy solids, offset joints, sags in the pipe, or collapsed pipe that will prevent the completion of the pipe bursting process.

- If preconstruction CCTV inspection reveals a sag in the lateral that is greater than one quarter (1/4) of an inch, Contractor shall excavate and replace those sections of pipe to result in acceptable grade without the sag.

ii. Utility Location and Required Clearances

- A minimum of one foot of clearance (vertical or horizontal) from the outside edge of the pipe to the outside edge of the utility pipe, wire or structure is required. Contractor shall confirm this clearance exists based on above-ground evidence including utility location marks or as-built drawings. Clearances shall also conform to Section 02720 - 3.07 - Utility and Water Pipe Clearances.

- Due to the hazards associated with pipe-bursting near natural gas lines, all natural gas lines, including but not limited to distribution mains, transmission mains, and service lines, marked within four (4) feet of the existing lateral shall be uncovered (pot-holed) to confirm the required clearance exists. If the existing gas line is installed parallel and within four (4) feet horizontally to the existing lateral, the gas line shall be uncovered a minimum of once every one hundred (20) feet along the length of the lateral.

iii. Pipe Relaxation

- After the pipe has been installed, allow pipe manufacturer's recommended amount of time, but not less than four (4) hours, for cooling and relaxation due to tensile stressing prior to reconnecting to the lateral or sewer.

iv. Reconnections to Existing Laterals

- Connections to existing laterals shall be made with a watertight non-shear coupling per Section 02720 - 3.11.

v. Bedding and Backfill Requirements

- Bedding and backfill for all point repairs or connections to the existing lateral shall be per Section 02720 - 3.08.

vi. Post-Construction CCTV Inspection

- Contractor shall perform a post-construction Closed Circuit TV (CCTV) inspection to verify the repair was successful and acceptable. Contractor shall repair any sections of pipe that do not meet the requirements of this Section. The inspection video shall be made available to the DWWR upon request.

3.07 UTILITY AND WATER PIPE CLEARANCES

A. The minimum horizontal clear distance between water and sewer mains shall be ten feet (10'). Minimum vertical clearances shall be 12" unless additional separation is required by the City. Where the stipulated clearances are not achievable, written approval from the State Health Department shall be required.

B. The minimum clear distances between the sewer pipe bell or flange and other utility pipes, ducts, and/or structures shall be as follows for sewer pipe four inches (4") and greater:

1. a. Thirty inches (30") for adjacent or parallel utilities.

   b. Sixty inches (60") for high-risk utilities as defined in Section 00700, subsection 29h.

2. a. Twelve inches (12") for perpendicular or crossing utilities.

   b. Thirty inches (30") for high-risk utilities as defined in Section 00700, subsection 29h.

3.08 TRENCH BACKFILL

A. Bedding

Unless otherwise specified bedding material shall be used in the construction of all sewer system pipelines.

1. Manholes

Twelve (12) inches of Type 1 aggregate base shall be placed under precast manhole bases and shall be compacted to a relative compaction of Ninety (90) percent per ASTM D1557-78 and ASTM D2922-81

2. Pipelines

There shall be no less than six (6) inches of bedding material under any pipeline. Haunching material shall be worked under the sides of the pipe to ensure proper compaction and side support. Haunching shall extend to the spring line of the pipe.

a. VCP

i. Less than fifteen (15) inch

Bedding and haunching shall conform to ASTM D448 –67

Sieve Sizes	Percent Passing
1	100
¾	90 – 100
½	-
3/8	20 – 55
No.4	0 – 15
No.8	0 – 5

ii. Fifteen (15) inch to thirty (30) inch

Bedding and haunching shall conform to ASTM D448-57

Sieve Sizes	Percent Passing
1 ½	100
1	95-100
¾	-
½	25 -60
3/8	20 – 55
No.4	0 – 10
No.8	0 – 5

b. Ductile Iron Pipe

Bedding and haunching shall be clean sand. Washed beach sand shall be tested and must have a PH of 7.0 and a resistivity of less than 2000 ohm-centimeters. Jetting may be required.

c. PVC and PE Pipe

i. Less than twelve (12) inches

Bedding and haunching shall conform to ASTM D448-7

Sieve Sizes	Percent Passing
¾	100
½	90 – 100
3/8	40 - 70
No.4	0 – 15
No.8	0 – 5

ii. Less than thirty (30) inches

Bedding and haunching shall conform to ASTM D448 –6

Sieve Sizes	Percent Passing
1	100
¾	90 – 100
½	20 - 55
3/8	0 – 15
No.4	0 – 5

B. Initial Backfill

1. Initial backfill

Initial backfill shall conform to ASTM D448-57

Sieve Sizes	Percent Passing
1 ½	100
1	95-100
¾	-
½	25 -60
3/8	20 – 55
No.4	0 – 10
No.8	0 – 5

C. Subsequent Backfill

1. Subsequent backfill shall be suitable native material as directed by the City's Project Inspector or Class II Aggregate Base.

2. Subsequent backfill must be compacted to ninety five (95) percent in paved areas and:

   a. filled to within six (6) inches of final grade and capped with six (6) inched of A/C or

   b. filled to within eight (8) inches of final grade with six (6) inches of Class II A/B and two (2) inches of A/C or

   c. filled to within eight (8) inches of final grade with a six (6) inch, five (5) sack, concrete cap and two (2) inches of A/C.

3. Subsequent backfill must be compacted to ninety (90) percent in unpaved areas and filled to within six (6) inches of final grade and topped off with six (6) inches of topsoil.

D. Compaction

1. Mechanical tampers, vibration or jetting may be used to achieve required compaction results. Jetting may only be used only if, in the written opinion of a Geotechnical Engineer, the backfill and surrounding ground will not soften or be damaged by the applied water. Jetting shall be used with mechanical compaction equipment to obtain the level of compaction required.

   Jetting may be used as follows and under the supervision of a Geotechnical Engineer:

a. Water is to be introduced into the backfill by means of at least a one (1) inch jet pipe.

b. The jet pipe shall extend to within fifteen (15) inches of the top of the pipe.

c. The source of the water shall be a properly metered hydrant or water tank with a minimum pressure of not less than sixty (60) psi.

d. "Bridges" in backfill are to be completely broken down during the jetting process without flooding.

e. Jet points along the line shall be staggered from side to side and shall not exceed six (6) feet or as necessary to ensure the proper results.

f. Backfill is to be done in no more than two (2) foot lifts

2. For trenches in paved areas, compaction of trench backfill from initial fill to subgrade shall be ninety five (95) percent.

3. Aggregate base shall be compacted to ninety five (95) percent.

4. Trench work within State Highway rights of way requires a specific permit to be obtained by CalTrans. Unless otherwise noted on the permit, all backfill shall be as stated above.

5. Trench backfill in private roads, parking lots, or sidewalks shall be as stated above.

6. For trenches in unpaved areas, compaction of trench backfill from initial fill shall be eighty five (85) percent.

7. All initial fill material shall be placed in two (2) stages as follows:

   a. From the bedding under the pipe to the top of the pipe.

   b. From the top of the pipe at least twelve (12) inches above the pipe

   Each stage shall be compacted mechanically or by hand to a minimum of ninety (90) percent.

8. Relative compaction tests are required on a project by project basis. Tests shall conform to ASTM D 1557-78 and ASTM 2922-81 unless otherwise specified by the City's Project Inspector.

   Test results shall show:

   a. Percent relative compaction

b. Optimum moisture content in percent

c. Maximum dry density in pounds per cubic foot

Tests shall be taken at locations designated by the City's Project Inspector.

3.09 CONNECTIONS TO EXISTING MANHOLES

A. Pipe connections to existing manholes shall be done under the direction of the City's Project Inspector and other applicable requirements specified for new manholes, including all necessary concrete work, cutting, and shaping of channel.

B. All PVC pipe entering or leaving a manhole shall have a rubber sealing gasket as supplied by the pipe manufacturer, firmly seated perpendicular to the pipe axis, around the pipe exterior and cast into the structure base or near the wall center as a water stop. Water stop may also consist of a manhole coupling with rubber sealing rings cast into the structure base.

C. Existing flow shall be maintained through a bypass. A bypass plan shall be submitted and the contractor shall be solely responsible for maintaining the bypass and shall be liable for any fines levied by any agency as a result of any spill or overflow.

3.10 CONNECTIONS TO EXISTING PIPE

A. The Contractor shall provide fittings or adapters required to connect new pipe to existing pipe. Detail drawings of such fittings or adapters and the method of connection shall be submitted to the City's Project Inspector for approval.

B. Pipelines shall be connected to existing mains as indicated on the drawing. Each connection shall be made at a time and in a manner that will result in the least interruption of service. Refer to Paragraph 3.26 of this Section for additional requirements.

3.11 SIDE SEWER CONNECTIONS TO MAIN SEWERS

A. Side sewer and lateral size shall be four inches (4") for single-family units and six inches (6") minimum for commercial or industrial buildings and multiple family units.

Six inch and larger connections to main sewers are to be made at a manhole. In some circumstances, a new manhole may need to be installed at the applicant's expense and with the required permits.

B. Connections to existing PVC, HDPE and vitrified clay pipe main sewer shall be made by the methods shown on applicable City Standard Drawings:

1. Core a neat trim opening in the upper portion of the main sewer and install a special drilled fitting (i.e., "Tap-Tite") to complete the side sewer connection.

2. Core a neat trim opening in the upper portion of the main sewer and install a PVC saddle tee or wye using the stainless steel straps and gasket provided by the manufacturer.

C. Connection to ductile pipe mains shall be made using a Romac style "CB" sewer saddle or an approved equal.

3.12 MANHOLES

A. Manhole Bases

1. Cast in place manholes shall be used only upon prior approval by the DWWR. Cast in place manhole bases shall be poured against a minimum of twelve (12) inches of three quarter (¾) inch drain rock, over undisturbed material, and excavated to the dimensions shown on the plans. The Contractor shall not deviate from plan dimensions, notwithstanding over-excavation or other detrimental field conditions, unless approved by the City's Project Inspector. A forming ring shall be used to form a level joint groove in fresh concrete of the manhole base to receive the precast barrel section of the manhole. The metal forming ring shall be removed after the concrete has sufficiently set to eliminate any slump in the joint groove.

   Manhole Channels: Where sewer lines ingress and egress manholes, construction shall conform to the City Standard Drawings. Pipe shall be used to form the channel. After the base concrete has set, the channel shall be shaped to the final required configuration. Perpendicular channel sides shall not be allowed. All channels shall be approved by the City's Project Inspector.

2. Precast bases shall be used whenever possible. Precast bases shall be manufactured in accordance with the requirements of ASTM C478. Precast manhole bases shall have a smooth flow line with a uniform slope from inlet to outlet. Precast bases shall have a shelf conforming to the requirements of City Standard Drawings. A 6 inch (6") layer of type 1 aggregate base shall be placed on native, undisturbed material and under precast manhole bases and shall be compacted to 90 percent relative compaction per ASTM/D 1557-78 and ASTM D 2922-81. Precast manhole bases shall be installed as an integral part of the pipe laying operation.

   Work on Existing Manholes: when work is to be performed above the flow channel of existing manholes, plywood shall be used to cover the entire channel

and a drop cloth shall be used to cover the entire base and prevent any debris from entering the flow-channel. Noncompliance will result in the suspension of that portion of the Contractor's work for the day until the precautionary measures are put in place. No contract time extensions will be granted due to said suspension of work. This precaution shall be taken to prevent debris from entering or obstructing the flow to the Collection System.

B. Sanitary sewer connections to existing manholes shall be core-drilled and made using a flexible rubber seal/waterstop.

Saw cutting and hammer through taps are prohibited.

All connections shall provide for a watertight seal between the pipe and the manhole. The connector shall be the sole element relied upon to assure a flexible water tight seal of the pipe to the manhole.

When connecting new pipe to existing manholes, a channel and bench walls shall be installed.

The pipe up to the structures shall not project beyond the inside wall of the structure and in no case shall the socket of a vitrified clay pipe be built into the wall of a structure.

Flexible connection at manhole tie-in shall be in accordance with applicable City Standard Drawings.

C. Joints in pre-cast manhole sections shall be filled using "Ram-Nek" in the joint space between matching parts. After placement of the subsequent section, excess sealant squeezed from joint shall be removed and the joint area troweled smooth. Special precautions shall be taken to ensure that the entire joint space is filled with sealant.

D. Concrete for reinforced manholes and bases shall be mixed, placed and cured in accordance with Section 03300 - "Minor Concrete," of these specifications.

3.13 ADJUSTING EXISTING FRAMES AND COVERS TO GRADE

A. General

Before any work is performed on existing manholes, plywood shall be used to cover entire channel and a drop cloth be used to cover the entire base. This precaution shall be taken to prevent debris from entering the Collection System.

Existing frames, covers, or adjustment rings removed during adjustments may be reinstalled only if the materials are undamaged and only if approved in advance by the City's Project Inspector.

All City manholes shall be raised to grade within ten (10) calendar days after street resurfacing.

Manholes shall be raised flush with the finished grade of the new road surface. The maximum allowable tolerance shall be ¼ inch measured with a straightedge between any two points located 5' on opposite side from the center of the manhole.

B. Upward Adjustments

All final grade adjustment of manhole covers and frame assemblies shall be completed utilizing injection molded high density polyethylene (HDPE) adjustment rings as manufactured by **LADTECH, Inc.** or an approved equal.

- The adjustment rings shall be manufactured from polyethylene plastic as identified in ASTM Designation D-1248 (Standard Specification for Polyethylene Plastic Molding and Extrusion Materials).
- Material properties shall be tested and qualified for usage per the ASTM Test Methods referenced in the above ASTM standard.
- The adjustment rings shall be molded from 100% recycled material.
- The plastic rings shall be manufactured utilizing the injection molding process as defined by SPE (Society of Plastic Engineers).
- The adjustment rings shall be tested to assure compliance with impact and loading requirements per the ASSHTO Standard Specification for Highway Bridges.
- Installation shall be per manufacturer's recommendations only.
- The annular space between the rings and cone basin, the rings, and the rings and cover frame shall be sealed utilizing an approved butyl sealant. The approved sealant shall be applied as required for the product to be accepted.
- All adjustment for matching road grade shall be made utilizing a molded and indexed slope ring.
- Mortar shall not be applied to the adjustment rings. Sealant, as approved by the manufacturer, is the only material to be used between the rings, between the rings, between the cone and rings and between rings and frame and cover.
- All grade rings shall be covered by the **LADTECH, Inc.** warranty or one of equal terms and duration.

C. Downward Adjustments

Downward adjustments can be made by removal of grade rings, mortar, concrete or brick. At no time shall the cone be modified in any way.

D. Manhole Surface Block

Manhole surface blocks (collars) are required on all manholes. A block is to be poured around each adjusted frame. The block is to be eighteen (18) inches wide as measured from the outside edge of the cover and twelve (12) inches thick. Concrete is to be poured **no more than two (2) inches** from final grade and rough finished to accept asphalt overlay. Frame is then to grouted to grade to grade rings and cone.

In the event no block is found during adjustment, the contractor performing the adjustment shall provide and install a manhole surface block as described above at no additional charge.

E. Paving Around Manholes

DWWR/ Engineering shall be notified no less than ten (10) working days prior to the start of any work that has the potential to impact public infrastructure and shall include and not be limited to resurfacing of roadways, parking lots or private streets. The City shall determine whether any City infrastructure such as a manhole frame and cover or utility box, is impacted. If any City infrastructure is found to be in need of replacement during review, the city will supply the new manhole frame and cover or utility box. The contractor shall install the new infrastructure per the appropriate section of these specifications and it shall be installed at no cost to the City. If requested by the City, the contractor shall return the old infrastructure to the City corporation yard. This section shall apply to all types of asphalt overlay.

3.14 PUMPING FACILITIES

A. Sewer Lift Stations

New lift stations for the conveyance of sewage by multiple dwellings in new developments will be reviewed and approved on a case by case basis. All materials shall be consistent and compatible with stations currently in use by the City.

B. Private Pump Stations

1. Introduction

a. This Section describes, in general terms, the guidelines and requirements for the planning, design, and submittal requirements for low pressure sewer systems.

2. General

   a. Private pumping systems will only be considered in areas where sanitary sewers currently serve the surrounding areas and where conventional sanitary sewer facilities cannot be constructed.

3. Required Permits

   a. Approval of private pumping systems will be evaluated on a case-by-case basis and will only be allowed with prior written approval from the Department.

   b. At the discretion of the City, a lift station may be required in lieu of a private pumping system.

      i. When submitting for an Approval and Construction Permit, the following are required:

         - Written approval from the Department;
         - Private pump system justification – Per Section 501.03;
         - 50-year life cycle analysis; and
         - Gravity sewer alternative cost estimate.
         - Private pumping system calculations – Per manufacturer's recommendations and at a minimum the following:
            - Calculation worksheet – Per manufacturer;
            - Individual pump curves; and
            - Make and model number of pumps.
         - Standard Private Pump System Detail Sheet;
         - Identification of the person/entity responsible for the maintenance of the pumps and other components of the system that are not the responsibility of the City;
         - Homeowners Association Covenants and Restrictions, if applicable; and
         - Any other information Engineering, DWWR and/or the Building Department deems relevant to review and evaluate the proposed low-pressure system.

4. Responsibility

   a. The City will only be responsible for the operation and maintenance of the city main.

b. The homeowner shall be responsible for all piping, pumping equipment, and appurtenances between the building and the city main.

c. For private pumping systems, the City is NOT responsible for assuring new or replacement equipment is compatible with the existing equipment in the system.

5. System Design and Layout

a. Due to the variability of each site, the design of private pumping systems shall rely on sound engineering judgment and manufacturer's recommendations.

b. The City may, if reasonably justified, make any requirement deemed necessary to assure the system performs as intended.

c. The minimum requirements for the design and layout of private pumping systems shall be per the most recent version of the Standard Detail Sheets, the manufacturers' recommendations, and as follows:

i. Pipe Size

- Pipe size shall be per pump manufacturer's recommendations with a minimum size of two (2) inches for the common force main and one and one-quarter (1- 1/2) inches between the grinder pump and the common force main. The City's Project Inspector shall assure adequate cleansing velocities in the common force main.

ii. Overall System Design/Layout

- The design shall be as follows:
- Sufficient to achieve a cleansing velocity of two (2) feet per second in the common force main; and
- Without any "loops" or parallel pumping segments in the system.

iii. Cleanouts

- Cleanouts shall be per pump manufacturers recommendations but at a minimum the following locations:
  - At the terminal end of each common force main;
  - When two (2) or more force mains are connected; and
  - Every 50 feet.

iv. Flushing Stations

- Flushing stations shall be incorporated into the system.

v. Air Relief Valves

- Air relief valves shall be installed at the following locations:
  - All high points in the system

vi. Backflow Assembly Installation

- A backflow assembly shall be installed on each service line.

vii. Other requirements as deemed necessary.

d. Maximum Connections to Grinder Pump

i. Units

- No more than one (1) building will be permitted to connect to a Grinder Pump Unit. Common Grinder Pumps for one (1) building with multiple residential units are also prohibited, except for the following:
- Apartment buildings (only one apartment building per grinder pump unit); and
- Condominiums where different floors have different owners (only one building per grinder pump unit).

The intent is to have individual residential units be served by individual Grinder Pump Units.

e. Commercial Facilities

i. Commercial facilities will be handled on a case-by-case basis.

f. Grinder Pump Types

i. To assure all the Grinder Pump Units are compatible, all units shall be the same Make, Model Number, and have the same pump performance characteristics, unless justified.

ii. Replacement units shall be the same make and model as was originally approved by the Division.

iii. Pump specifications and pump replacement requirements shall be part of the Homeowners Association (HOA) Covenants and Restrictions if a HOA is planned.

iv. The type of pumps and allowable applications are as follows:

- Positive Displacement Pumps
  - o May be used in all low pressure system applications.
- Semi-Positive Displacement Pumps
  - o May be used in all low pressure system applications.
- Centrifugal Pumps
  - o May only be used if the number of units is ten (10) or less and the Total Dynamic Head is less than forty (40) feet.
  - o The design engineer and manufacturer are responsible for assuring the system will operate as intended.

g. Grinder Pump

i. Equipment

- Simplex or duplex grinder pumps may be used for single dwelling units. For uses other than single dwelling units, the City's Project Inspector shall determine which is appropriate.

  General equipment requirements are as follows:

  a. Grinder Pump Station

     i. The grinder pump stations shall be a complete package consisting of all equipment and appurtenances required for a fully operable pumping system.

     ii. Pump level controls, starter, alarm, piping, fittings, valves, and all accessories shall be part of a factory fabricated package so that after burying the wet well, the field connection of the gravity lateral, discharge line and electrical service line to the control box will complete the installation.

  b. Manufacturer

     i. Each grinder pump station shall be manufactured and assembled by a single manufacturer.

  c. Pumps

     i. The pumps shall be capable of macerating all material in normal domestic and commercial sewage, including reasonable amounts of foreign objects such a wood, plastic, glass, rubber, disposable diapers and the like to a fine slurry that will pass freely through the pump and one and one-quarter (1-1/4) inch discharge pipe.

  d. Electrical Motor and Level Controls

     i. Electrical and level controls shall be provided by the pump manufacturer. All controls shall be mounted so they can be cleaned or replaced without disturbing the pump or piping.

  e. Control Panels

     i. The control panels and all associated components on each standard unit shall be U.L. Approved and installed per manufacturer's recommendations. All equipment associated with each unit shall meet the current requirements of all applicable Federal, State, and Local electrical codes.

     ii. The design engineer and manufacturer are responsible for assuring the equipment is designed properly and will operate in a safe manner.

3.15 RECONSTRUCTION AND REPAIR

A. Reconstruction of damaged curbs and gutters, sidewalks, driveways, handicapped ramps, and median curbs shall be in accordance with Section 03300 - "Minor Concrete," of these Specifications.

3.16 CONCRETE THRUST BLOCKS

A. Concrete thrust blocks shall be provided on all force main bends having a deflection angle of eleven degrees (11^{o}) or more. Thrust blocks shall have a sufficient bearing area to withstand the maximum force to be exerted. Concrete for thrust blocks shall conform to Section 03300 - "Minor Concrete," of these Specifications. Thrust blocks shall not be hand mixed.

B. Thrust blocks shall conform to details shown on applicable City Standard Drawings.

3.17 LATERALS - CLEANOUTS

A. Unless otherwise noted on the plans, all sanitary sewer laterals shall terminate in a cleanout constructed to the form and dimensions shown and detailed on applicable City Standard Drawings. As a minimum, one one-way cleanout adjacent to building shall be provided. When the distance from this cleanout to main exceeds fifty (50) feet or there is a change of lateral direction, an additional one-way cleanout shall be provided in consultation with the City and prior to installation. All clean outs shall be within the applicant's property. At no time shall cleanouts in the City's right of way be allowed.

B. Location of all laterals shall be permanently marked by imprinting or carefully chiseling the letter "S" four inches (4") in height on the top of the curb above the lateral.

3.18 CLEANING SANITARY SEWERS

A. Contractor shall flush and clean all sewer mains by means of pneumatic, sewer cleaning balls or porcupine. The balls or porcupine shall be of the appropriate size to fit the sewer pipe being cleaned. Hydroflushing or water jet cleaning, or "sewer balling" or "porcupining" operations shall be conducted by experienced personnel. The ball shall be introduced at the uppermost manhole and passed from manhole to manhole by means of a line with sufficient head of water to carry the ball along.

The movement of the ball shall be controlled by a rope. Care shall be exercised not to feed the ball too rapidly to enable removal of all debris from each manhole. A vacuum/flushing truck shall be used for all hydro-flushing operations.

B. Each section of the sewer line shall be thoroughly cleaned before proceeding to the next section. Where sewer balls will not pass flexible sewer rods or jet flusher may be used to clear the obstruction. Where obstructions cannot be cleared by sewer rodding, the obstructions shall be removed by excavation at the Contractor's expense. The Contractor shall remove all debris from the sewer lines by installing screens at all downstream manholes, or by using other methods acceptable to the City's Project Inspector.

C. The City's Project Inspector shall be present for all cleaning operations. The Contractor shall provide written notice to the City's Project Inspector Twenty four (24) hours prior to any cleaning operations.

D. Contractor shall use recycled water for sanitary sewer flushing and cleaning operations.

3.19 RECONSTRUCTION OF EXISTING STRUCTURES

A. General: The contractor, when removing existing structures located on live systems, shall take precautions to ensure that no foreign material enters into the existing sewer lines. Care shall be taken and proper methods employed to prevent dirt, rock, concrete, brick, wood, etc., from entering into the live lines.

During the period of time in which the contractor is working on a live sewer system, DWWR maintenance crews shall have continuous access to the structure. All work on the structure shall be complete within 3 days after the original structure is removed.

B. Structure Adjustments and Repair: When work is performed on existing manholes, plywood shall be used to cover entire channel and a drop cloth be used to cover the entire base. This precaution shall be taken to prevent debris from entering the Collection System. This precaution shall remain in place during all work and when complete be removed containing all debris.

C. Reuse of Material: Existing precast material, adjustment rings, frames and covers removed in adjustments and/or repairs may be reinstalled only when such undamaged items are permitted by the City Project Inspector.

3.20 TESTING SANITARY SEWERS

A. Sanitary sewer systems, including laterals and sanitary sewers, shall be tested for tightness, alignment, cleanliness, and compliance with these Standards after completion of all backfilling and prior to request for final inspection. Contractor shall notify the City's Project Inspector at least five (5) working days in advance of

proposed testing dates. Tests of gravity sewers shall be made from end of pipe or manhole to manhole unless grades are flat enough to permit testing of two or more sections at one time. All testing shall be performed under the presence of the City's Project Inspector. No payment will be made nor will any permit be signed off without the successful completion of all phases of testing.

B. The Contractor shall take all necessary precautions to prevent any joint from drawing ground water while the pipeline and its appurtenances are being tested. Contractor shall, at own expense, correct any excess leakage and repair any damage to the pipe, structures, and appurtenances resulting from or caused by this test. Where the actual leakage exceeds the allowable leakage, the Contractor shall discover the cause and remedy it before the test is accepted. If the leakage is less than that allowed and leaks are observed, such leaks shall be repaired at the City's Project Inspector's direction.

1. Main Sewers: Main sewers shall be tested after they have been inspected and cleared of obstructions and following backfill, but prior to repaving. Each section of sewer shall be tested between successive manholes by closing the lower end of the sewer to be tested and the inlet sewer of the upper manhole with stoppers.

2. At the Contractor's option, either the hydrostatic or the air test may be used. The City's Project Inspector shall require video inspection be performed on newly constructed sewer mains and laterals. If scheduling permits the City shall supply all video personnel and equipment. Video inspection services shall be requested at least five (5) working days in advance. If DWWR video inspection services are not available at the time of the request then the contractor shall supply the personnel and equipment and perform the work. The Contractor shall pay for all associated testing costs.

3. In the event that any portion of the new sewer main or lateral are found to be deficient during any phase of the testing, repairs shall be made within a reasonable time frame and in conformance with these specifications. All repairs shall be retested and shall be re-televised at the contractor's expense.

    a. Hydrostatic Test:

        i. Fill the pipe and manhole with water to a point four feet (4') below the ground surface of the upper manhole, but in no case less than four feet (4') above the pipe invert. If ground water is present, the water surface in the upper manhole shall be at least four feet (4') above the level of the ground water. The line shall be filled at least one (1) hour prior to testing and shall be tested at least two (2) hours, maintaining the head specified above with measured additions of water. The sum of these additions shall be the leakage for the test period.

ii. The maximum allowable head of water above any portion of sewer being tested shall be fifteen feet (15'). Where the difference in elevation between successive manholes exceeds fifteen feet (15'), a test tee shall be installed between manholes, and testing shall be carried on between the tee and the manhole. Test tee shall conform to applicable City Standard Drawings.

iii. The allowable leakage shall not exceed one-tenth gallon (0.1) per minute per inch diameter per one thousand feet (1,000') of main line sewer being tested for a two (2) hour duration test.

b. Mandrel Testing of PVC Sewer Main:

i. The contractor shall pull a mandrel through each segment of installed PVC sewer main to test the amount of deflection incurred during installation. This test shall be done after the pipe trench has been backfilled and compacted to the level of the pavement subgrade in paved areas or to the ground surface in unpaved areas. The City's Project Inspector shall observe mandrel testing. The contractor shall give at least five (5) working days notice to the City's Project Inspector before commencing mandrel testing.

ii. Mandrels shall be full circle, solid or rigid odd numbered (nine leg minimum) steel cylinders with pulling rings at each end and approved by the City's Project Inspector. The circular cross section of the mandrel shall have a diameter no smaller than ninety (95) percent of the average inside diameter of the pipeline being tested. The length of the mandrel shall be no less than two times the full cross section diameter. A separate pull line shall be attached to each pull ring to facilitate removal of the mandrel if an obstruction is encountered.

iii. Mandrels shall be pulled through the pipeline by hand without the aid of mechanical pulling devices. Any deficiencies found by mandrel testing shall be corrected by the Contractor, at the Contractor's expense. Deficiencies shall be repaired by excavating the pipe at least to the pipe spring line. Pipe bedding and backfill shall be re-compacted after the repair. Internal rounding or vibration to correct deflection shall not be permitted. After repair and re-compaction of the pipe bedding and trench backfill material, the pipe shall be retested using the mandrel. Any pipe failing two mandrel tests shall be replaced.

iv. PVC Sewer Deflection Standards:

Pipe Size (inches	Mandrel O.D. (inches)
6	5.619
8	7.524
10	9.405
12	11.191
15	13.849
18	16.924
21	19.952
Over 21	Follow Manufacturers Spec.

c. Air Test:

Air test shall be applied to each length between adjacent manholes, and the procedure shall be as follows:

i. Pressurize the test section to approximately four (4.0) psig. After this pressure is reached, allow pressure to stabilize. The pressure will normally drop as the air temperature stabilizes. This will usually take two (2) to five (5) minutes, depending on the pipe size. The pressure should be reduced to three and five-tenths (3.5) psig before starting the test. Start the test when the pressure is at three and five-tenths (3.5 psig). If the pressure drops below two and five-tenths (2.5) psig in less than the time given in the following table, the section of pipe shall not have passed the test:

Size	Minimum Time per 100 ft. Test Section
4"	1min. 53 sec.
6"	2 min. 50 sec.
8"	3 min. 47 sec.
10"	4 min. 43 sec.
12"	5 min. 40 sec.
15"	7 min. 05 sec.
18"	8 min. 30 sec.
21"	9 min. 55 sec.
24"	11 min. 20 sec.
27"	12 min. 45 sec.

ii. When the prevailing groundwater is above the line being tested, air pressure shall be increased forty-three hundredths (0.43) psig for each foot the water table is above the invert of the line.

iii. The pressure gauge used shall be supplied by the Contractor, shall have minimum divisions of one-tenth pound per square inch gauge (0.10 psig), and shall have an accuracy at least of four-hundredths of a pound per square inch gauge (0.04 psig). The gauge shall have been calibrated within forty-five (45) calendar days of the air test and the calibration tag shall be affixed to the gauge.

iv. The gauge assembly shall be equipped with three-quarter inch (3/4") IPT nipple and isolation valve to allow the City's Project Inspector to install a second gauge.

v. The City may test pressure gauges for accuracy.

d. Video Inspection

All sewer main repairs and new sewer main installations shall be televised in conformance with Section 02720 - 3.21 - Closed Circuit Television Inspection of Sewer Lines. All televising shall be performed at the contractor's expense. No sags greater than one quarter (0.25) inches shall be allowed.

3.21 CLOSED CIRCUIT TELEVISION INSPECTION OF SEWER LINES

A. Intent

1. It is the intent of this Specification to provide for the inspection of pipelines utilizing closed-circuit television techniques to identify the location and extent of sewer line defects to allow for a determination of rehabilitation needs, to document pre-rehabilitation line condition, and/or to document post-rehabilitation line condition and/or new construction.

B. Scope of Work

1. Prior to performing closed circuit television inspection activities, CONTRACTOR shall thoroughly clean the sewer line(s) designated to be televised. Sewer cleaning requirements are contained in Section 02720 - 3.18 - Cleaning Sanitary Sewers.

C. Safety

1. CONTRACTOR shall be solely responsible for safety during the performance of all work. CONTRACTOR shall not enter into any sewer segment where hazardous conditions may exist until such time as the source of those conditions is identified and eliminated by CONTRACTOR

and/or the DWWR. CONTRACTOR shall perform all work in accordance with the latest OSHA confined space entry regulations. CONTRACTOR shall coordinate his work with the City's Project Inspector. The City's Project Inspector presence shall be requested at least five (5) working days in advance.

2. CONTRACTOR shall be responsible for any damage to public or private property resulting from his/her televising activities and shall repair or otherwise make whole such damage at no cost to the City.

D. Equipment

1. Television inspection equipment shall have an accurate footage counter that displays on a remote monitor the exact distance of the camera from the centerline of the starting manhole. The camera shall be of the remotely operated pan and tilt type. The rotating camera and lighthead configuration shall provide 240 degrees of pan and tilt angle measuring centerline to centerline and 70 degree lens viewing angle.

2. The camera shall be color and shall provide a minimum of 460 lines of horizontal resolution and 400 lines of vertical resolution. The image pick-up device shall contain in excess of 379,000 picture elements (pixels). Geometrical distortion of the image shall not exceed one percent.

3. The color camera shall be equipped with the necessary circuitry to allow for the remote adjustment of the optical focus and iris from the power control unit at the viewing station.

E. Execution

1. Inspection of pipelines shall be performed by experienced personnel trained in locating breaks, obstacles, and service connections by closed-circuit television inspection techniques. The interior of the pipeline shall be carefully inspected to determine the location and extent of all pipeline defects. The location of any conditions which may result in a limitation of rehabilitation techniques that could be used and/or prevent proper installation of designated rehabilitation materials in the pipelines shall be noted so that these conditions can be considered and, if necessary, corrected prior to actual rehabilitation.

2. CONTRACTOR shall internally inspect, via closed circuit television inspection, the sewer segments as required. Generally, inspection shall be completed one sewer line section at a time. Access for televising purposes shall only be via existing manholes. Should access to particular sewer section be difficult and adjacent sections require television inspection, CONTRACTOR may be allowed to complete inspection in multiple sewer line sections. When multiple sewer line sections are inspected using one setup, CONTRACTOR shall zero the camera's footage metering device at

each subsequent sewer manhole to establish uniform starting location of Station 0+00 for each line section televised.

3. At all defects and service connections, the camera shall be stopped and the pan and tilt features shall be used to obtain a clear picture. Where possible, the camera shall be panned to view up each lateral or point of connection.

4. CONTRACTOR shall record these inspections on extra-high quality one-half inch VHS color videotape or DVD and on a suitable log. Tapes shall be recorded at SP speed. Videotape or DVD shall include a visual and audio narrative noting:

   a. Date, time of day, and depth of flow;

   b. Sewer segment number. Segment numbers shall be designated by OWNER.

   c. Upstream manhole number.

   d. Downstream manhole number.

   e. Type of sewer (e.g. sanitary, storm, combined)

   f. Size of sewer

   g. Sewer materials of construction

   h. Closest street address and street name on which sewer is located

   i. Beginning and ending tape counter numbers for each run (manhole to next manhole) of sewer inspected

   j. Direction of movement of camera, heading, and direction of flow

   k. Locations of service connections into sewer by clock position and with counter distance in feet from beginning manhole's centerline

   l. Location (start and end counter distances in feet from the beginning manhole's centerline) and description of obstructions, structural defects, missing pieces of pipe, longitudinal and/or circumferential cracking, joint deterioration including open and/or offset joints, ovality, leakage or evidence thereof, corrosion, erosion, break-in connections, protruding connections, mineral deposits, roots, previous repairs, grease/fats/oil deposits on pipe walls, sags, and other abnormalities with respect to the sewer's condition with counter distance in feet from the beginning manhole's centerline.

5. Contractor's Log

   a. The contractor's log shall contain the same information as above.

6. Videotape shall visually display at a minimum the date, pipe segment number (manhole number) and distance from the centerline of the upstream manhole. The distance between manholes shall be verified by

measuring tape. If the counter distance and the taping distance differ by more than 2 feet per 100 feet, the run shall be re-televised by CONTRACTOR at no additional cost to OWNER.

7. Videotape shall be maintained and delivered in a case, which shall display the project name, project number, date of inspection, manhole segment number(s) inspected, and crew ID number. The entire length of any one sewer segment shall be on one tape. No segment shall be split between two tapes. A tape may have multiple segments, so long as an entire section is on one tape. Original videotapes of all sections will be provided to the City's Project Inspector along with the respective television inspection field logs.
8. If during television operation television camera will not pass safely through entire sewer line section being investigated, CONTRACTOR shall, at no additional cost to OWNER, set up equipment so that inspection can be performed from opposite (downstream) manhole. Where an obstruction is encountered and a reverse set up is required, the distance shall be entered into the log and verbally noted on the VHS video from which manhole the measurements are being made. If under the reverse set-up the camera again fails to pass through the entire sewer line section, inspection shall be considered complete. All obstructions in the sewer segment that prohibit passage of the television camera shall be immediately reported to the City's Project Inspector by CONTRACTOR referencing location and nature of the obstruction. No rehabilitation work shall proceed until CONTRACTOR receives direction from OWNER regarding removal of the obstruction.
9. Should CONTRACTOR's televising equipment become lodged in any sewer line, it shall be removed by CONTRACTOR at his expense. This shall include, if necessary, excavation and repair of the sewer, underground utility repairs, backfilling and surface restoration. CONTRACTOR shall re-televise any line segment in which his equipment became lodged after said equipment has been removed to demonstrate to the OWNER that no damage exists as a result of his televising operations.

F. Bypass Pumping/Flow Control

1. Should bypass pumping or other form of sewage flow control be required by/of CONTRACTOR to facilitate sewer line televising, CONTRACTOR shall be solely responsible for providing all labor, equipment and materials necessary to control the flow of sewage in and/or around sewer segment(s) being televised. Requirements for sewage flow control and bypass pumping are contained in Section 02720 - 3.26 - Bypass Pumping/Sewage Flow Control.

G. Acceptance

1. CONTRACTOR shall present on videotape a continuous image in complete conformance with these Specifications of not less than ninety percent (90%) of the internal pipe surface at all times, including sags in sewer lines. The video tape shall be accompanied by a complete log. Maximum acceptable speed of camera through sewer shall be thirty (30) feet per minute. Lighting system shall be adequate for quality color picture at least five (5) feet in front of the camera's lens. CONTRACTOR shall re-clean and televise any segment for which video tape does not present a clear image of at least 90% of the internal pipe surface at all times, and/or is accompanied by an incomplete log.

H. Measurement and Payment

1. Payment for closed-circuit television inspection work which is not required as part of a construction contract for sewer line rehabilitation shall be made on an actual televised lineal footage basis per diameter of sewer televised and shall include the cost of all items necessary to complete the closed-circuit television inspection including any bypass pumping/flow control which may be required.

2. No direct payment shall be made for closed-circuit television inspection services required as part of a construction contract for sewer line rehabilitation. Payment for television inspection shall be included in the contract bid prices for the related sewer rehabilitation items.

3. Payment for closed-circuit television inspection work which is part of a new development to be accepted by the City shall be the responsibility of the developer and shall include the cost of all items necessary to complete the closed-circuit television inspection including any bypass pumping/flow control which may be required.

3.22 SANITARY SEWER PLUGS

A. All ends of sanitary sewers provided for future connection shall be plugged with "Polycap" stopper providing the same joint characteristics as specified for the sanitary sewer main or lateral.

3.23 ABANDONMENT OF SANITARY PIPES AND MANHOLES

A. Sanitary Sewer Facilities shall be abandoned as follows:

1. Combined Sewers, Sanitary Sewers, and Force Mains Combined

a. Sewers, sanitary sewers, or force mains to be abandoned shall be plugged with mortar and an eight (8) inch thick concrete brick wall. The facility being abandoned shall be filled with sand or concrete slurry and plugged, unless an

alternate plan is approved by the DWWR. Service shall be maintained within sanitary and combined sewers until the DWWR orders the bulkheads placed. No timber bulkheads shall be allowed.

2. Laterals

   a. Numerous existing buildings use common or shared laterals. The Contractor shall determine if the lateral is common/shared prior to abandonment. The requirements to abandon laterals are as follows:

      i. If the lateral serves one building and is NOT part of a common/shared lateral:

         - The downstream end of the lateral shall be sealed with a manufactured watertight cap/stopper made specifically for the purpose of sealing/capping the end of a sanitary sewer. The cap/stopper shall be installed per manufacturer's recommendation and in such a way to prevent any source of water from entering the sanitary sewer system. Any device or material that may slide into the lateral and potentially cause a blockage or obstruction in the mainline sewer will not be allowed. The cap/stopper shall be installed on a defect free portion of the lateral immediately before the wye connection to the city main. If defects are found in the wye connection, the Contractor shall excavate toward the main and the wye shall be removed and replaced with a new portion of equally sized pipe.

         - The remaining portion of the lateral from the point of termination to structure shall be sealed at both ends sealed with a manufactured watertight cap/stopper made specifically for the purpose of sealing/capping the end of a sanitary sewer. The cap/stopper shall be installed on a defect free portion of the lateral. If defects are found then the contractor shall excavate the lateral until a defect free portion of the lateral is located.

      ii. If the lateral serves more than one building and IS part of a common/shared lateral:

         - If at least one service from the common lateral is intended to remain, the connecting fitting for the laterals shall be removed and replaced with a new section of straight pipe or an elbow of sufficient angle to provide a smooth transition between the existing portions of the lateral. Elbow shall be a manufactured fitting and shall be installed per manufacturer's recommendation to assure a watertight seal.

3. Manholes

   a. Manholes to be abandoned shall have their cones removed, backfilled and compacted to ninety-five percent (95%) relative compaction. Frames and

covers not to be reused shall be delivered to the City as directed by the City's Project Inspector.

3.24 REPAIR/RESTORATION OF PROPERTY

A. Any repair or restoration work resulting from Contractor's activity shall be completed within twenty-four (24) hours. Contractor may use the sod saved from the existing lawn or use new sod/seed to match existing lawn. Any concrete or other repair shall match existing. Contractor shall maintain the new planting for a minimum thirty (30) day period.

3.25 CONSTRUCTION PROCEDURES, CONNECTIONS AND SYSTEM REROUTING

A. Construction involving expansion and/or modification of the existing Collection System shall be performed in a manner resulting in the minimum possible interruption during construction.

B. Prior to the start of any construction, the Contractor shall submit a schedule of all planned flow disruptions required for completion of project and shall indicate anticipated date, work to be performed, and estimated duration of work.

C. Prior to any disruption of flow, all labor, materials, fittings, supports, equipment and tools needed for the scheduled work, as well as possible emergency work, shall be on the site.

D. All connections involving flow disruption of City's existing facilities shall be done in the presence of the City's Project Inspector. The Contractor shall complete the connection work without interruption.

E. Planned Flow Disruption

1. Flow disruptions are subject to the following constraints:

   a. Flow disruptions will not be performed on a Monday, Friday nor on the first workday following a City holiday. (It is preferred that flow disruptions also not be performed on the day preceding a City holiday, if possible.)

   b. Under special circumstances, and only upon approval by the City, flow disruptions may be scheduled on a weekend or during non-working hours.

   c. No more than two flow disruptions of the Collection System will be performed on any two consecutive workdays. This includes all disruptions whether scheduled by the City, the Contractor or other parties.

d. The City's Project Inspector must receive the flow disruption request in writing from the Contractor at least six (6) calendar days prior to the anticipated date of the disruption of flow. A bypass plan must be submitted.

e. The City will review the request to ensure that the Contractor will have all materials available and complies with all provisions of the City's procedures, including the submission of required information and scheduling requirements.

f. All excavations required to make the connection must be completed and approved at least twelve (12) hours prior to the scheduled flow disruption.

g. If the flow disruption is cancelled or cannot be performed, the Contractor will notify the City's Project Inspector at least twenty-four (24) hours in advance of the requested disruption date.

3.26 BYPASS PUMPING/SEWAGE FLOW CONTROL

A. INTENT

1. It is the intent of this Specification to provide the minimum requirements for bypass pumping/sewage flow control necessary to facilitate sewer line inspection and/or sewer line rehabilitation activities and/or new construction.

B. SCOPE OF WORK

1. CONTRACTOR shall provide all labor, equipment, supervision and materials necessary to reduce/control flows via sewage flow control mechanisms or eliminate flows via bypass pumping through a section or sections of pipe designated for inspection and/or rehabilitation. CONTRACTOR shall be responsible for controlling and maintaining all sanitary and storm flows within the sewer system during the work. CONTRACTOR may drain flows by pipes, chases, fluming, bypass pumping, or other appropriate methods approved by the DWWR. Plugging of any sewer line shall not be permitted without bypassing.

C. PROTECTION OF PUBLIC AND PRIVATE PROPERTY

1. Precautions shall be taken to ensure that flow control and dewatering operations shall not cause flooding or damage to public or private properties. In the event flooding or damage occurs, CONTRACTOR shall make provisions to correct such damage at no additional cost to the City. CONTRACTOR shall be responsible for any damages to public or private property, overflows from the sewer system and violations resulting in fines as a result of the dewatering/bypass operation.

2. CONTRACTOR shall assume all responsibility for notification to and coordination with all customers whose building sewer laterals will be out of service during the Work. Notifications shall be in writing via door hanger, door flier or U.S. mail. Notification shall be given 24-hours in advance of loss of service, (excluding weekends and holidays). Notice shall clearly state the purpose of the work, shall advise all affected customers against water usage until the sewer line is placed back in service, and shall clearly state the potential consequences of use of residential wastewater generating facilities during the time when the building sewer service will be out of service (i.e. sewer back-up). The notice shall include the project name, project number, City department name, City employee contact number, and CONTRACTOR's local 24-hour contact number for residents to call if they have questions regarding the work.

D. BYPASS PUMPING

1. When required by the Contract Documents or when required by the manufacturer of the sewer line rehabilitation product in order to facilitate the installation of a sewer line rehabilitation product, CONTRACTOR shall provide all labor, equipment and materials necessary for the transfer of flow around the section or sections of pipe designated. The bypass shall be made by diversion of the flow from an existing upstream location, around the section(s) to be taken from service for inspection or rehabilitation, to an existing downstream location. The bypass system shall be of adequate capacity to handle all flows including wet weather related flows. If bypass pumping is utilized by CONTRACTOR to control flows, CONTRACTOR shall be responsible for monitoring the bypass pumping operation at all times until work is complete. The location of pump(s), force main, discharge point, pumping rates, etc., shall be approved by DWWR.

2. CONTRACTOR shall prepare a detailed Flow Control Plan that describes the measures to be used to control flows. CONTRACTOR shall submit the Plan to and obtain approval of the Plan from the City's Project Inspector prior to beginning any flow control work. CONTRACTOR's Plan shall include, but not necessarily be limited to the following:

   - Location of flow diversion structures, collapsible sewer plugs, dams, pumps and related materials and equipment.
   - Key operational control factors, (i.e. maximum flow elevations upstream of plugs or dams).
   - Pump sizes and flow rates.
   - Destination of bypassed flows including routing of force mains and provisions for vehicular and pedestrian traffic as necessary.
   - Wet weather event procedures.

3. The number and size of pumps utilized in bypass pumping shall be such that if the largest pump is out of service, bypass flows will be maintained during the bypass operation.

E. WET WEATHER EVENTS

1. Where the flow control mechanism is not sufficient to handle a wet weather event, the flow control/diversion or pumping system shall be capable of quick removal so as not to create an overflow to surface waters, overflow to ground, or back-up in buildings.

F. MEASUREMENT AND PAYMENT

1. Payment for bypass pumping/sewage flow control, including provisions for wet weather flow control, shall be included in the contract bid prices for the related sewer line inspection, sewer line rehabilitation items and/or new construction.

3.27 AS-BUILT DRAWINGS

A. As-built drawings for all projects shall be updated daily and shall be made available to the project inspector upon request. Location of all valves and other water system appurtenances, as specified by the City's Project Inspector, shall be verified by a licensed surveyor and shall be incorporated into the as-built records at the expense of the contractor. At the completion of the project, the as-built drawings shall be submitted to the City's Project Inspector together with an electronic copy of the as-builts in a form acceptable to the City Inspector and compatible with the City's Standards. Final payment to the contractor for the project will not be made until the as-built drawings are submitted, verified and accepted.

End of Section