DIVISION 7 STORM DRAIN, SANITARY AND COMBINED SEWERS, WATER MAINS AND RELATED STRUCTURES

SECTION 7-01 SUBSURFACE DRAINS

7-01.1 DESCRIPTION

Section 7-01 describes work consisting of constructing subsurface drains in accordance with the Contract. This work shall include installation of solid, slotted (See Standard Plan No. 291), and perforated pipe, filter Material, and filter fabric (geotextile). Subsurface drains shall be constructed of gravel filter Material and may include perforated pipe and filter fabric as detailed on the Drawings.

7-01.2 MATERIALS

Materials shall meet the requirements of the following Sections:

Gravel Backfill for Drains	9-03.12(4)
Pipe and Tubing	9-05
Geotextiles	9-37

Notes: Unless indicated otherwise in the Contract (all pipe sizes are inside diameter):

1. Corrugated Polyethylene Drainage Tubing Drain Pipe shall be limited to less than 10 inch.
2. Corrugated Polyethylene Drain Pipe shall be limited to 12 inch minimum to 36 inch maximum.
3. PVC Subsurface Drain Pipe shall be limited to 6 inch minimum to 10 inch maximum.

All reference to filter fabric shall be construed to mean a geotextile Material as specified in Section 9-37, Geotextile, Underground Drainage, Low Survivability, Class to be specified in Contract.

7-01.3 CONSTRUCTION REQUIREMENTS

7-01.3(1) EXCAVATION

Trenching is subject to the provisions of Section 2-04 Excavations. Backfill and compaction is subject to the provisions of Sections 2-10 and 2-11.

Work in excavations over 4 feet deep are subject to the provisions of Section 2-07 Protective Systems.

A trench shall be excavated to the grade, line, and dimensions indicated on the Drawings.

7-01.3(2) PLACING PIPE AND FILTER MATERIAL

See Section 2-15.3 for construction requirements for other than subsurface drains.

The filter Material for pipe shall be damp when placed in the trench and shall be deposited uniformly on both sides of the pipe for the full width of the trench and to the springline of the pipe. The Material shall be tamped in 4-inch lifts to provide thorough compaction under and on each side of the pipe. Succeeding lifts of gravel shall be deposited in 8-inch lifts and be thoroughly compacted to the depth shown on the Drawings.

The geotextile shall be placed in the manner and at the locations as indicated in the Contract. The surface to receive the geotextile, and the trench into which the geotextile is to be placed, shall be free of obstructions and debris.

Should the geotextile be damaged during construction, the torn or punctured section shall be repaired by placing a piece of geotextile of sufficient size to cover the damaged area including a minimum 12 inch overlap with all surrounding geotextile. In places where the trench width is less than 1 foot, the minimum overlap shall be the trench width.

Subsurface drains, as specified in Section 9-05, shall be located as shown in the Contract.

Clearances between drains and other utilities shall be maintained per Section 1-07.17(2).

All drain pipe shall be installed with the bell or larger end upstream, and shall be open, clean, clear of debris, and free draining.

7-01.3(3) JOINTS

Polyvinyl chloride (PVC) drain pipe shall be installed upstream with the bell end upstream, or solvent welded per manufacturer's instructions. Corrugated polyethylene drain pipe shall be jointed with snap-on, screw-on, or wraparound coupling bands as recommended by the pipe manufacturer.

7-01.4 MEASUREMENT

Bid items of Work completed pursuant to the Contract will be measured as provided in Section 1-09.1, Measurement of Quantities, unless otherwise provided for by individual measurement paragraphs herein this Section.

Measurement for "Filter Material, (Type)" will be per cubic yard based on the neat line cross section indicated on the Drawings.

Measurement for geotextile will be as specified in Section 2-15.4.

Measurement for "Pipe, Subsurface Drain, (Material), (Size)" will be by the linear foot measured along the centerline of the pipe from pipe end to pipe end.

7-01.5 PAYMENT

Compensation for the cost necessary to complete the work described in Section 7-01 will be made at the Bid item prices Bid only for the Bid items listed or referenced as follows:

1. "**Pipe, Subsurface Drain, (Material), (Size)",** per linear foot.

The Bid item price for "Pipe, Subsurface Drain, (Material), (Size)" shall include all costs for the work required to furnish and install the pipe, excavate the pipe trench, backfill, compact and haul and dispose of excess excavated Material.

2. "**Filter Material, (Type)",** per cubic yard.

The Bid item price for "Filter Material, (Type)" shall include all costs for the work required to furnish, install, and compact the Mineral Aggregate filter Material specified on the Drawings, and shall also include, when the subsurface drain is constructed of only gravel filter Material, the costs of the work required to excavate the trench and to haul and dispose of excess excavated Material.

3. **Other payment information**.

Any part of the trench excavated below grade or to a greater width than specified in the Contract shall be backfilled with filter Material as specified in the Contract at the Contractor's sole expense.

Payment for geotextile will be in accordance with Section 2-15.5.

Payment for protective systems will be in accordance with Section 2-07.5.

SECTION 7-02 RESERVED

SECTION 7-03 RESERVED

SECTION 7-04 RESERVED

SECTION 7-05 MAINTENANCE HOLES, CATCH BASINS, INLETS, JUNCTION BOXES AND BRIDGE DRAINS

7-05.1 DESCRIPTION

Section 7-05 describes work consisting of constructing maintenance holes, catch basins, inlets, junction boxes, bridge drains, and the rebuilding or rechanneling of existing maintenance holes in accordance with the Contract at locations shown on the Drawings.

This work shall also include excavation, backfilling and compaction as specified in Sections 2-04, 2-10 and 2-11.

Work in excavations over 4 feet deep shall comply with Section 2-07 Protective Systems.

7-05.2 MATERIALS

Materials shall meet the requirements of the following Sections:

Maintenance Holes, Catch Basins, Inlets, Junction Boxes, Appurtenance, and Related	9-12

Maintenance holes, catch basins and inlets shall be constructed in accordance with the following Standard Plan nos.:

Drainage Structure	Standard Plan nos.
Maintenance Holes	204a through 212b
Catch Basins	240 through 243b and 260a through 261
Inlets	250 and 252 and 260a and 260b
Junction Boxes	277
Bridge Drains	290

Deviations from Standard Plans, other than Material(s) substitutions allowed in Section 9-12, shall be subject to a Shop Drawing submitted by Contractor and approved by the Engineer in accordance with Section 1-05.3. Substitution(s) in Materials indicated on the Standard Plans and allowed in Section 9-12 shall comply with the requirements in Section 1-06.1. Concrete masonry units or concrete (masonry) rings may be used for adjustment of the casting to final street grade.

Joints between maintenance hole components shall be rubber gasket and shall conform to ASTM C443.

The concrete mix for maintenance hole channel shall be Class 3000 (see Section 6-02).

Concrete for maintenance hole, catch basin, and inlet structures shall be Class 4000 (see Section 6-02).

Precast maintenance hole components shall conform to ASTM C 478 except as modified in Section 7-05.

7-05.3 CONSTRUCTION REQUIREMENTS

7-05.3(1) MAINTENANCE HOLE

7-05.3(1)A FOUNDATION PREPARATION

7-05.3(1)A1 DEWATERING

Dewatering of maintenance hole and catch basin excavations shall comply with Section 2-08.

7-05.3(1)A2 FOUNDATION PREPARATION

The foundation preparation for maintenance holes, catch basins and inlets shall be in accordance with Section 2-09.

7-05.3(1)B BEDDING AND FOUNDATION SUPPORT

Maintenance holes and catch basins constructed with precast base sections shall be placed to grade upon a 6-inch minimum thickness of Mineral Aggregate Type 9 per Section 9-03 mixed with 4 sacks of Portland cement per cubic yard of Mineral Aggregate, with sufficient water added to form a stabilized foundation. The mixed Material shall be placed across the area of the excavation for the base to a minimum distance beyond the face of the maintenance hole as indicated on the Standard Plans and shall be graded to provide uniform bearing support with the precast base section.

All cast-in-place bases for maintenance holes and catch basins shall be poured to grade upon a properly prepared foundation as indicated in the Standard Plans. Imported Mineral Aggregate Type 2, when required in the Contract, shall be placed and compacted to the same limits specified in the paragraph above. The concrete base shall meet the requirements indicated in the Standard Plans.

7-05.3(1)C RESERVED

7-05.3(1)D REINFORCED CONCRETE

7-05.3(1)D1 CONCRETE MIXTURE

Concrete shall meet the requirements of Section 9-12.1.

7-05.3(1)D2 CURING

Upon completion of concrete casting, the precast components shall be protected and cured in a moist atmosphere maintained by injection of steam for the requisite length of time and at the required temperature to develop the compressive strength required for maintenance hole components.

Precast components may also be water-cured by any approved method that keeps the components continuously moist during the curing period. Cast-in-place components shall be moist cured for a period not less than 7 Days, except that Type III Portland cement concrete shall be cured for not less than 3 Days.

A pigmented membrane curing compound may be applied in lieu of moist curing with prior approval of the Engineer.

7-05.3(1)E BASE SLAB

7-05.3(1)E1 GENERAL

Base slab thickness and reinforcement of the base slab shall be in accordance with the Standard Plan nos. 204a through 212b

7-05.3(1)E2 PRECAST BASE

The base section shall be carefully placed on the prepared bedding so as to be fully and uniformly supported in true alignment and ensuring that all entering pipes can be inserted on proper grade.

All lift holes shall be thoroughly wetted and then completely filled with mortar and smoothed both inside and out to ensure watertightness.

Reinforcement for precast base slab with integral risers shall extend into the wall of the maintenance hole section and be tied to the longitudinal steel.

7-05.3(1)E3 CAST-IN-PLACE BASE

When the Drawings call for cast-in-place base, or the Contractor elects a cast-in-place base, the Contractor shall submit a shop drawing of the reinforcing mat that meets the requirements of the Standard Plans.

Concrete shall not be poured prior to inspection by the Engineer.

7-05.3(1)F PRECAST WALL SECTIONS

Precast wall sections shall meet the requirements of ASTM C478.

All joints between precast sections shall be rubber-gasketed and meet the requirements of ASTM C443.

Precast sections shall be placed and aligned so as to provide vertical sides and vertical alignment of the ladder rungs.

The completed maintenance hole shall be rigid, true to dimension, and watertight. No more than two lift holes shall be cast into each section. Holes shall be so located as to not damage reinforcing or expose it to corrosion. All lift holes shall be thoroughly wetted and then completely filled with mortar and smoothed both inside and out to ensure watertightness. At the manufacturer's option, steel loops may be provided for handling, in lieu of lift holes. When loops have been provided in lieu of lift holes, the loops shall be removed flush with the inside wall surface. No sharp cutoff protrusion will be permitted. If concrete spalling occurs as a result of the loop removal, the spalled area shall be restored to a uniform smooth surface with mortar.

7-05.3(1)G PRECAST CONES

Precast cone sections shall meet the requirements of the Standard Plans, ASTM C478 and Section 7-05.3(1)F.

Precast cones shall provide reduction in diameter within a range of height from not less than 18 inches to a maximum 36 inches.

Jointing of a cone section to the riser sections shall be similar to jointing between riser sections, but the top surface of the cone section shall be flat and at least 5 inches wide radially, to receive adjustment bricks of precast risers.

7-05.3(1)H TOP SLAB

Top slabs shall be per the Standard Plans, including details of opening location and reinforcing.

7-05.3(1)I RESERVED

7-05.3(1)J T-TOP PIPE MAINTENANCE HOLES

T-Top pipe maintenance holes shall conform to the Drawings and shall be provided with foundation and bedding.

7-05.3(1)K JOINTS

Joints between precast maintenance hole components shall be rubber gasketed in a manner similar to pipe joints conforming to ASTM C 443. Shop Drawings of joint details and end details in Standard Plan nos. 204a through 212b shall be submitted to the Engineer for approval at least 5 Working Days before manufacture. Completed joints shall show no visible leakage and shall conform to the dimensions of ASTM C 478.

7-05.3(1)L RESERVED

7-05.3(1)M MAINTENANCE HOLE CHANNELS

All maintenance holes shall be channeled unless otherwise specified in Contract.

Maintenance hole channels shall conform to the curvature of the connecting pipes. Maintenance hole channel slopes shall be made to conform accurately to the Sewer grade and shall be brought together smoothly with well rounded junctions. Where pipe connections have differing grades or differing invert elevations or differing inside diameters, a smooth transition in channel grade(s) or side(s) is required. Channel sides for each pipe shall be carried up vertically from the I.D. at the springline to the crown elevation of the pipe. The concrete shelf between channels shall be smoothly finished and warped evenly with slopes to drain.

Channel shall be Class 3000 concrete or pre-pack concrete mix as approved by the Engineer.

7-05.3(1)N MAINTENANCE HOLE PIPE CONNECTIONS

All pipes, except CMP, entering or leaving the maintenance hole shall be provided with flexible joints within 1/2 of a pipe inside diameter or 12 inches, whichever is greater, from the outside face of the maintenance hole structure and shall be placed on firmly compacted bedding, particularly within the area of the maintenance hole excavation which normally is deeper than that of the Sewer trench. Openings surrounding pipes entering the maintenance hole shall be completely filled with a non-shrink cement sand grout and shall be finished flush with the remaining maintenance hole concrete wall surfaces to ensure watertightness. PVC pipe connecting to maintenance hole shall be provided with a maintenance hole adapter complete with gasket and approved by the Engineer.

7-05.3(1)O RESERVED

7-05.3(1)P MAINTENANCE HOLE GRADE ADJUSTMENT

The Contractor shall be responsible for selecting the appropriate precast concrete maintenance hole components, allowing for a maximum height of 2 foot 2 inch from the top of the cone section or top slab to the finished surface grade for installation of the maintenance hole frame and cover including 8 inches minimum for leveling or adjustment brick, or concrete collar. The surface grade for frame and cover on unimproved roadways shall match the adjacent existing roadway surface.

Final elevation and slope of the frame and cover shall conform to the restored and adjacent street surface. No warping of grades in lieu of maintenance hole frame adjustment will be allowed. All joints in the brick or ring adjustment shall be filled with mortar to a thickness of ¼ inch minimum to ½ inch maximum, and the casting shall be seated in mortar a thickness of ¼ inch minimum to ½ inch maximum placed on the top brick course. Bricks shall be laid in a running bond pattern. When the frame is circular, radial bricks or concrete grade rings shall be used. A 3/8-inch thick mortar lining shall be installed inside and outside the adjustment section to provide a smooth, watertight finish.

7-05.3(1)Q LADDER, STEPS AND HANDHOLDS

The Contractor shall submit to the Engineer for approval at least 5 Working Days in advance, the single Material of choice for step, handhold, and ladder from the Section 9-12.2, and shall consistently use this single chosen Material in every maintenance hole. Steps, handholds, and ladder made of copolymer polypropylene plastic manufactured only by Lane International Corp., M. A. Industries, or approved equal will be accepted. Should the Contractor request a different Material between or among different maintenance holes, then the submittal shall be clear in identifying which Material is for which maintenance hole.

Ladders, steps and handholds shall be per Standard Plan nos. 232a and 232b and provide regular 1'-0" vertical spacing, except for: up to one foot six inch spacing is allowed between the top step or handhold and the rim; and up to one foot four inch spacing is allowed between the bottom step and the channel shelf.

The minimum horizontal clear opening, measured at the shortest dimension, shall be one foot six inch.

Penetrations of the precast wall sections to attach steps, handholds and ladders shall be kept clear of the joints two inch minimum.

Vertical handholds shall be installed four feet above the channel shelf when indicated in the plan view of Standard Plan nos. 204b through 212b or on the drawings.

Where a concentric cone section is required, an additional step shall be provided on the side opposite the ladder steps at midheight of the cone section.

7-05.3(1)R FRAME AND COVER

The casting shall be as shown on Standard Plan no. 230.

Where Standard Plan no. 230 casting is located within the concrete pavement or within the rigid concrete pavement base, reinforcing in the concrete pavement slab shall be installed as specified in Section 5-05.3(9) and per Standard Plan 406. Standard Plan no. 230 casting located across, or located within 18 inch of a concrete pavement joint as measured from the casting barrel (not the flange), does not require Section 5-05.3(9) pavement reinforcing.

Total height of casting and leveling brick shall not exceed 26 inches.

7-05.3(1)S CONNECTIONS TO EXISTING MAINTENANCE HOLES

The Contractor shall verify invert elevations prior to construction. Discrepancies in invert elevations shall be immediately brought to the attention of the Engineer. The crown elevation of lateral pipes shall be the same as the crown elevation of the existing incoming pipe. The existing base shall be reshaped to provide a channel equivalent to that specified for a rechanneled maintenance hole (see Section 7-05.3(1)T).

The Contractor shall excavate completely around the maintenance hole to prevent unbalanced loading. The maintenance hole shall be kept in operation at all times, and the necessary precautions shall be taken to prevent debris or other Material from entering the Sewer. This includes building a tight pipeline sewage bypass as required.

The Contractor shall core drill, line drill or wall saw an opening to match the size of pipe to be inserted. Where line drilling is the method used, the method of drilling holes shall prevent overbreakage. All openings shall provide a minimum and a maximum clearance around the outside circumference of the pipe as shown on the Standard Plans. Upstream pipes penetrating the walls of maintenance holes shall be placed with the bell facing out. Pipe leaving or entering maintenance holes shall be provided with a flexible joint within 1/2 of a pipe inside diameter, or 12 inches, whichever is greater from the outside wall of the maintenance hole. After pipes have been placed in their final position, the surface area around the opening in the maintenance hole and the surface of the pipe shall be cleaned of all dirt, dust, grease, oil and other contaminants and then roughened and wetted with water. The opening between pipe and broken out concrete shall be grouted as specified in Section 7-05.3(1)N

7-05.3(1)T RECHANNEL EXISTING MAINTENANCE HOLE

Rechanneling of an existing maintenance hole shall include all necessary work such as; excavating shelf and maintenance hole bottom, filling existing channel or channels with concrete, installing the new channel or channels, constructing new pipe opening or openings, and finishing the channel(s) and shelf(ves). It shall also include the work of connecting the pipe to the maintenance hole in accordance with Section 7-05.3(1)S. Rechanneling shall meet the requirements specified in Section 7-05.3(1)M.

7-05.3(1)U REBUILD EXISTING BRICK MAINTENANCE HOLE

Where noted on the Drawings, the Contractor shall rebuild the existing brick maintenance hole per Standard Plan no. 220 to accommodate a new maintenance hole frame and cover meeting the requirements of Standard Plan no. 230. Work required to rebuild an existing brick maintenance hole includes excavation around the maintenance hole; removal and salvage of the existing maintenance hole frame and cover; removal of leveling or adjustment bricks or rings; and removal of the upper portion of the cone section to a depth yielding an opening of inside diameter as indicated on Standard Plan no. 220. The cone section shall be rebuilt using a running bond pattern; leveling bricks or rings installed; new maintenance hole steps and handholds installed, and a new frame and cover installed in accordance with Section 7-05.3(1)R.

Salvage shall be in accordance with Section 2-02.3(7).

7-05.3(2) CATCH BASINS AND INLETS

7-05.3(2)A GENERAL

Construction requirements for catch basins and inlets shall follow all applicable Specifications of Section 7-05.3(1) for maintenance holes and maintenance hole pipe connections.

Catch basins shall be installed as indicated on Standard Plan nos. 240 through 242 and 260a and 260b unless the Contract indicates otherwise. Staking points shall be established by the Contractor at the centerline of grate at the face of curb for drainage structures along a curb line.

Connections to the catch basin shall be made only either at the pre-drilled holes or at the concrete knock outs provided in the walls of the catch basin. In order to meet this requirement, the Contractor shall determine beforehand the approximate elevation of the proposed inflow and outflow pipes by taking into account the length of inlet connection pipe, the throw in the roadway, including drainage transition zone, and any existing utilities or obstructions that may interfere with installing the inlet connection or catch basin connection pipe. All these items have a bearing on the depth of the pipes at the catch basin, and the bottom elevation of the catch basin.

7-05.3(2)B PIPE CONNECTIONS FOR CATCH BASINS AND INLETS

All new catch basins shall be provided with openings or concrete knockouts for insertion of pipe connections and with a trap for the outlet pipe. When connections are to be made to existing catch basins with no available hole or knockout, or where a “knockout” of adequate size is not provided, pipe connections shall be accomplished by core drilling, line drilling or wall sawing. All openings shall provide a minimum of 1½ inch and a maximum of 2½ inches clearance around the circumference of the pipe. Where line drilling is the method used, the method of drilling holes shall prevent overbreakage. After pipes have been placed in position, the opening between pipe and wall of catch basin or inlet shall be grouted as specified in Section 7-05.3(1)N. See Sections 7-08.3(4) and 7-08.3(5) for additional pipe connection requirements.

The outlet trap and the frame and grate shall be located as shown on the Standard Plans and shall be vertically aligned to allow reasonable access for removal and replacement of the outlet trap for vactor cleaning maintenance operations.

The Contractor shall furnish and install new outlet traps for relocated and rebuilt catch basins.

7-05.3(2)C CATCH BASIN GRADE ADJUSTMENT

The Contractor shall be responsible for selecting the appropriate precast concrete catch basin components, allowing for a maximum and minimum height of the leveling bricks or riser as shown in the Standard Plan for the Catch Basin Type.

Final elevation and slope of the grate or cover shall conform to the restored and adjacent street surface, Drainage Transition Zone; see Standard Plan No. 260a and Section 7-20.3(1). No warping of grades, in lieu of catch basin frame adjustment, will be allowed. On projects calling for regrading and pavement improvements, the Contractor shall determine grades and perform surveying in accordance with Sections 1-05.4 and 1-05.5.

7-05.3(2)D INLET GRADE ADJUSTMENT

The inlet frame shall be placed on a minimum 4 inch thick leveling brick or precast risers. It shall not, in any case, be mortared to final grade until the final elevation of the pavement in which it is to be placed has been established and permission has been given by the Engineer to mortar the frame in place. Location of inlet will be established by the Engineer. The bottom of the inlet shall be sloped to drain level with the invert of the outlet pipe.

Final elevation and slope of the frame and cover shall conform to the restored and adjacent street surface, Drainage Transition Zone; see Standard Plan No. 260a and 260b and Section 7-20.3(1). No warping of grades in lieu of inlet frame adjustment will be allowed.

Existing Type 164 inlets shall be adjusted as shown on Standard Plan no. 268 with new grate as shown on Standard Plan no. 266 only for pavement resurfacing projects.

7-05.3(2)E RELOCATE EXISTING CATCH BASIN OR INLET

Work required for relocation of existing catch basin or inlet shall include necessary excavation to remove without damage the existing catch basin or inlet, its frame and grate or cover and transporting and installing at the new location. Grade adjustment shall be in accordance with Sections 7-05.3(2)C or 7-05.3(2)D.

The Contractor shall furnish and install new outlet traps (see Section 7-05.3(2)B for outlet trap location requirements).

7-05.3(2)F REBUILD EXISTING CATCH BASIN

Where noted on the Drawings, the Contractor shall rebuild existing catch basin to accommodate a new frame and grate, or cover, as designated in the Contract. Work required to rebuild catch basin includes excavation, the removal of the existing frame and grate or cover, leveling or adjustment bricks, upper portion of catch basin chamber, and installing a new cone section, leveling or adjustment bricks and new frame and grate or cover. Excavation, backfill, and compaction shall conform to the applicable portions of Section 7-17. Salvage shall be in accordance to Section 2-02.3(7). Grade adjustment shall be in accordance with Sections 7-05.3(2)C.

The Contractor shall furnish and install new outlet traps (see Section 7-05.3(2)B for outlet trap location requirements).

7-05.3(3) JUNCTION BOX

Junction box shall be installed as shown on the Drawings. See Standard Plan no. 277 and Section 9-12.9 and Section 9-04.3(2)B. The bottom of the structure shall be filled to match the invert of the lowest pipe and sloped to drain.

7-05.3(4) BRIDGE DRAIN

Bridge Drain shall be located and installed as shown on the Drawings. See Standard Plan no. 290 and Section 7-08.3(9) Bridge Downspouts.

Bridge Drain shall be furnished with vaned grates as shown on Standard Plan no. 265. The grate shall be fitted to the frame and shall be ground to rest evenly and without rocking.

Bridge Drain shall be furnished with 6-inch diameter standard weight galvanized steel pipe that shall be shop welded to bridge drain box.

The assembled Bridge Drain shall be galvanized in accordance with ASTM A53, “Black and Hot-Dipped Zinc-Coated Welded and Seamless Steel Pipe for Ordinary Uses”. The assembled and galvanized bridge drain shall be coated inside and outside with an asphaltic base, black dipping paint. The asphaltic coating shall extend to cover all welds.

The drain pipe, when encased in concrete shall be fully encased in a sponge rubber compound ½ inch thick and meeting the requirements of ASTM D 1752, Type No. 1, except the color requirement is waived.

The Contractor shall submit to the Engineer at least five (5) Working Days in advance of delivering the Bridge Drain to the Project Site, a combined Shop Drawing of the Bridge Drain and Bridge Downspout per Section 7-08.3(9) and connection details.

7-05.4 MEASUREMENT

Bid items of Work completed pursuant to the Contract will be measured as provided in Section 1-09.1, Measurement of Quantities, unless otherwise provided for by individual measurement paragraphs herein this Section.

Measurement for “Extra Depth (Type) Maintenance hole” will be by the vertical foot for all depth in excess of 10 feet measured from the invert of the outlet pipe to the top of the casting.

Measurement for Extra Depth for the type of maintenance holes which are built on top of and are fully supported by large diameter pipe, will be by the vertical foot for extra depth in excess of the 10 feet measured from the springline of the "supporting" pipe to the top of the maintenance hole casting.

Measurement for "Extra Excavation" will be per Section 2-04.4.

7-05.5 PAYMENT

Compensation for the cost necessary to complete the work described in Section 7-05 will be made at the Bid item prices Bid only for the Bid items listed or referenced as follows:

1. "**Maintenance Hole (Type)",** per each.

The Bid item price for "Maintenance Hole (Type)" shall include all costs for the work required to furnish and install the maintenance hole complete to finish grade, including excavation, bedding, mortar, non-shrink grout, brick, block, castings, channeling, ladder, steps, connections to pipelines, and haul, stockpile and or disposal of soil, backfill and compaction with suitable native Material for a maintenance hole depth up to and including 10 feet.

2. "**Extra Depth, (Type) Maintenance Hole**", per vertical foot.

The Bid item price for "Extra Depth, (Type) Maintenance Hole" shall include all costs for the work required to construct the portion of a maintenance hole excavation in excess of 10 vertical feet.

3. "**Rechannel Maintenance Hole**", per each.

The Bid item price for "Rechannel Maintenance Hole" shall include all costs for the work required to complete the maintenance hole rechanneling work as specified in Section 7-05.3(1)T and of core drilling openings for new pipes to the maintenance hole when performed in an existing maintenance hole.

If connecting a new pipe to an existing maintenance hole requires rechanneling of the maintenance hole, the work involved in connecting such pipe to the maintenance hole is incidental to "Rechannel Maintenance hole", per each, and shall be performed as specified in Section 7-05.3(1)T. If the work involves only the cutting of an opening and connecting the pipe without rechanneling, then this work shall be considered included in the Bid item price for installation of the pipe and no other payment will be made therefore.

4. "**Catch Basin, (Type)",** per each.

The Bid item price for "Catch Basin, (Type)" shall include all costs for the work required to furnish and install the catch basin including trap, excavation, haul, stockpile and or disposal of soil, backfill and compaction, adjustment brick and blocks, mortar, non-shrink grout, plaster, and castings.

5. "**Inlet, (Type)",** per each.

The Bid item price for "Inlet, (Type)" shall include all costs for the work required to furnish and install the inlet including excavation, haul, stockpile and or disposal of soil, backfill and compaction, brick, block, mortar, grout, and castings.

6. "**Junction Box (Type)**", per each.

The Bid item price for "Junction Box, (Type)" shall include all cost for the work required to furnish and install the junction box complete to finish grade including but not limited to excavation, mortar, grout, brick, block, castings, haul, stockpile and or disposal of soil, backfill and compaction with suitable native material.

7. **"Bridge Drain",** per each.

The Bid item price for "Bridge Drain" shall include all costs for the work required to furnish and install drain, including outlet pipe through the bridge deck, reducer, if needed, and grate to structure complete. All costs in connection with maintaining and cleaning of bridge drains shall be considered incidental to the construction of the bridge drain.

8. "**Rebuild (Item)",** per each.

The Bid item price for "Rebuild (Item)" shall include all costs for the work required, including the new casting, to completely rebuild the existing item to finished street grade as specified in Sections 7-05.3(1)U or 7-05.3(2)F as applicable.

9. "**Relocate (Item)",** per each.

The Bid item price for "Relocate (Item)" shall include all costs for the work required to relocate the catch basin or inlet including furnishing and installing new outlet trap, excavation, haul, stockpile and or disposal of soil, backfill and compaction with native Material, adjustment brick and blocks, mortar, non-shrink grout, plaster and castings in accordance with Section 7-05.3(2)E.

10. **Other payment information**.

When Mineral Aggregate Type 17, or other Mineral Aggregate Type designated by the Engineer, is used as backfill, payment shall be per Section 1-09.4.

Payment for "Extra Excavation", will be per Section 2-04.5.

Foundation Material will be paid as "Mineral Aggregate, (Type)".per Section 4-01.5.

When it is determined by the Engineer that the existing foundation is unsuitable and where foundation Material is not specified in the Contract and no Bid item for "Mineral Aggregate, (Type)" of the type required by the Engineer is included in the Bid Form, payment will be made in accordance with Section 1-04.1(2).

Final adjustment of the casting for new construction of maintenance hole, catch basin and inlet shall be considered incidental to and included in the Bid item price for the maintenance hole, catch basin, and inlet.

Payment for protective systems, when applicable, will be as specified in Section 2-07.5.

SECTION 7-06 RESERVED

SECTION 7-07 CLEANING EXISTING DRAINAGE STRUCTURES

7-07.1 DESCRIPTION

Section 7-07 describes work consisting of cleaning and removing all debris and obstructions from existing Culvert pipes, sanitary Sewer pipes, combined Sewer pipes, drains, inlet Structures, maintenance holes, box Culverts, grates, trash racks, or other drainage features in conjunction with the Work within the Project Site.

7-07.2 RESERVED

7-07.3 CONSTRUCTION REQUIREMENTS

Existing drainage facilities connecting to new work shall be cleaned as a first order of Work to enhance drainage off and through the Project Site. These facilities shall be kept clean up to the Physical Completion Date.

All existing pipes and drainage Structures connecting to new work shall be cleaned by flushing, or by rodding, or by such manner as may be necessary as approved by the Engineer to provide unobstructed drainage. All catch basin sumps, maintenance holes, inlet and outlet Structures, and debris racks shall also be freed of all dirt, rock, and debris.

7-07.4 MEASUREMENT

Work described in Section 7-07 will not be measured for payment.

7-07.5 PAYMENT

All work described in Section 7-07 shall be considered incidental to the various Bid items comprising the Work.

SECTION 7-08 MISCELLANEOUS PIPE CONNECTIONS

7-08.1 DESCRIPTION

Section 7-08 describes work consisting of excavation, foundation preparation, bedding, backfilling and compacting for the construction of miscellaneous Sewer and drain pipe connections other than those described in Sections 7-01, 7-17 and 7-18.

7-08.2 MATERIALS

Materials shall meet the requirements in Section 9-04 and Section 9-05.

7-08.3 CONSTRUCTION REQUIREMENTS

7-08.3(1) EXCAVATION, FOUNDATION PREPARATION, BEDDING, AND BACKFILL

Work in trench excavations over 4 feet deep is subject to the provisions of Section 2-07 Protective Systems.

Trench excavation, backfill and compaction shall be as specified in Sections 2-04, 2-10 and 2-11.

7-08.3(2) CONNECTIONS TO EXISTING SEWERS

When making a connection to an existing Sewer line or maintenance hole, the Contractor shall excavate and expose the existing facility where shown on the Drawings. In the event there is no existing tee or wye, refer to Section 7-17.3(2)C3 “Cut-in Tee on Existing Pipe.” See Section 7-05.3(1)S for connections to existing maintenance holes.

7-08.3(3) PIPE INSTALLING, JOINTING, AND TESTING

Pipe installing, bedding, jointing, and pipe connections shall conform to the applicable requirements of Section 7-17.

7-08.3(4) CATCH BASIN CONNECTIONS

Catch basin connections are pipe lines connecting outlets of catch basins to a Storm Drain or other facility. Catch basin connections shall be installed upgrade from Storm Drain or other originations. Catch basin connection slopes shall be not less than 2% nor more than 50% within one foot of the catch basin, nor more than 100%.

Alignment shall be as shown on Standard Plan 261. Type 240A, 240B and 241 catch basin connections shall be straight with the exception of maintaining clearances in accordance with Section 1-07.17(2), or to meet the slope requirement of not more than 50% within one foot of the catch basin. Type 240C, 240D, 242A and 242B catch basin connections shall be aligned so that the outlet is at the narrow end and directly below the frame opening to allow for tool insertion.

Maximum bends shall be twenty two and one half degrees (22.5°). Between each bend, a minimum one foot section of straight pipe shall be installed, or the bend shall have an equivalent manufactured sweep.

When the catch basin connection material is ductile iron pipe and is connecting to a mainline by core tap and an inserted tee, connection shall include a one foot long plain end by plain end section of ductile iron pipe inserted into the bell end of the tee manufactured to accept ductile iron pipe. The one foot section shall be connected to the upstream pipe with a shielded flexible gasketed coupling.

No connection shall be made to the catch basin outlet pipe until the excavation around the catch basin has been backfilled and compacted to an elevation which provides support for pipe bedding and the connection pipe. Bedding for catch basin connection pipe shall be Class B bedding.

The Contractor shall furnish and install a new outlet trap to the new outlet of the existing catch basin. See Section 7-05.3(2)B for outlet trap location and catch basin pipe connection requirements.

Television inspections are required for catch basin connections – refer to Section 7-17.

7-08.3(5) INLET CONNECTIONS

Inlet connections are pipe connections from drainage inlets to catch basins or other approved outlets. Inlet connections shall be installed upgrade from catch basin openings or other originations. Inlet connection slopes shall be not less than 5% nor more than 50%.

Where a straight alignment or a uniform slope is not feasible and curves are necessary, the altered alignment shall be made, either by deflecting each pipe into a smooth curve, or with fittings.

When using deflection, the Contractor shall submit the manufacturer's pipe joint deflection criteria to the Engineer for approval. Such deflection shall be water tight and allow rodding the pipe in a relatively easy manner. Under no circumstances will deflection or change of direction be allowed by cutting or trimming the end of the pipe on a bias or an angle. All pipe ends shall be normal angle.

When using fittings, maximum bends shall be twenty two and one half degrees (22.5°). Between each bend, a minimum one foot section of straight pipe shall be installed, or the bend shall have an equivalent manufactured sweep.

No connection shall be made to the catch basin, or other approved outlet, until the excavation around the catch basin has been backfilled and compacted to an elevation which provides support for pipe bedding and the inlet connection pipe. Bedding for inlet connection pipe shall be Class B bedding.

See Section 7-05.3(2)B for inlet pipe connection requirements.

7-08.3(6) DROP CONNECTIONS

Inside and outside drop connections to allow for abrupt drop in elevation of the inflow, shall be constructed as shown on Standard Plan nos. 233a and 233b, and at locations indicated on the Drawings. The invert elevation of the outside drop connection will be specified on the Drawings. The crown elevation of the inside drop connection shall match the crown elevation of the maintenance hole outlet pipe.

7-08.3(7) VERTICAL CONNECTIONS

Vertical connections shall be constructed in accordance with Standard Plan no. 234, and at locations shown on the Drawings.

7-08.3(8) DETENTION PIPE OUTLET CONNECTIONS

Detention pipe outlet connections shall be constructed as shown on the Drawings. Pipe shall be installed upgrade from Storm Drain or other originations. When connection is to an existing maintenance hole on the mainline, the maintenance hole shall be rechanneled. Where a straight alignment and uniform slope is not feasible, alterations to the alignment can be made using fittings. Maximum bends shall be twenty two and one half degrees (22.5°). Between each bend, a minimum one foot section of straight pipe shall be installed, or the bend shall have an equivalent manufactured sweep.

No connection shall be made to the flow control structure, until the excavation around the flow control structure has been backfilled and compacted to an elevation which provides support for pipe bedding and the detention pipe outlet connection pipe. Bedding for detention pipe outlet connection shall be Class B bedding.

7-08.3(9) BRIDGE DOWNSPOUTS

The Contractor shall furnish and install standard weight steel pipe or ductile iron pipe Bridge Downspouts, whichever is shown on the Drawings. Inside diameter shall be 6-inch minimum.

The Bridge Downspout shall be full length pipe section in all straight runs. The Contractor may propose types of couplings and fittings other than grooved couplings and fittings, provided they are equal performance and are included in the submittal specified in the last paragraph of this Section.

The drain pipe, when encased in concrete shall be fully encased in a sponge rubber compound ½ inch thick and meeting the requirements of ASTM D 1752, Type No. 1, except the color requirement is waived.

All pipe bends, whether encased in concrete or not and whether they are fittings or bent steel pipe, shall have a bend radius of not less than four (4) feet. All straight run pipe shall have a minimum slop of 10%.

The Contractor shall verify all downspout lengths by field measurements prior to fabrication and shall determine the exact lengths of pipe and hangers required for each Bridge Downspout.

The Contractor shall install pipe hangers per the Manufacturer's written direction.

When the Contract requires clean outs, they shall be of the size and type specified, and shall be installed as indicated on the Drawings.

The Contractor shall submit to the Engineer at least five (5) Working Days in advance of delivering the Bridge Downspout to the site, a combined Shop Drawing of the Bridge Downspout and Bridge Drain per Section 7-05.3(4) and connection details. Shop Drawings shall show each downspout pipe layout including size of pipe(s) and fittings, spacing and type of pipe hangers, manufacturer's directions on hanger installation, concrete inserts, radius of bends, details of pipe connections, including connection to receiving pipe or drainage structure, cleanouts, slopes of straight run pipe and connection to Bridge Drain.

7-08.4 MEASUREMENT

Bid items of Work completed pursuant to the Contract will be measured as provided in Section 1-09.1, Measurement of Quantities, unless otherwise provided for by individual measurement paragraphs herein this Section.

Measurement for "Pipe, Catch Basin Connection, (Material), (Class), (Size)" will be by the linear foot of pipe installed between the tee or wye in the receiving Sewer and the inside face of the catch basin.

Measurement for "Pipe, Inlet Connection (Material) (Class), (Size)" will be by the linear foot of pipe installed between the inside face of the inlet, and the inside face of the catch basin.

Measurement for "Drop Connection, Outside, (Size)" will be by the vertical foot from the invert of the bend connection at the maintenance hole, to the invert at the upstream end of the tee as shown on Standard Plan no. 233a.

Measurement for "Drop Connection, Inside, (Size)" will be by the vertical foot from surface grade to the crown elevation at the end of the pipe elbow in the maintenance hole as shown on Standard Plan no. 233b.

Measurement for "Vertical Connection (Size)" will be from surface grade to the crown elevation of the connecting pipe.

Measurement for "Pipe, Detention Pipe Outlet Connection, (Material), (Class), (Size)" when the pipe is an outlet pipe from a flow control Structure will be measured from the inside wall of the flow control Structure to either the inside face of a maintenance hole or to tee.

Measurement for "Bridge Downspout, (Material), (Class), (Size)" will be by the linear foot along the center line of the pipe through fittings.

7-08.5 PAYMENT

Compensation for the cost necessary to complete the work described in Section 7-08 will be made at the Bid item prices Bid only for the Bid items listed or referenced as follows:

1. "**Pipe, Catch Basin Connection, (Material), (Class), (Size)",** per linear foot.
2. **"Pipe, Inlet Connection, (Material), (Class), (Size)",** per linear foot.

The Bid item prices for "Pipe, Catch Basin Connection, (Material), (Class), (Size)" and for "Pipe, Inlet Connection, (Material), (Class), (Size)" shall include all costs for the work required to furnish and install the pipe, including connections to catch basins or inlets, excavation, haul, stockpile and or disposal of soil, backfill, and compaction.

3. "**Drop Connection, (Type), (Size)",** per vertical foot.

The Bid item price for "Drop Connection, (Size)" shall include all costs for the work required to furnish and install the complete inside or outside drop connection as shown on Standard Plan nos. 233a and 233b.

4. "**Vertical Connection, (Size)**", per vertical foot.

The Bid item price for "Vertical Connection, (Size)" shall include all costs for the work necessary to furnish and install the vertical connection as shown on Standard Plan no. 234.

5. "**Pipe, Detention Pipe Outlet Connection, (Material), (Class), (Size)"**, per linear foot.

The Bid item prices for "Pipe, Detention Pipe Outlet Connection, (Material), (Class), (Size)" shall include all costs for the work required to furnish and install the pipe, including connections to existing maintenance holes, pipe, flow control structures, excavation, haul, stockpile and or disposal of soil, backfill, and compaction.

6. **"Bridge Downspout, (Material), (Class), (Size)"**, per linear foot

The Bid item price for "Bridge Downspout, (Material), (Class), (Size)" shall include all costs for the work required to furnish and installing bridge downspouts, including field measurement and adjustment, galvanizing where required, and other items necessary to make a complete construction as specified.

7. **Other payment information**.

The cost for furnishing and installing new outlet trap when installing catch basin connection pipe to existing catch basin shall be included in the Bid item price for "Pipe, Catch Basin Connection, (Material), (Class), (Size)".

Payment for bedding will be in accordance with Section 7-17.5.

Payment for television inspection will be in accordance with Section 7-17.5.

Payment for protective systems, when applicable, will be as specified in Section 2-07.5.

Payment for clay dam, and for CDF bedding will be as specified in Section 7-17.5.

SECTION 7-09 RESERVED

SECTION 7-10 RESERVED

SECTION 7-11 PIPE INSTALLATION FOR WATER MAINS

7-11.1 DESCRIPTION

Section 7-11 describes work consisting of installing Water Main pipe in accordance with the manufacturer's printed specifications and instructions and with the AWWA standards for installing the type of pipe proposed.

Pipe sections shall be joined in such a manner as not to damage the lining or coating. The method of pulling or jacking the pipe home shall allow for both vertical and horizontal movement of the pipe for protection of the gasket.

Water Main installation shall not proceed until line and grade hubs have been set and measurements for connection fittings have been made in accordance with Section 7-11.3(4).

Clearances shall be maintained between Water Mains and other utilities per Section 1-07.17(2). Water distribution main, water transmission main, water services, and fire hydrant and connection pipe shall be installed at least five (5) feet clear of any tree measured horizontally from the edge of the vault/pipe to a vertical plane projected down from the tree's outer bark surface at ground level.

Clear access shall be provided and maintained to fire hydrants, water valves, water meters, water vaults, and related water Structures at all times unless the Contract specifies otherwise.

This work shall also include excavation, backfilling and compaction as specified in Sections 2-04, 2-10 and 2-11.

Work in excavations over 4 feet deep shall comply with Section 2-07 Protective Systems.

7-11.2 MATERIAL

7-11.2(1) GENERAL

Material shall meet the requirements of Section 9-30.

Pipe and Pipe Coatings	9-30.1
Fittings	9-30.2
Valves, Valve Boxes, and Valve Chambers	9-30.3
Hydrants	9-30.5
Service Connections and Service Pipe or Tubing	9-30.6
Bedding, Foundation Material and Gravel	9-30.7
Joint Bond Cable	9-30.10
Thermite Weld Materials	9-30.11
Electrolysis Test Station	9-30.12
Turbine Meters (sizes 2" – 12")	9-30.13
Locating Wire	9-30.14
Coating for Bolts and Shackle Rods	9-30.15
Backflow Prevention Assemblies	9-30.16
Mineral Aggregates	9-03

It is not intended that Materials listed to be considered equal or generally interchangeable for all applications. The Engineer will determine from the Materials listed, those that are suitable for the project and will so specify in the Contract.

The Engineer shall have free access to all testing and records pertaining to Material to be delivered to the site. The Engineer may elect to be present at any or all Material testing operations.

7-11.2(2) PRE-INSTALLATION TASTE AND ODOR RATING TEST

All Water Main manufactured of any material and all Water Main lining material shall either:

1. Satisfactorily pass an Engineer conducted SPU Taste And Odor Rating Test, or
2. Be a product of a Materialperson pre-approved by the Engineer in accordance with SPU's Taste and Odor Rating Test Program.

The Contractor shall allow for Taste and Odor Rating Testing as follows:

Material	Time for Testing and Reporting Results
Water Main	Up To 30 Working Days[1]
Water Main Lining Material	Up to 30 Working Days[1]

Note 1 This time can be reduced to as little as 10 Working Days if:
1) a test on a section of pipe, either with or without lining Material, can be done as a bench scale test and not by a full scale test with a pipe manifold, and
2) a retest is not required.

Time for testing and reporting results is based on the day the Material is received by the Engineer to the day the results are available to the Engineer.

Water Main pipe Material will be sampled for testing at the rate of one for each lot of 100 or fewer, for each diameter size pipe.

Water Main lining Material will be sampled for testing.

No Taste and Odor Rating Test will be required for service connection pipe.

Materialperson with Taste and Odor Rating Test Program pre-approved Water Main and Water Main lining material can be obtained by contacting 206-684-7834.

Materialperson can obtain cost information on the Taste and Odor Rating Test Program pre-approval process for Water Main and Water Main lining material by contacting 206-684-7834.

7-11.2(3) POST INSTALLATION TASTE AND ODOR RATING TESTS

The Engineer reserves the right to perform post installation Taste and Odor Rating Tests on any portion of the Work prior to, or after, connection to existing Water Main. Such retesting may be performed as part of bacteriological sampling and testing during flushing and testing (see Sections 7-11.3(12)L and 7-11.3(12)M), and may include sampling and testing of mortar and lining materials. Post-installation Taste and Odor Rating Testing shall require a minimum 48 hours contact time in the Water Main assembly under test. Depending on the extent of the testing required, results will be made available in not more than 15 Working Days.

If results of additional Taste and Odor Tasting Rating Tests are determined unacceptable, the Contractor shall be prepared to make timely correction as determined by the Engineer.

Failure of the system or portion of the system to pass the Taste and Odor Rating Test will result in the rejection of all of the new Water Main under test.

7-11.3 CONSTRUCTION REQUIREMENTS

7-11.3(1) TRENCH DEWATERING, EMBANKMENT FILL AND PIPE BEDDING

7-11.3(1)A DEWATERING OF TRENCH

In addition to the requirements of Section 2-08, where water is encountered in the trench, the water shall be removed during pipe installation operations and trench dewatering shall be maintained until the ends of the pipe are sealed and provisions are made to prevent floating of the pipe. Trench water or other deleterious materials shall not be allowed to enter the pipe at any time.

7-11.3(1)B INSTALLING PIPE IN EMBANKMENT FILL

Where the Drawings show pipe is to be installed above existing ground surface, an embankment fill shall be made and compacted as shown on the Drawings, and the Water Main trench shall be excavated therein. That portion of the embankment below the bottom of the pipe shall be compacted with rollers or mechanical compactors under controlled moisture conditions as required under Method B of Section 2-11.

7-11.3(1)C BEDDING RIGID PIPE

7-11.3(1)C1 GENERAL

All distribution Water Main shall have Class B bedding with either of Mineral Aggregates Type 6 or Type 7. All transmission Water Main shall have Class B bedding with Mineral Aggregate Type 9. See Standard Plan no. 350.

All classes of bedding shall provide uniform support along the entire pipe barrel, without load concentrations at pipe bells and fittings.

Care shall be taken to prevent any damage to the pipe, to any protective coating, and to any electrolysis monitoring system.

7-11.3(1)C2 BEDDING FOR POLYETHYLENE ENCASED, MULTI-LAYERED POLYETHYLENE TAPE COATING, THERMOPLASTIC POWDER COATED, OR SPECIAL COATED PIPE

Class B bedding Material for specially protected or coated pipe shall be Mineral Aggregate either Type 6 or Type 7 in accordance with Section 9-03. Class B bedding consisting of Mineral Aggregate Type 6 or Type 7 shall be compacted by tamping.

Bedding of specially protected pipe shall be conducted at all times in such manner as to prevent damage to the protective coating or wrap.

Placing of Class B bedding around wrapped or coated or specially protected pipe shall be conducted at all times in such manner as to prevent damage to the protective coating or wrap. Any damage to the special protection or coating or wrap shall be repaired by the Contractor at the Contractor's sole expense.

7-11.3(1)C3 SAND BEDDING AT TRENCH CROSSINGS

See Standard Plan no. 350 for protective sand bedding requirements. When trenching exposes the metal pipe, the pipe shall be protected from exposure to cementitious materials placed in the trench by:

1. After excavation wrap the existing metal pipe in 8 mil polyethylene wrap.
2. Bring controlled density fill, or fluidized thermal backfill, as required in the Contract, to an elevation one (1) foot below the existing metal pipe.
3. Bed the exposed pipe in one (1) foot, bottom, sides and above, as described in Section 7-11.3(1)C1. Bedding material shall be Mineral Aggregates Type 6 or Type 7, or sand approved by Seattle City Light for heat dispersion if required in the Contract.
4. Backfill above as specified in the Contract.

7-11.3(1)D BEDDING FLEXIBLE PIPE

Bedding for flexible pipe, when flexible pipe is permitted for use, shall be Class B with Mineral Aggregate Type 22 placed in lifts as shown on Standard Plan no. 350. Care shall be used in installing flexible pipe to prevent vertical pipe deflection.

The first bedding lift thickness shall be placed, spread and compacted across the width and length of the trench bottom at the required grade to support the pipe. Allowance shall be made for pipe bells and any other fitting. Pipe is then

installed and the next lift of bedding Material carefully placed and compacted evenly along both sides of the pipe up to the crown, being careful not to displace the pipe from its set line and grade. Once the bedding is completed to the crown of the pipe, and the pipe shows no visible misalignment, the final bedding lift over the pipe shall be placed.

7-11.3(2) HANDLING OF PIPE

7-11.3(2)A GENERAL

All types of pipe shall be handled in a manner that prevents damage to the pipe, and pipe lining or coating. Pipe and fittings shall be loaded and unloaded using hoists and slings in a manner to avoid shock or damage, and under no circumstances shall they be dropped, skidded, or rolled against other pipe. Damaged pipe will be rejected, and the Contractor shall immediately place all damaged pipe apart from the undamaged and shall remove the damaged pipe from the Project Site within 24 hours.

Threaded pipe ends shall be protected by couplings or other means until the pipe is installed.

The pipe and fittings shall be inspected for defects.

Ductile iron and cast iron pipe, while suspended above grade, shall be rung with a light hammer to detect cracks. Dirt or other foreign material shall be prevented from entering the pipe or pipe joint during handling or installing operations, and any pipe or fitting that has been installed with dirt or foreign material in it shall be removed, cleaned, and reinstalled. A clean whisk broom shall be used for this purpose and for brushing to remove foreign matter prior to joining of pipe ends. At times when pipe installation is not in progress, the open ends of the pipe shall be closed by a watertight plug or by other means approved by the Engineer to ensure cleanliness inside the pipe.

Pipe shall be stacked in such a manner as to prevent damage to the pipe, to prevent dirt and debris from entering the pipe, and to prevent any movement of the pipe. The bottom tiers of the stack shall be kept off the ground on timbers, rails or other similar supports. Pipe on succeeding tiers shall be alternated by bell and plain end. Timbers 4-inch X 4-inch in size shall be placed between tiers and chocks shall be placed at each end to prevent movement. Each size of pipe shall be stacked separately.

7-11.3(2)B HANDLING SPECIAL COATED PIPE

Handling and shipping of enameled or multilayered polyethylene tape coated or thermoplastic powder coated ductile iron pipe while being transported and in the field shall be in accordance with AWWA C214, and as specified herein.

Pipe, at all times, shall be handled with equipment such as stout wide canvas slings and wide padded skids designed to prevent damage to the coating. Bare cables, chains, hooks, metal bars or narrow skids shall not be permitted to come in contact with the lining or coating. When shipped by rail, all pipe shall be carefully loaded on properly padded saddles not less than 12 inches in width. Pipe sections shall be separated so that they do not bear against each other and the whole load shall be securely fastened together and to the cars to prevent movement in transit.

In truck shipments, the pipe shall be supported in wide cradles of suitable padded timbers hollowed out on the supporting surface to fit the curvature of pipe. All chains, cables or other equipment used for fastening the load shall be carefully padded.

The Engineer will inspect the pipe and coating after delivery to the Project Site prior to installation by the Contractor. The Contractor shall allow inspection of the coating on the underside of the pipe while suspended from the sling, before the pipe is lowered into the trench.

Pipe stored along the trench side shall be supported by padded wooden timbers placed under the pipe to hold the pipe off the ground, or by other acceptable means not damaging to the pipe and pipe coating.

Repair of multi-layered polyethylene tape coating shall be in accordance with AWWA C214 and Section 7-11.3(6)C. Repair of thermoplastic powder coated pipe shall be per manufacturer's written instructions. The Contractor shall submit at least 3 Working Days in advance the manufacturer's recommendations for thermoplastic coating repair.

7-11.3(3) CUTTING PIPE

Whenever it becomes necessary to cut a length of pipe, the cut shall be made by abrasive saw or by a special pipe cutter. All pipe ends shall be square with the longitudinal axis of the pipe. The outside of slip joint pipes shall be beveled and smoothed so that good connections can be made without damage to the gasket. Threads shall be cleanly cut. Torch cutting of ductile iron pipe will not be allowed.

Restrained joint pipe shall be cut in accordance with the pipe manufacturer's recommendations. The Contractor shall submit at least 3 Working Days in advance, the pipe manufacturer's recommendation for cutting restrained joint pipe including a Manufacturer's Certificate of Compliance stating the cutting process does not adversely impact the pipe material or integrity of the joint.

7-11.3(4) GRADE AND ALIGNMENT

7-11.3(4)A GENERAL

Trenches for pipe shall be opened in accordance with the lines and grades indicated on the Drawings, and to a depth that maintains the minimum required depth of cover unless indicated otherwise in the Contract.

The grade and alignment shall be taken from points established by the Engineer.

7-11.3(4)B VERIFICATION OF LOCATION

After marking underground facilities (see Sections 1-07.17(1) and 7-10.3(6)) and prior to any pavement cutting or removal or excavation for pipe installation, the Contractor shall verify, in the presence of the Engineer, the locations of existing Water Mains. The Contractor shall arrange to establish their depths at points where connections are to be made. After excavation, the Contractor shall verify the dimensions, type, condition, and roundness (16 inch diameter and larger) of the exposed Water Main. The excavation for pipes 16 inch and larger in diameter shall provide access all around the pipe for measurement of the outside diameter by the Engineer. Should a condition be discovered which materially differs from indicated in the Contract, the Contractor shall immediately notify the Engineer. When necessary, the profile shall be adjusted as directed by the Engineer to prevent abrupt changes in grade and alignment of Water Main and connection.

7-11.3(4)C MINIMUM DEPTH OF COVER

The depth of trenching for distribution Water Mains shall give a minimum depth of cover as indicated on Standard Plan no. 030. The depth of trenching for transmission Water Main shall give the minimum depth of cover as indicated in the Contract. Where profile of Water Main and ground surface is shown on the Drawings, the Water Main shall be installed to the elevation shown on the Drawings, regardless of depth of cover for distribution Water Main indicated on Standard Plan no. 030. Deeper excavation may be required due to localized breaks in grade or due to installing the new distribution Water Main under existing underground facilities. Excavation shall be to such depth that the cover over the valve operating nut shall be a minimum 1 foot.

7-11.3(4)D INSTALLING PIPE ON CURVES

On long radius curves, either horizontal or vertical, pipe may be installed with standard pipe by deflecting the joints. If the pipe is shown curved on the Drawings and no special fittings are shown, the Contractor can assume that the curves can be made by deflecting the joints with standard lengths of pipe. If shorter lengths are required, the Drawings will indicate maximum lengths that can be used. The amount of deflection at each pipe joint when pipe is installed on a horizontal or vertical curve shall not exceed 50 % of the manufacturer's printed recommended deflections. The Contractor shall submit to the Engineer the pipe manufacturer's joint deflection recommendations prior to pipe installation indicating deflections are within allowable AWWA specification tolerances.

Where field conditions require deflection or curves not anticipated on the Drawings, the Engineer will determine the methods to be used.

When rubber gasketed pipe is installed on a curve, the pipe shall be jointed in a straight alignment and then deflected to the curved alignment. Trenches shall be made wider on curves for this purpose.

Maximum deflections at pipe joints and installation radius for various pipe lengths shall conform to the manufacturer's and AWWA specifications for the given type of pipe.

Where pipe installation on curves requires the use of special fittings, concrete blocking shall be used per Section 7-11.3(13).

Where restrained joint pipe is installed on a curve, the Contractor shall submit the pipe manufacturer's recommendations to the Engineer for approval.

7-11.3(5) CLEANING AND ASSEMBLING JOINTS

All parts of the pipe ends, couplings, fittings, and appurtenances shall be cleaned to remove oil, grit, or other foreign matter from the joint. Care shall be taken to keep the joint from contacting the ground.

Pipe not furnished with a depth mark shall be marked before assembly to ensure visual observation of the Work.

7-11.3(6) INSTALLING AND JOINTING PIPE

7-11.3(6)A INSTALLING AND JOINTING - DUCTILE IRON PIPE AND APPURTENANCES

The installation of ductile iron pipe and appurtenances shall be in accordance with AWWA C600.

Except where restrained joint systems are required, mechanical or slip joints may be used.

7-11.3(6)B INSTALLING AND JOINTING POLYETHYLENE ENCASED (FILM WRAPPED) PIPE

Pipe with polyethylene (film wrap) encasement shall be installed in accordance with AWWA C105. The method used for encasing the pipe shall be approved by the Engineer. All damage to the polyethylene encasement shall be repaired at the Contractor's sole expense. Bedding, backfill and compaction shall be in accordance with Sections 7-10.3(9), and Sections 2-10 and 2-11.

7-11.3(6)C INSTALLING AND JOINTING MULTI-LAYERED POLYETHYLENE TAPE COATED PIPE

Pipe shall be hoisted from the trench side into the trench by means of a wide canvas or leather sling. Use of chains, cables, tongs or other equipment likely to cause damage to the lining or to the coating of the pipe will not be permitted. Dragging or skidding the pipe will not be permitted. The Contractor shall allow inspection of the coating on the underside of the pipe while suspended from the sling. Any damage to the coating shall be repaired to a condition meeting the specified requirements before the pipe is lowered into the trench. Bedding, backfill and compaction shall be in accordance with Sections 7-10.3(9), and Sections 2-10 and 2-11.

At all times during construction of the Water Main, the Contractor shall use every precaution to prevent damage to the protective coating on the pipe. No metal tools or heavy objects shall be unnecessarily permitted to come in contact with the finished coating. Workers will be permitted to walk on the coating only when necessary, in which case they shall wear shoes

with rubber or composition soles and heels. This shall apply to all surfaces whether bare, primed or coated. Any damage to the protective coating from any cause, prior to final acceptance of the Water Main, shall be repaired as directed by the Engineer and at the Contractor's expense.

Cutbacks on the spigot end shall be 6 inches or less and shall be made with a cutting device that is guided from the end of the pipe to ensure a straight, uniform cutback. No cutback shall be made on the bell end of the pipe.

Following the application of the outerwrap, the coating shall be electrically tested for holidays with a pulse tape holiday detector. The detector voltage range for this coating is 7000 to 9800 volts. The testing shall conform to NACE RP-02-74.

All holidays detected in the field shall be repaired by removing the outerwrap and primary coating from the damaged area, cleaning the exposed surfaces thoroughly and applying a suitable primer and tape to the exposed area as specified by the manufacturer. If required by the Engineer, the repaired area shall be outerwrapped after patching.

If the outerwrap is damaged and a holiday is not found in this area, the damaged outerwrap area shall be repaired by applying a patch as recommended by the manufacturer and approved by the Engineer.

If the outerwrap is damaged and a holiday is found, the damaged outerwrap shall be removed, taking care not to damage the inner coating. Before new outerwrap is placed, a holiday detector shall be applied to the exposed innerwrap to determine if it has been damaged during removal of the outerwrap. The outerwrap shall be installed as recommended by the manufacturer and approved by the Engineer.

After electrical bonds are installed and tested, the entire pipe joint and electrical bond strap shall be protected with a heat shrink joint sleeve. See Section 9-30.1(6)E Heat Shrink Joint Sleeve.

7-11.3(6)D INSTALLING RESTRAINED JOINT PIPE

Restrained joint Water Main shall be installed as shown on the Drawings and the lay plan. The Contractor shall submit a Water Main lay plan and the manufacturer's recommendations to the engineer at least 20 Working Days prior to pipe installation. This work shall include all equipment necessary to complete the work.

The restrained joint Water Main shall be fully extended by pulling on the joint after the installation of the pipe segments as recommended by the manufacturer of the restrained joint pipe, unless stated otherwise in the Drawings or Specifications. When newly installed Water Main is pressurized, bending or buckling will not be allowed.

Where adjustment of the Water Main line and grade is required to avoid existing or planned facilities, the use of mechanically jointed fittings may be used with Wedge Restraint Glands to make the needed changes. All Wedge Restraint Glands shall be wax tape encased per Section 7-11.3(7)D2. Submit change requests to the Engineer for approval prior to installation.

7-11.3(7) INSTALLING STEEL PIPE

7-11.3(7)A THREADED STEEL PIPE LESS THAN 4 INCHES IN DIAMETER

Steel pipe in sizes up to and including 3-1/2 inches shall be connected with malleable iron screwed couplings. Couplings shall be galvanized. Unions or flanges shall be used at all equipment and valves. Cut ends shall be reamed and threads cleanly cut. Exposed threads, after jointing, shall be brush-coated with an asphalt varnish, Royston Roskote Mastic R28 or approved equal. In wet conditions, use three component wax tape wrap consisting of: primer, wax tape and fiberglass overwrap per Section 7-11.3(8)A.

7-11.3(7)B COUPLED PIPE 4 INCHES IN DIAMETER AND LARGER

Steel pipe 4-inch and larger, for use in underground services, shall be coupled as specified in the Contract.

Any welding of steel pipe shall be in accordance with AWWA C206.

Bell and spigot joints shall be thoroughly cleaned before assembly, and a lubricant suitable for potable water meeting the approval of NSF shall be brushed on the inside of the bell just prior to assembly.

7-11.3(7)C STEEL CASING PIPE

7-11.3(7)C1 GENERAL

Where shown on the Drawings, the Contractor shall install steel casing pipe for the Water Main. Where trenchless construction is shown on the Drawings installation shall be per Section 7-17.3(2)J, and if by directional drilling then in accordance with Section 2-16.

All joints shall be welded by operators who have been qualified by testing as prescribed by the AWS in "Standard Qualifications Procedure" and are certified to perform the type of work required. The quality of welding shall conform to the current edition AWS D1.1 Structural Welding Code, Section 3, Workmanship.

7-11.3(7)C2 SEALS AND SPACERS BETWEEN CASING AND WATER MAIN

Casing end seals shall meet the requirements of Section 9-30.2(15)A, shall completely seal the annular space at each end of the casing pipe, and shall be installed in accordance with the manufacturer's instruction.

Casing spacers shall electrically isolate the outer casing pipe from the inserted Water Main. The spacers (also known as "casing insulators", "crossing insulators", and "casing isolators") shall meet the requirements of Section 9-30.2(15)B. There shall be a minimum of two spacers per length of pipe, and the spacing between any two (2) spacers shall not exceed 10 feet. For 4 inch through 12 inch diameter pipe, each spacer shall have at least four (4) runners. For 14 inch through 36 inch diameter pipe, each spacer shall have at least six (6) runners. At least 2 runners shall be located on the upper half of the

spacer for all diameter Water Main. At least 2 runners shall be located on the lower half of the spacer for 4 inch through 12 inch diameter Water Main, and at least 4 runners shall be located on the lower half of the spacer for 14 inch through 36 inch diameter Water Main. Actual locations of runners on the spacer shall be as recommended by the manufacturer. Casing spacers shall first be installed on the Water Main and then the Water Main inserted in the casing pipe in accordance with the manufacturer's instructions.

The Contractor shall submit the spacer and end seal manufacturer's catalog cuts and installation instruction to the Engineer at least 5 Working Days in advance of this work.

7-11.3(8) FIELD APPLIED COATINGS

7-11.3(8)A WAX TAPE COATING

Wax tape coating (see Section 9-30.1(6)F) shall be field applied to Water Main including pipe, fittings, valves, couplings, bolts, flanges, shackle rods, other appurtenance, and as indicated in the Contract.

Preparation for wax tape coating shall be one of the following, as applicable:

1) On Water Main without a coating, the surfaces shall be cleaned with wire brush, cleaning products, duct tape "dust and particle pickers", and similar means and Supplies to remove all rust, dirt, oil, and other deleterious material. The Contractor shall be prepared to employ sandblasting methods for stubborn rust and other deleterious coating removal. The surface shall be dry, have no loose particles of any kind, and shall be in a prepared condition as recommended by the wax tape Supplier.

2) On Water Main with a coating, the surfaces shall be cleaned with Supplies and means that do not injure or harm the existing coating; however, produce a prepared surface as recommended by the wax tape Supplier. Water Main with existing coating and type of coating will be identified in the Contract.

Coverage by wax tape coating shall be "complete" meaning full contact with all Water Main Material and no voids. Where voids, or gaps, or irregular surfaces and transitions in the Water Main exist, joint filler, compatible with the wax tape coating product as recommended by the wax tape Supplier, shall be applied "complete". Outerwrapping without being complete is unacceptable.

Coverage shall extend to a minimum 1 pipe diameter length beyond the wax tape limits indicated in the Contract up to 18 inches.

Coverage thickness shall be a minimum 70 mil. Spiral wraps shall overlap by 1 inch and the ends of the wax tape circumferential segments shall overlap 6 inches.

Wax tape application on prepared surfaces shall include:

1. Initial coating with a petrolatum primer,
2. Wrapping with wax tape, and
3. Outer wrapping with fiberglass mesh.

All products in the wax tape application shall be compatible with each other and with the Water Main prepared surfaces. The Supplier may recommend an alternate component(s) to provide an acceptable protective coating.

Submittal: The Contractor shall submit to the Engineer for approval at least 10 Working Days in advance, the Supplies and method proposed for preparing the Water Main, the wax tape coating system and how applied, any alternate component(s) and the reason(s) for, Supplier recommendations with sufficient detail indicating an acceptable finished product, and Supplier contact information.

7-11.3(9) CONNECTIONS

7-11.3(9)A CONNECTIONS TO EXISTING WATER MAINS

The Contractor shall not operate any valve on an existing Water Main.

SPU Water Operations will make all connections to charged Water Mains and will operate all valves to accomplish shutdowns and subsequent reactivation. Draining of existing Water Mains will be done by Water Operations staff. The Contractor shall match the grade and alignment of the new Water Main to the existing Water Main. The excavation shall be sufficiently large to accommodate connection work as approved by the Engineer.

Connection points shall be verified in accordance with Section 7-11.3(4)B.

The Contractor shall provide the Engineer two (2) Working Days advance notice for scheduling inspections for approval of Water Main installations for connection. Within two (2) Working Days after the inspection, the Contractor will be provided with written approval or with a list of items to be corrected. Items to be corrected will be reinspected. The notification requirement and reinspection response times are the same as the initial inspection.

Approval is contingent on the Water Main and appurtenances being completely installed and tested per Contract but does not require completion of street, sidewalk and planting strip restorations. Water Main and appurtenances include all pipe, fittings, all blocking except temporary blocking, all hydrants, hydrant pads, blowoff assemblies, valves, flowmeters, chambers, corrosion protection, and coating systems.

Newly installed Water Main shall be pressure tested and be acceptable in accordance with Section 7-11.3(11) and Section 7-11.3(12). Flushing and Disinfection of Water Mains before making any connection; and when required shall be acceptable for Taste and Odor Rating Testing before and/or after making any connection as specified in Section 7-11.2(3).

After all tests, flushing, and disinfection have been successfully completed and the installed Water Main and appurtenances, including hydrants and valves, have been approved by the Engineer, it shall be the Contractor's responsibility

to request the Engineer to schedule the shutdown(s) and connection(s). In general, the Contractor's request for shutdown(s) and connection(s) shall be submitted to the Engineer at least five (5) Working Days in advance of the desired date of the connection, per Section 1-07.28. However, the Contractor is encouraged to communicate and coordinate with the Engineer as early in the project as possible regarding the scheduling of these connections as SPU Water Operations' shutting down and starting up portions of the water system will take into consideration:

1. Size of Water Main and total system impacts,
2. Coordination with Fire Department
3. End user needs and coordination, and
4. SPU Water Operation's workforce availability.
5. Notifications of the scheduled shutdown will be made by SPU Customer Service / Inspection Services personnel to the affected consumers a minimum of 2 Working Days in advance of the shutdown.
6. Connections must be made within 2 weeks (14 days)after Flushing and Disinfection of the pipes..

The Contractor's scheduling of connections requires the Engineer's approval on the following items:

a. Verification of existing Water Main grade and alignment per Section 7-11.3(4)B;

b. Contractor's written list of materials being supplied;

c. Verification and inspection of Contractor's supplied materials.

After approval by the Engineer, the Contractor may submit a request for a shutdown to the Engineer. This notice must allow for at least five (5) Working Days for SPU staff to prepare for the shutdown date and notify customers.

The excavation for the connection shall be completed, shored and dewatered, and all required materials and equipment supplied by the Contractor shall be available on the Project Site at the time of shutdown. SPU will furnish connection fittings to Existing Water Mains, unless otherwise specified. The Contractor shall furnish and install the connection fitting on new Water Mains (see Standard Plan nos. 300a, 300b, and 300c). In addition, prior to and after connection of the new Water Main, SPU Water Operations will:

a. Deactivate and dewater the Water Main;
b. Cut, remove, and dispose of pipe sections as necessary to install the new Materials, with Contractor assistance;
c. Dewater existing pipe, as required, to perform connections;
d. Swab all connecting pipe and fittings with chlorine solution (5-6% Cl_2); and
e. Perform the connection work; and
f. Reactivate and flush the Water Main.

All fittings and other Materials and equipment not specifically called out in the Contract as being furnished by SPU Water Operations, required to complete the connection shall be furnished by the Contractor.

The Contractor shall coat, wrap and joint bond the connection to conform with the requirements of the new Water Main.

The Contractor shall make all necessary excavation, protective measures, and backfill, and provide any equipment and operators required to move and lower the component parts of the connection into position. All temporary and permanent blocking shall be done by the Contractor.

In addition to those connections shown on the Drawings, segments of a new Water Main may be placed in service prior to completion of the entire Water Main. All connections between the charged and uncharged segments of the new Water Main will be done by SPU Water Operations.

Locations of connections between segments of new Water Main are dependent on Contractor's operations and therefore are not shown. All Materials for such connections shall be furnished by the Contractor.

7-11.3(9)B MAINTAINING SERVICE

Where existing services are to be transferred from old to new Water Mains, the Contractor shall plan and coordinate the Work with that of SPU Water Operations so that service is resumed with the least possible inconvenience to customers.

To supply customers with water during the construction of a project, where any section of pipe has passed the required hydrostatic and bacteriological tests, SPU Water Operations reserves the right to tap corporation stops into a section of a new Water Main and install corporation stops and service connections at such locations as SPU Water Operations deems necessary, at no expense to the Contractor. The attaching of any such service connections by the SPU Water Operation's shall not be construed by the Contractor as any acceptance by the Owner of any part of the Work required under the Contract.

7-11.3(9)C WATER SERVICE CONNECTIONS

See Section 7-15.

7-11.3(9)C1 INSULATED COUPLINGS AND FLANGE KITS

Insulated couplings and flange kits shall be installed to electrically isolate the Water Main from other Structures. Insulated joints shall be located at the locations indicated on the Drawings.

The Contractor shall carefully align and install insulating couplings and flange kits according to the manufacturers recommendations to avoid damaging insulating Materials. Coat all exposed surfaces of insulating flange, including fasteners, with petroleum-impregnated wax tape as specified in AWWA C217. The Contractor shall submit to the Engineer for review, the manufacturer's installation recommendations at least three (3) Working Days prior to use.

7-11.3(9)D TEMPORARY WATER MAINS AND SERVICES

When called for in the Contract, SPU Water Operation's will install and maintain temporary Water Mains and services in such a manner as to provide constant adequate water supply to consumers and to avoid impeding traffic and access to abutting properties.

The Contractor's critical path schedule shall allow adequate time for SPU Water Operations to install these facilities. A minimum of 2 weeks advance written notice shall be provided to the Engineer for scheduling of the temporary Water Main and service work.

Contractor shall support SPU Water Operations by performing all required excavation, backfill, and compaction. SPU Water Operations will furnish the necessary equipment and pipe for temporary Water Mains, unless otherwise noted on the Drawings and Project Manual.

All temporary Water Mains will be disinfected, flushed, and sampled for bacteriological testing by the SPU Customer Service / Inspection Services. When found acceptable, the temporary Water Mains will be placed in service.

7-11.3(9)E TEMPORARY PRIVATE WATER SERVICE LATERALS

The Contractor shall maintain private water service laterals in service at the Contractor's expense. When it is necessary to provide temporary water supply, it shall be the responsibility of the Contractor to provide temporary services on the private side of the water service. Should the Contractor damage or disrupt private water service laterals or appurtenances, the Contractor shall immediately notify the Engineer of any such damage or disruption, shall begin repairs immediately as directed by the Engineer, and shall work continuously until the condition the water service lateral is restored.

7-11.3(10) LOCATING WIRE

Locating wire shall be installed 6 inches directly above the centerline of all non-metallic pipe, except that the locating wire shall be bonded by exothermic welds to all metallic fittings, valves and valve boxes to form an electrically continuous system.

7-11.3(11) HYDROSTATIC PRESSURE TEST

7-11.3(11)A GENERAL

All Water Mains and appurtenances shall be hydrostatically pressure tested. Once the new Water Main has passed the hydrostatic pressure test, the Water Main shall be flushed, disinfected, and bacteriologically sampled in accordance with Section 7-11.3(12), and may be required to pass additional post-installation Taste and Odor Rating Test in accordance with Section 7-11.2(3).

All labor, equipment, pumps, gauges, plugs, saddles, corporation stops, miscellaneous hose and piping, a 1/4 inch F.I.P.T. connection for pressure recorder, and as necessary for performing the test, shall be furnished and operated by the Contractor.

Pressure recorders and charts used to record the tests will be furnished and operated only by the Engineer.

The Contractor, prior to notifying the Engineer to witness and record the pressure test, shall have set up beforehand and successfully performed the pressure test to make certain that the pipe is in acceptable condition. The Contractor shall then notify the Engineer at least 2 Working Days before recording and conducting the test.

The Contractor shall furnish and install temporary blocking as required for pressure testing. Upon successful testing, temporary blocking shall be removed.

To protect existing Water Mains from contamination by backflow of test water during filling operations, a WSDOH approved reduced pressure principle backflow prevention assembly shall be temporarily installed between the test and supply Water Main. See Section 1-07.28 item 7D for notification requirements regarding BPA inspection. A current BPA performance test report shall be provided by the Contractor and shall be on the Project Site for the assembly being used. Prior to hydrostatic testing, the temporary backflow protection shall be installed and the Water Main under test isolated from the supply Water Main.

7-11.3(11)A1 TEST PRESSURE FOR FIELD TESTING WATER MAIN PIPE

Field hydrostatic testing of various diameter ductile iron Water Main pipes and appurtenances shall be as indicated in the following table:

Diameter Pipe (inches)	4	6	8	10	12	16 and larger
Test Pressure (psi)	300	300	300	300	300	250

Test pressure for pipe other than ductile iron will be indicated in the Contract.

The indicated test pressure shall be at the lowest elevation of the section of Water Main being tested. All air in the pipe shall be vented prior to test.

The hydrostatic test pressure shall be maintained until the Engineer has determined that the section of pipe, valves, and fittings are watertight. If there are no visible leaks and the test pressure is maintained without pumping for 15 minutes with a pressure drop of less than 15 psi, the Water Main will be accepted as a water tight installation. When testing short (less that 18 feet) lengths of Water Main pipe or when testing hydrant pipe, maintaining the test pressure without pumping for 5 minutes with less than 5 psi drop in pressure will be considered evidence of an acceptable test.

Sections to be tested shall be limited to 1,500 feet or less. The Engineer may require that the first section of pipe, not less than 1,000 feet in length, installed by each of the Contractor's crews, be tested in order to qualify the crew and the

Material. Pipe installation shall not be continued more than an additional 1,000 feet until the first section has been tested successfully.

Hydrostatic tests shall be performed on every completed section of Water Main between valves. The pressure differential across closed valves shall not exceed the rated operating pressure of the valve.

All tests shall be made with the hydrant auxiliary gate valves open and with pressure exerted against the closed hydrant inlet valve. After the test has been completed, gate valves shall be tested by closing each one in turn and relieving the pressure beyond. This test of the gate valve will be acceptable if no immediate loss of pressure is registered on the gauge when the valve is being checked. The Contractor shall verify that the pressure differential across the valve does not exceed the rated test pressure of the valve.

Any visible leakage detected shall be corrected by the Contractor regardless of the allowable leakage specified above. Should the tested section fail to meet the pressure test as specified, the defects shall be located and repaired and the Water Main retested at the Contractor's sole expense.

Defective materials or workmanship discovered as a result of a hydrostatic field test shall be replaced and remedied by the Contractor in accordance with Section 1-05.7. Whenever it is necessary to replace defective Material or correct the workmanship, the hydrostatic test shall be rerun until an acceptable test is obtained.

7-11.3(11)B TESTING EXTENSIONS FROM EXISTING WATER MAINS

When an existing Water Main is extended over 18 feet, the section of new pipe installed to the existing Water Main will be made by SPU Water Operations with pretested, pre-disinfected pipe, and no hydrostatic test will be required. SPU Customer Service / Inspection Service shall be notified for approval at least 3 Working Days in advance if predisinfected pipe is proposed for installation. When the required hydrostatic tests are conducted in the new Water Main section beyond the installed new valve in the closed position, the normal pressure of the existing Water Main may be present against the other side of the new valve.

Where the distance between the end of an existing Water Main pipe extension to the new valve is more than 18 feet, the connection of the new pipe to existing pipe shall not be made until after hydrostatic tests have been made to the required pressure in both directions against the new valve. This shall be accomplished by a temporary cap or plug installed on the end of the new pipe, beyond the new valve, as close as possible to the existing pipe for testing purposes. Where a new valve is not part of the Work, the Contractor shall notify the Engineer at least 10 Working Days in advance to coordinate other arrangements for hydrostatic testing.

The short length of pipe between the temporary cap or plug end with the new valve in the closed position, with no hydrostatic pressure active on the opposite side of the valve, shall be subjected to the required test pressure. The same test shall be made against the other side of the new valve when that section of pipe is tested with no hydrostatic pressure active in the short section of pipe toward the existing Water Main pipe. The final connection to the existing Water Main shall be made by the SPU Water Operations with pretested, pre-chlorinated pipe, and no hydrostatic test will be required.

7-11.3(11)C TESTING SECTION WITH HYDRANTS INSTALLED

When hydrants are included with the section of Water Main pipe to be tested, the testing shall be conducted in three separate tests as follows:

Test No. 1	Water Main gate valves and hydrant auxiliary gate valves closed, with the hydrant operating stem valves and hose ports wide open.
Test No. 2	Water Main gate valves and the hydrant operating the stem valves tightly closed but the hydrant auxiliary gate valves and hose ports wide open.
Test No. 3	Each hydrant shall be tested to 200 psi with the hydrant auxiliary gate valve and hose ports closed and the hydrant operating stem valve wide open. Twenty-five pounds per square inch shall be in the supply Water Main beyond the hydrant auxiliary gate valve when testing a hydrant singly.

7-11.3(11)D TESTING HYDRANTS INSTALLED ON EXISTING WATER MAINS

For hydrants installed and connected to an existing Water Main, the hydrant connection including hydrant tee, connection pipe, and auxiliary gate valves, shall be installed with pretested Materials.

Before the hydrant connection is made to the existing Water Main, the hydrant installation shall be subjected to the hydrostatic Test No. 3 as specified in Section 7-11.3(11)C. Following an acceptable hydrostatic test, hydrants installed and connected to an existing Water Main shall have a bacteriological sample obtained and tested for acceptable results before connection the Water Main.

7-11.3(12) FLUSHING AND DISINFECTION OF WATER MAINS

7-11.3(12)A GENERAL

Before being placed in service, all newly installed pipe, valves, hydrants, and appurtenances shall be flushed, disinfected, kept clean, and will be sampled for acceptable bacteriological analysis. Additional Taste and Odor Rating Testing may be required (see Section 7-11.2(3)).

Newly installed Water Main will have a sample taken from each and every 500 foot interval, and at each end. For each hydrant lateral over 18 feet in length, a sample will be taken at the hydrant end. Hoses for sampling will not be allowed. On new Water Main without hydrant, temporary sampling taps shall be provided, and then removed and plugged after the

Engineer notifies the Contractor of acceptable bacteriological results. Hydrant used for sampling shall be fitted with a sampling tap acceptable to the Engineer.

The Contractor shall coordinate with the Engineer for the location of sampling taps. All bacteriological analysis will be performed by the SPU Water Quality Laboratory. Written notice of the results of sample analysis will be returned to the Contractor 2 Working Days after the sampling. Analysis of any sample indicating unacceptable results shall require the remedy specified in Section 7-11.3(12)M. Analysis of any sample indicating acceptable results shall require the new Water Main be connected to existing Water Main within 14 calendar Days of the Date of written notice. Failure to make the connection within this time frame shall require additional disinfection, flushing, and additional sampling and testing for acceptable results. The Engineer reserves the right to perform additional bacteriological sampling and testing at any time.

7-11.3(12)B PRE-DISINFECTION FLUSHING

Sections of pipe smaller than 24-inch diameter to be disinfected by methods other than that found in Section 7-11.3(12)D, METHOD 1, shall first be flushed to remove any solid or contaminated material. If METHOD 1 is used, the 2-1/2 fps flushing shall be done after disinfection is complete (see Section 7-11.3(12)L, Final Flushing and Testing). If no hydrant is installed at the end of the new pipe, the Contractor shall provide a tap large enough to develop a velocity of at least 2.5 feet per second in the pipe. Flushing period shall be at least 5 minutes for every 150 feet of new pipe but in no case less than 30 minutes. One 2-1/2 inch hydrant opening will, under normal pressure of 40 psi, provide this velocity in pipe sizes up to and including 12 inches. For pipe sizes exceeding 12-inch diameter, flushing taps size requirements are:

REQUIRED FLOW AND OPENING TO FLUSH WATER MAINS		
Pipe Diameter (inches)	**Flow Required to Produce 2-1/2 feet per second (fps) Velocity in Water Main (gpm)**	**Number - Size (inch) of Taps Required for a 2-1/2 fps Flush**
14	1200	3 - 2", or 1 - 3"
16	1600	4 - 2", or 1 - 4"
20	2500	6 - 2", or 3 - 3", or 2 - 4"
24	3600	4 - 3", or 2 - 4", or 1 - 6"
30	5625	4 - 4", or 2 - 6", or 1 - 8"
36	8100	2 - 6", or 1 - 8"
42	11025	3 - 6", or 1 - 10"
48	14400	4 - 6", or 1 - 12"

Taps required for chlorination, flushing or temporary or permanent release of air shall be furnished and installed by the Contractor and are incidental to the construction of Water Mains. When a hose bib faucet is installed for bacteriological sampling, it shall be located upstream from the flushing point. Taps on existing Water Mains required for chlorination or flushing will be furnished and installed by SPU's Water Operations Division.

As an alternative to 2-1/2 fps flushing, sections of pipe 24 inches or larger diameter may be prepared for disinfection by mechanical cleaning methods approved by the Engineer.

The Contractor shall be responsible for disposing of treated water flushed from the Water Mains in a manner acceptable to state and local authorities. The water shall be neutralized to 0.1 parts per million chlorine, or less, before disposal into any natural drainage channel. The Contractor shall maintain an air gap equal to twice the discharge pipe/hose diameter (but not less than 12 inches) between the discharge outlet and the overflow rim of the receiving waters.

7-11.3(12)C REQUIRED CONTACT TIME

Before being placed into service, all newly installed pipe shall be disinfected so that a chlorine residual of not less than 10 mg/L remains in the water after the retention period. Treated water shall be retained in the pipe at least 24 hours. If the water temperature is less than 41°F (5°C), the water shall remain in the pipe for at least 48 hours. After the retention period, chlorine residual shall be tested at all extremities of the pipe and shall measure at least 10 mg/L. If a measurement of less than 10 mg/L is obtained repeat disinfection is required.

7-11.3(12)D FORM OF APPLIED CHLORINE

Chlorine shall be applied by one of three methods to give a dosage of not less than 25 mg/l of available chlorine:

METHOD - 1 Dry Calcium Hypochlorite

As each length of pipe is installed, sufficient high test calcium hypochlorite (65 -70% chlorine) shall be placed in the pipe to yield a dosage of not less than 25 mg/l available chlorine, calculated on the volume of the water to be contained in the pipe and appurtenances. This method may only be used if the pipes and appurtenances are kept clean and dry during construction.

The number of ounces of 65% test calcium hypochlorite required for a 20 foot length of pipe equals $0.004216d^2$ in which "d" is the pipe diameter in inches.

METHOD - 2 100% Gas Chlorine

A chlorine gas-water mixture shall be applied by means of a solution-feed chlorinating device. Chlorinating devices for feeding solutions of the chlorine gas shall provide means for preventing the backflow of water into the chlorine supply. See Section 1-07.28 item 7D regarding BPA notification and testing requirements.

METHOD - 3 Sodium Hypochlorite

Sodium Hypochlorite, commercial grade (12.5% Cl_2) or in the form of liquid household bleach (5 - 6% Cl_2), may be substituted for the chlorine gas-water mixture. This liquid chlorine compound may be used full strength or diluted with water and injected into the Water Main with fill water in correct proportion to produce a mixture of at least 25 mg/l Cl_2.

7-11.3(12)E CHLORINE DOSAGE

The amounts of chlorine (Cl_2) required to give 25 mg/l for 100-foot lengths of various diameters of pipe are:

AMOUNTS OF CHLORINE REQUIRED FOR 25 MG/L DOSAGE				
Pipe Size (inch)	**Volume of Water per 100 ft Length** (gallons)	**Cl_2 100%** (lbs)	**Household Bleach 5-1/4% Cl_2** (gallons)	**Commercial Bleach 12-1/2% Cl_2** (gallons)
4	65.3	.014	.03	.013
6	146.5	.031	.07	.03
8	261.0	.054	.13	.053
10	408.0	.085	.2	.08
12	588.7	.121	.3	.12
14	799.6	.167	.4	.16
16	1044.4	.22	.5	.21
20	1631.9	.34	.8	.33
24	2349.9	.49	1.1	.47
30	3671.7	.77	1.8	.75
36	5287.3	1.1	2.5	1.1
42	7196.6	1.5	3.5	1.44
48	9399.0	2.0	4.6	1.6

7-11.3(12)F POINT OF APPLICATION FOR LIQUID/GAS DISINFECTION

The preferred point of application of the chlorinating agent is at the beginning of the Water Main extension or any valved section of it and through a corporation stop inserted in the horizontal axis of the pipe. The water injector for delivering the chlorine-bearing water into the pipe shall be supplied from a tap on the pressure side of the gate valve controlling the flow into the Water Main extension. Alternate points of application may be used when approved by the Engineer.

7-11.3(12)G BACKFLOW PREVENTION REQUIREMENT

To prevent contaminated water from the new Water Main from entering the existing distribution system, a disinfected WSDOH approved reduced pressure backflow assembly shall be used on the line supplying the water. An approved reduced pressure backflow assembly is sufficient backflow protection only for filling and flushing of the new Water Main. During the hydrostatic pressure test, the temporary connection between the new Water Main and the existing distribution system shall be removed. See Section 1-07.28 item 7D for backflow prevention assembly notification and testing requirements.

7-11.3(12)H RATE OF APPLICATION

Water from the existing distribution system, or other approved supply source, shall be controlled for very slow flow into the newly installed Water Main during chlorine application. The rate of chlorine gas-water mixture or dry gas feed shall be in such proportion to the rate of water entering the newly installed pipe that the dosage applied to the water is at least 25 mg/l.

Sodium hypochlorite, commercial grade (12.5% Cl_2) or in the form of liquid household bleach (5-6% Cl_2), may be substituted for the chlorine gas-water mixture. This liquid chlorine compound may be used full strength or diluted with water and injected into the Water Main in correct proportion to the fill water so that dosage applied to the water is at least 25 mg/l.

7-11.3(12)I RESERVED

7-11.3(12)J RESERVED

7-11.3(12)K DISINFECTION OF CONNECTIONS TO EXISTING WATER SYSTEMS

All connections shall be disinfected per the requirements of AWWA C651 section titled “Disinfection Procedures When Cutting into or Repairing Existing Main”. All pipe and fittings shall be swabbed or sprayed with a chlorine solution at least as strong as liquid household bleach (5-6% Cl_2).

7-11.3(12)L FINAL FLUSHING AND TESTING

Following chlorination, all treated water shall be flushed from the pipe until the replacement water treated throughout its lengths shows an absence of chlorine. If chlorine is normally used in the source of supply, tests shall show a residual not in excess of that carried in the system.

Where dry calcium hypochlorite has been used for disinfection, flushing velocity shall be at least 2.5 feet per second in the Water Main. Flushing period shall be at least 5 minutes for every 150 feet of new Water Main but in no case less than 30 minutes.

See Section 7-11.3(12)A for bacteriological sampling and testing, and see Section 7-11.2(3) for post installation Taste and Odor Rating Testing when required by the Engineer.

All hydrants on the new Water Main shall be flushed to remove excess chlorine from the hydrant and hydrant branch.

7-11.3(12)M REPETITION OF FLUSHING AND TESTING

Based on any unacceptable bacteriological sample results (see Section 7-11.3(12)A), the new Water Main or hydrant connection over 18 feet shall be either flushed and re-sampled, or re-disinfected, flushed and re-sampled. These procedures shall be repeated by the Contractor until acceptable bacteriological sample results are obtained.

7-11.3(12)N PRE- FLUSHING AND DISINFECTION OF WATER MAINS BY SPU (SPECIAL CASE)

SPU may determine that installation of Pre-Flushed pipe is in the best interest of the City and its customers. This will be a case-by-case determination by the Engineer. When Pre-Flushing, the following "Flushing and disinfection of pipe for water main connection" procedure shall be followed:

1. Contractor shall deliver to SPU the required pipe, of proper diameter and material for connection, at least five (5) Working Days before the installation date.
2. SPU shall flush, disinfect, flush and obtain bacteriological sampling and testing of pipe;
3. SPU shall bag the ends of the pipe as it is removed from the cleaning and testing rack and will deliver it to site.
4. SPU shall install pipe connection.

7-11.3(13) CONCRETE THRUST BLOCKING

Concrete thrust blocking, as indicated on Standard Plan nos. 330a through 331b, shall be placed at bends, tees, deadends, and crosses as located on the Drawings. Blocking shall be Class 3000 (see Section 6-02) concrete mix poured in place or the Engineer may approve the use of ecology blocks as a substitute.

Concrete blocking shall bear against solid undisturbed earth at the sides and bottom of the trench excavation and shall be shaped so as not to obstruct access to the joints of the pipe or fittings.

The Contractor shall provide the Engineer at least 1 Working Day advance notice before pouring concrete thrust blocking or placing ecology blocks and 1 Working Day advance notice for inspection and approval of all concrete blocking or placement of ecology blocks prior to backfilling. All metallic components of thrust blocks shall be protected from corrosion by a wax tape system or another method approved by the Engineer.

Unacceptable concrete blocking and corrosion protection shall be replaced at the Contractor's expense.

7-11.3(14) BLOWOFF ASSEMBLIES

Water Main blowoff assemblies shall be constructed as shown on the Drawings or Standard Plan nos. 340a and 340b. A standard meter box shall be installed in non-traffic bearing areas; a Type 361 Frame and Cover shall be used for all other installations subject to vehicular traffic. Care shall be taken in locating the meter box or frame and cover such that it is not in any water course or in any other location subject to drainage or sewerage contamination. Tops shall be set to conform to finished grade. Backfilling and compaction shall conform with Sections 2-10 and 2-11.

Drilling and tapping into the Water Main shall be performed by the Contractor except in the event of installation on a charged (in-use) Water Main, in which case SPU Water Operations will make the connection.

7-11.3(15) ELECTROLYSIS MONITORING SYSTEM FOR DUCTILE IRON PIPE

7-11.3(15)A GENERAL

Where called out on the Drawings, the Water Main Contractor furnishing the pipe shall comply with the following:

1. **Install Electrical Continuity Bonds:** The Contractor shall furnish and install electrical joint bonds, as specified herein, at all mechanical coupling non-insulated flange joints and all rubber gasket joints. The Contractor shall take special precautions to avoid disturbing existing bonds, electrical cables, and wires for test stations and other cathodic protection equipment connected to, or installed near the Water Main.
2. **Install Electrolysis Test Stations:** The Contractor shall furnish and install the Electrolysis Test Stations where shown, and as detailed on the Drawings.

7-11.3(15)B ELECTRICAL JOINT BONDS FOR DUCTILE IRON PIPES AND FITTINGS

7-11.3(15)B1 GENERAL

Where shown on the Drawings, each length of ductile iron pipe in the Water Main, and each hydrant run, shall be electrically bonded together, and each mechanical joint shall be bonded to the pipe as shown on on Standard Plan no. 362. The Contractor shall make adhesion tests of all bonds and bonded joints in the presence of the Engineer. Any bonded joint which fails to meet the adhesion test shall be rebonded until an acceptable test is obtained. Bonding cable shall be as specified in Section 9-30.10.

7-11.3(15)B2 JOINT BOND CABLE CONNECTIONS FOR DUCTILE IRON PIPE

Prior to making any bond connection to metal, a 2 inch x 2 inch section of coating materials shall be removed from the pipe surface to make the connection. Paint, primer, and coating material shall be removed from the pipe surface with clean rags and solvent prior to preparing the metal surface. The metal surface shall be cleaned to white metal by sandblasting, grinding, or filing prior to welding the conductor. Resin-base grinding disks shall not be used. Ceramic base disks are acceptable. Joint bonding cable shall be welded to the pipe or fitting by the exothermic process with a copper sleeve fitted over the exposed conductor. Only sufficient insulation shall be removed from the bonding cable to allow placing of the welding mold. After the weld is completed it shall be tested and capped in accordance with Section 7-11.3(15)D.

Defective welds shall be removed and replaced.

Exposed metal surfaces around the exothermic weld including the end of the copper conductor, and the weld itself, shall be covered with coating material as shown on the Drawing or in accordance with Section 9-30.11(3).

The Contractor shall provide the Engineer three (3) Working Days notice so that all connections to pipe obtain inspection and approval prior to covering. Bond connections not receiving Engineer inspection prior to cover or backfill will be rejected.

7-11.3(15)B3 RESERVED

7-11.3(15)B4 TESTING ELECTROLYSIS TEST STATION

The Contractor shall provide the Engineer written notice at three (3) Working Days in advance, to perform a functional test of the electrolysis test station before backfilling.

7-11.3(15)C ELECTROLYSIS TEST STATION

7-11.3(15)C1 GENERAL

Electrolysis Test Stations shall be installed as indicated on Standard Plan no. 360.

7-11.3(15)C2 ZINC REFERENCE ELECTRODES

Place reference electrode within the Water Main trench excavation 6” horizontally from the Water Main at or just below the springline. An exception is where Water Main crosses any other metallic pipe in which the electrode is to be placed between the Water Main and the other pipe. Reference electrodes shall be backfilled with suitable Material. Terminate wires in the test stations.

7-11.3(15)C3 TEST STATION

The test station shall consist of a molded test station box installed inside a conventional cast iron water meter box for non-traffic areas or inside a Type 230 frame and cover for traffic areas. The cover shall have the letters “WATER” cast into it.

7-11.3(15)C4 TEST WIRES

Wire location, connections to pipe, size, insulation color, and crimp-on wire connectors shall be as shown on the Standard Plan no. 363.

7-11.3(15)D TESTING AND CAPPING EXOTHERMIC WELD CONNECTIONS

7-11.3(15)D1 GENERAL

Two methods of testing, a manual test using a hammer blow, or an electronic method that measures bond resistance, may be required. Also, when required in the Contract, the Contractor shall identify a cathodic protection specialist to oversee installation of joint bonds and testing for electrical continuity. The Contractor’s cathodic protection specialist shall prepare a Shop Drawing and procedures for testing the pipe and maintaining records. The procedure shall, at a minimum, require the cathodic protection specialist to monitor testing of bonded joints for the first two (2) days of testing, and the Contractor will complete testing of the remaining joint bonds and prepare records of the testing results on a test form to include:

1. Description and location of the pipeline tested;
2. Starting location and direction of test;
3. Date of test;
4. Joint type;
5. Test current and voltage drop across each joint and calculated bond resistance (Calculated Resistance Method as described in Section 7-11.3(15)D3).
6. Measured joint bond resistance (Digital Low-Resistance Ohmmeter method)
7. Review of test records by the Contractor’s cathodic protection specialist.

7-11.3(15)D2 CAPPING EXOTHERMIC WELD CONNECTIONS

Each bond connection shall be insulated thoroughly with a Royston Handy Cap or approved equal. The cap shall completely cover the cleaned area and provide insulation of the bond connection from the soil environment. The cap shall be attached by use of a bonding cement or primer and shall contain an elastomeric Material under a plastic dome. The elastomeric Material shall mold completely around the bond wire and weld area. The cap shall be a minimum of 4 inches x 4 inches x 125 mils thick. Caps are not required when the connection is covered by heat shrink joint wrapping.

7-11.3(15)D3 TESTING EXOTHERMIC WELD CONNECTIONS

After the exothermic weld has cooled, slag shall be removed and the weld tested with a glancing blow with a 16 ounce hammer to assure proper metallurgical bond.

When required in the Contract, each joint bond connection shall also be tested for resistance using a Digital Low Resistance Ohmeter (DLRO). The Contractor shall, prior to backfilling, test each bond in the presence of the Engineer and prepare a record of the testing results. Any joint bond that exceeds the maximum allowable resistance shall be replaced by the Contractor and retested. Any defective joint bond discovered during energizing and testing shall be located, uncovered and repaired by the Contractor with no further pay

The following electrical continuity test equipment, or approved equal, shall be stored at the project site, maintained in accurate working condition and be available to the Engineer for testing purposes:

1. One Biddle Model No. 247001 digital low-resistance ohmmeter;
2. One set of duplex helical current and potential hand spikes, Biddle Model No. 241001, cable length as required;
3. One calibration shunt rated at 0.001 ohms, 100 amperes, Biddle Model No. 249004.

The testing shall measure the resistance of joint bonds with the low-resistance ohmmeter in accordance with the manufacturer's written instructions. The helical hand spikes will contact the pipe on each side of the joint, without touching the exothermic weld, cap, or bond wire. The contact area shall be cleaned to bright metal by filing or grinding and without any surface rusting or oxidation.

Joint bond continuity will be acceptable if tested resistance values are less than or equal to:

Maximum Allowable Resistance in ohms		
Joint Type	**3 bonds/joint**	**1 bond/joint**
Push-on or Mechanical	0.000110	0.000325
Flexible Coupling	0.000145	0.000425

7-11.3(16) ELECTRICAL INSULATION OF WATER MAIN

7-11.3(16)A GENERAL

The Water Main shall be installed so as to maintain electrical insulation from dissimilar pipe material, other water Structures, and other underground installations.

7-11.3(16)B TESTING OF INSULATING COUPLINGS OR INSULATING FLANGE KITS

Insulating couplings or insulating flange kits shall be located and installed as shown on the Drawings. The Contractor shall install an electrolysis test station at each insulating device. The Contractor shall notify the Engineer at least 72 hours in advance for the SPU Corrosion Engineer to perform a functional test of the insulating couplings and flange kits. All damaged or defective insulating devices shall be replaced at the Contractor's sole expense.

7-11.4 MEASUREMENT

Bid items of Work completed pursuant to the Contract will be measured as provided in Section 1-09.1, Measurement of Quantities, unless otherwise provided for by individual measurement paragraphs herein this Section.

Measurement for "Bedding, (Class), (Size) Pipe" for Water Main will be in accordance with Section 7-17.4.

Measurement for "Pipe, Water Main, (Material), (Class), (Size), including Fittings" and "Pipe, Water Main, (Material), (Class), (Size), including Fittings, (Trenchless Construction Method)", will be per linear foot based on the distance from point to point. The point of beginning or ending of measurement in any particular run of pipe will be either with the vertical intersection of the center line of the intersecting pipe, or with the beginning or ending of any new pipe installed. No deductions will be made for the linear length of fittings, valves, couplings, etc. contained within the measured length. At changes in pipe size connected by a reducer, the point of measurement will be taken as the midpoint of the reducer.

Measurement for "Blocking, Cement Concrete" will be by the cubic yard of concrete placed as computed by the Engineer.

Measurement for "Blocking, Ecology Block" will be per each.

Measurement for "Blowoff Assembly, (Size)" will be per each complete blowoff assembly installed which includes not in excess of 10 feet more than the length of blowoff connection pipe indicated on the Drawings as part of the each.

Measurement for "Steel Casing Pipe, (Class), (Size), (Construction Method)" will be per Section 7-17.4.

Measurement for "Station, Electrolysis Test" will be per each installed complete.

7-11.5 PAYMENT

Compensation for the cost necessary to complete the work described in Section 7-11 will be made at the Bid item prices Bid only for the Bid items listed or referenced as follows:

1. "**Pipe, Water Main, (Material), (Class), (Size), (Coating), including Fittings**", per linear foot.

The Bid item price for "Pipe, Water Main, (Material), (Class), (Size), (Coating), including Fittings" shall include all costs for the work required as follows:

(1) Costs required for excavating, installing and joining pipe, backfilling and compacting native material, and disposing of and/or placing excess native material elsewhere;
(2) Cost of Materials, including but not limited to, the pipe, fittings and pipe supports, locating wire, special coatings, and other items called for in the Contract. Where required, the costs of sand or foam cushioning between the Water Main and other pipes shall also be included;
(3) Costs for the work required to furnish and install mechanical joint sleeves and pipe supports, including pipe hanger rods with nuts, single pipe rolls, steel angles, reinforcing bars, nuts, bolts, washers, mastic, and galvanizing;
(4) Costs required to perform the "Taste and Odor Rating Test Procedures", "Procedures for Hydrostatic Pressure Testing", and "Procedures for Flushing, Disinfection and Bacteriological Sampling of New Water Mains";
(5) Costs necessary for installing pipe on curves as shown on the Drawings, including field changes involving standard lengths of pipe deflected at the joints;
(6) Costs of all Material, labor and equipment associated with making pipe connections unless otherwise specified; and
(7) Costs of furnishing and installing service connecting tees 4-inches and larger.

Special fittings used but not called for on the Drawings will be paid for at the Supplier's invoice cost plus 15 percent for overhead and profit. Special fittings called for on the Drawings but not used will be deducted from the Contractor's final estimate based on the current cost to the Supplier of fittings used on the Improvement.

If the pipe, its lining or its coating is damaged, the Contractor will be required, at the Contractor's sole expense, to repair the damage to an acceptable condition prior to installation.

Payment for protective systems will be in accordance with Section 2-07.5.

Defective Material or workmanship discovered as a result of tests will be addressed in accordance with Section 1-05.7.

2. "**Blocking, Cement Concrete**", per cubic yard.

The Bid item price for "Blocking, Cement Concrete" shall include all costs for the work required as follows:
(1) Costs of placing concrete blocking including: excavation, turnbuckles, shackle rods, steel plates, corrosion protection of all metallic components, concrete form work, finishing, removal and disposal of material not required for backfill; and
(2) Other work that may be necessary for constructing the blocking in place as specified.

3. "**Blocking, Ecology Block**", per each.

The Bid item price for "Blocking, Ecology Block" shall include all costs for the work required as follows:
(1) Costs of furnishing and installing the Ecology Block including: excavation, turnbuckles, shackle rods, steel plates, corrosion protection of all metallic components, removal and disposal of material not required for backfill; and
(2) Other work that may be necessary for constructing the blocking in place as specified.

4. "**Blowoff Assembly, (Size)**", per each.

The Bid item price for "Blowoff Assembly, (Size)" shall include all costs for the work required as follows:
(1) Costs for furnishing and installing the complete assembly including corporation, fittings, pipes, valve, meter box or ring and cover, and all excavation, backfill with native material and compaction;
(2) Costs to furnish and install the pipe between the corporation and the blowoff assembly including fittings; and
(3) If the location of the blowoff assembly differs from that shown on the Drawings and requires an increase of more than 10 feet of connection pipe, the excess of pipe over 10 feet will be paid for in accordance with Section 1-09.4.

5. "**Steel Casing Pipe, (Class), (Size), (Construction Method)**", per linear foot.

Payment for "Steel Casing Pipe, (Class), (Size), (Construction Method)" shall be as specified in Section 7-17.5.
Payment for directional drilling installation shall be as specified in Section 2-16.5.

6. "**Pipe, Water Main, (Material), (Class), (Size), (Coating), including fittings, (Trenchless Construction Method)**", per linear foot.

The Bid item price for "Pipe, Water Main, (Material), (Class), (Size), (Coating), including fittings, (Trenchless Construction Method)" shall include all costs for the work required to furnish and install the pipe, including spacers, end seals, and placing the designated fill in the annular space when applicable.
Payment for directional drilling installation will be as specified in Section 2-16.5.

7. "**Station, Electrolysis Test",** per each.

The Bid item price for "Station, Electrolysis Test" shall include all costs for the work required as follows:
(1) Costs of furnishing and installing water meter box, test box, terminal blocks, wires, zinc reference electrodes, removal and restoration of sidewalks; and
(2) All other Materials and labor required to complete this construction.

8. "**Bedding, Water Main, (Class), (Size) Pipe",** per linear foot.

Payment for "Bedding, Water Main, (Class), (Size), Pipe will be as specified in Section 7-17.5.

9. **Other payment information**.

No separate payment will be made for electrical joint bonds, capping, testing and recording test results. Costs for labor, material and equipment required to acceptably bond and test across mechanical couplings and across rubber gasket joints, and all incidentals required to provide acceptable and complete bonding shall be included in the Bid item price for "Pipe, Water Main, (Material), (Class), (Size), including Fittings" or the Bid item price for "Pipe, Water Main, (Material), (Class), (Size), including Fittings, (Trenchless Construction Method).

Joint bonding Material shall include without being limited to all required cables, bolts, molds, cold applied tape coatings and heat shrink sleeves.

SECTION 7-12 VALVES FOR WATER MAINS

7-12.1 DESCRIPTION

Section 7-12 describes work consists of furnishing and installing Water Main valves and valve accessories as indicated in the Contract, and supplying materials, tools and appurtenances needed to complete the installation.

7-12.2 MATERIALS

Materials shall meet the requirements of Section 9-30.3.

Valves for Water Mains shall be suitable for ordinary waterworks service and are intended to be installed in a normal position on buried Water Mains for water distribution and water transmission systems.

7-12.3 CONSTRUCTION REQUIREMENTS

7-12.3(1) GENERAL

The Contractor shall not operate any valve on an existing Water Main.

All valves shall be inspected upon delivery in the field to ensure proper working condition before installation and to verify free of rust and dirt. The valves shall be set and jointed to the pipe according to the AWWA Standards, unless indicated otherwise in the Contract, for the type of connecting ends furnished. The valves shall be carefully inspected for damage to the outer protective coating(s) and verified damage free prior to installation.

An operating nut extension shall be installed when the ground surface is more than 30 inches above the valve operating nut. In standard valve boxes, which contain valves 12 inch and smaller, the operating nut extension shall extend into the top section of the standard valve box (see Standard Plan nos. 315a and 315b). In vaults, which contain valves greater than 12 inch, the operating nut extension shall extend into the upper section of the vault and shall clear the bottom of the lid within a range of 24 to 30 inches. The Contractor shall be prepared to furnish and install an operating nut extension when required. Upon delivery at the Project Site, all valves shall be opened to prevent the collection of water in the valve. Valves shall have the interiors cleaned of all foreign matter and shall be inspected both in open and closed position prior to installation. Valves shall be set perpendicular to the Water Main. Valve boxes shall be placed over the 12 inch and smaller valve or valve operator and any extension in a manner that the valve box makes no contact with the valve assembly or extensions and does not transmit shock or stress to the valve assembly or Water Main (see Section 7-12.3(4)). The lower casting of the valve box shall be installed first, so as to be supported by backfill and a polyethylene foam collar not less than 2 inches in thickness. The casting shall not rest directly upon the body of the valve or upon the Water Main. Backfill shall be carefully tamped around the valve box to a distance of 3 feet on all sides or to the undisturbed face of the trench if it is closer. The cast iron valve box cover shall be set flush to finished grade.

The combination air release/air vacuum valves shall be installed as shown on the Drawings. All piping shall be sloped to permit escape of any entrapped air. Backfilling and compaction shall be as specified in Sections 2-10 and 2-11.

After installation, all valves shall be tested and disinfected in accordance with Sections 7-11.3(11) and 7-11.3(12). Should any defects in design, Materials installation, or workmanship appear during these tests, the Contractor shall correct such defects to an acceptable condition as determined by the Engineer.

7-12.3(2) VALVE CHAMBERS

7-12.3(2)A GENERAL

Where shown on the Drawings, valve shall be enclosed in a valve chamber.

Valve chambers may be either precast or cast in place. The use of solid concrete blocks or concrete brick will be allowed only when indicated in the Contract.

Valve chambers and the casting assembly for valves larger than 12 inch shall make no contact with the valve assembly or extension where surface shock or stress can be transmitted to the valve assembly or Water Main.

7-12.3(2)B PRECAST VALVE CHAMBERS

The concrete base shall be poured-in-place or precast. Poured-in-place base shall be allowed to attain sufficient strength to support the chamber (usually 2 or 3 Days), as approved by the Engineer. Precast chambers shall be set on the concrete base in cement mortar. The vault chamber shall have adequately sized and located openings for chamber installation adequately clear of the Water Main.

The Water Main shall be wrapped with 2-inch thick plastic foam Material at those areas where the Water Main intersects the chamber walls. The plastic foam Material shall cover the Water Main the full width of the chamber wall. Any remaining space between the chamber wall and the plastic foam Material shall be filled with cement mortar, and when the opening is large enough, brick and mortar. In no case shall the Water Main rest on the chamber wall.

7-12.3(2)C CHAMBERS MADE WITH PRECAST CONCRETE BLOCKS

Circular or rectangular chambers may be made with solid precast concrete blocks. The base shall first be poured in place. After the base has reached sufficient strength (usually 2 or 3 Days), the walls may be constructed of concrete blocks with water-tight cement mortar joints.

Circular chambers shall be constructed with curved maintenance hole blocks. The chamber top shall be tapered in to the dimensions shown on the Standard Plans, unless the Contract specifies otherwise.

Chambers shall have a cast-in-place or precast concrete top slab suitable for H20 traffic loading unless greater loading is required by the Contract.

7-12.3(2)D CAST-IN-PLACE CHAMBERS

Cast-in-place chambers may be constructed by using forms and poured concrete. Finishing of walls is not required other than the patching of porous spots (rock pockets) and bolt holes. Forms shall be removed for inspection of concrete.

7-12.3(3) SETTING FRAME AND COVER

The cast iron frame and cover (see Standard Plan no. 361) shall be set to grades furnished by the Engineer. Provisions for future adjustment of frame to changes in grade shall be made by constructing a minimum of 2 courses of brick with mortar joints between the top of the chamber and the bottom of the casting. Brick for this purpose shall be standard concrete brick 2-1/4 inches thick. When the casting is in concrete pavement or in rigid concrete base, reinforcement within the concrete pavement slab shall in accordance with Section 5-05.3(9).

7-12.3(4) SETTING VALVE BOX

Cast iron valve boxes shall be positioned during backfilling operations to be in vertical alignment with the gate valve operating stem. The lower casting of the unit shall be supported by a plastic foam collar not less than 2 inches thick, and shall be held in place by carefully compacted backfill. The casting shall not rest directly upon the body of the gate valve, operating nut extension, or upon the Water Main. The upper casting of the valve box shall be placed in the plane of and flush with the finished grade, and when installed on slopes may both need to be tilt adjusted and adequately offset to provide valve and extension clearances meeting the requirements of Section 7-12.3(1) and allow straight and direct access to the operating stem.

Backfill and compaction shall be as specified in Sections 2-10 and 2-11.

7-12.3(5) VALVES INSTALLED ON SPECIALLY COATED PIPE

Valves installed on Water Mains that are polyethylene encased, tape coated, or special coated, shall be polyethylene encased, epoxy coated, or special coated the same as the Water Main.

7-12.3(6) LADDERS

Refer to Section 7-05.3(1)Q.

7-12.3(7) PAINTING OF VALVES

7-12.3(7)A PAINTING AT FACTORY

After the factory test and inspection, all ferrous parts of the valves except finished or bearing surfaces shall be painted inside and out with two coats of asphalt varnish, Federal Specification TT-V-51A or approved equal.

7-12.3(7)B PAINTING IN THE FIELD

The valve shall be carefully inspected for injury to the outer protective coatings. At all places where the coating has been ruptured or scraped off, the damaged area shall be thoroughly cleaned to expose the iron base, and the cleaned area shall then be recoated with the manufacturer's recommended primer and two or more coats of Royston Roskote R28, or equal, per manufacturer's instructions. In wet conditions, use three component wax tape wrap consisting of: primer, wax tape and fiberglass overwrap per Section 7-11.3(8)A.

7-12.3(8) THERMOPLASTIC POWDER COATING

Valves and attachments to be installed on Water Mains where the Contract specifies Thermoplastic Powder Coating for the Water Main, shall also have a coating equivalent such as fusion bonded epoxy, or polyurethane, or approved equal.

All bolts, nuts, followers, and similar shall be wax tape coated (see Section 9-30.1(6)F).

Substitute Material requires the Contractor to submit sufficient information and a Manufacturer's Certificate of Compliance stating that the proposed substitute Material shall perform at least as well as that specified.

7-12.4 MEASUREMENT

Bid items of Work completed pursuant to the Contract will be measured as provided in Section 1-09.1, Measurement of Quantities, unless otherwise provided for by individual measurement paragraphs herein this Section.

7-12.5 PAYMENT

Compensation for the cost necessary to complete the work described in Section 7-12 will be made at the Bid item prices Bid only for the Bid items listed or referenced as follows:

1. "**Valve, Gate, (Size)",** per each.
2. **"Valve, Butterfly, (Size)",** per each.

The Bid item price for "Valve, (Type), (Size)" shall include all costs for the work required to furnish and install the valve, including painting, jointing, disinfecting, hydrostatic testing, operating nut and extensions.

When the valve is to be polyethylene encased or coated as specified in the Contract, the cost for furnishing and installing the coating as specified in Section 7-12 shall be included in the Bid item price for "Valve, (Type), (Size)".

3. "**Valve Chamber, (Type), (Size)",** per each.

The Bid item price for "Valve Chamber, (Type), (Size)" shall include all costs for the work required to furnish and install the precast concrete, brick and block, or cast-in-place chamber, including foundation, adjustment brick, castings and lid, ethafoam cushion, mortar plastering, valves, support piers, water proofing Materials and steps or ladders.

4. "**Valve Box, Cast Iron**", per each.

The Bid item price for "Valve Box, Cast Iron" shall include all costs for the work required to furnish and install the valve box, including plastic foam cushion.

SECTION 7-13 RESERVED

SECTION 7-14 HYDRANTS

7-14.1 DESCRIPTION

See Section 2-12 regarding hydrant use.

These Specifications are to be used in conjunction with the AWWA Standard C502 for dry barrel hydrants for ordinary water works service.

Section 7-14 describes work consisting of installing and setting and adjusting hydrant; and furnishing, installing and setting the hydrant tee, auxiliary valve, restraint system and shackles, gravel drain, concrete blocks, shear block, bleeder, hydrant connection, connection pipe, marker posts, retaining wall and rock facing, coating, painting, excavation, backfilling, furnishing and installing hydrant markers and quick connect adapters when required, and other pertinent Work as specified in other Sections of this Specification. The work also includes flushing, hydrostatic pressure testing and disinfecting of furnished hydrants and hydrant barrel extensions. Hydrants will be furnished by SPU Water Operations. When required by the Engineer, hydrant barrel extensions kits will be furnished by SPU and installed by the Contractor prior to hydrant pressure testing. The Contractor shall take delivery of, and responsibility for, hydrants and extension kits provided at the Water Operations Center (2700 Airport Way South, Seattle) and shall transport them to the Project Site. The Contractor shall notify the Engineer at least 5 Working Days in advance to schedule hydrant pick-up and extension kit pick-up, and at least 2 Working Days in advance for hydrant installation. One hydrant extension kit, sized as determined by the Engineer, will be provided for each hydrant requiring adjustment.

7-14.2 MATERIAL

Materials shall meet the requirements of Section 9-30.

Hydrants will be furnished by SPU. Arrangements for hydrant pickup will be addressed per Section 1-08.1(2).

7-14.3 CONSTRUCTION REQUIREMENTS

7-14.3(1) SETTING HYDRANTS

The Contractor shall check and tighten any loose bolts on the hydrant prior to installation.

Where shown on the Drawings, hydrants shall be installed in accordance with the detail shown on Standard Plan nos. 310a through 314. Hydrants shall not be installed within 3 feet of a traveled roadway. In addition, a minimum 4-foot radius unobstructed working area shall be provided around all hydrants. The bottom surface of the breakaway flange shall be set 2-inches minimum and 7-inches maximum above the concrete shear block finished grade.

For each hydrant requiring vertical adjustment, see Section 7-14.1.

All barrel adjustment risers are to be positioned between the hydrant foot assembly and the barrel section provided with the hydrant. The companion extension for the hydrant main stem is to be positioned on the valve stem immediately below the stem section contained within the hydrant curb stand or discharge section.

After installation hydrants shall be subjected to a hydrostatic test as specified in Section 7-11.3(11).

The hydrant excavation shall be backfilled and compacted when installation and testing are complete and accepted by the Engineer.

A concrete shear block with rebar, as shown by the hydrant details on Standard Plan nos. 310a through 311b, shall be constructed for all hydrants. Construction, Materials, and finishing of the concrete shear block shall conform to Section 8-14, Cement Concrete Sidewalk. The shear block shall be set flush with the immediately surrounding finish grade.

The Contractor shall flush, test and disinfect furnished hydrants and hydrant barrel extensions according to Section 7-11.3.After all installation and testing is completed, the hydrants shall be painted in accordance with Section 7-14.3(11).

Any hydrants not in service shall be identified by covering with a burlap or plastic bag.

7-14.3(2) HYDRANT CONNECTIONS

7-14.3(2)A GENERAL

Hydrant laterals shall consist of a section of 6-inch ductile iron pipe from the Water Main to the hydrant and shall include an auxiliary gate valve set vertically and placed in the line as indicated in the Standard Plans.

7-14.3(2)B HYDRANT RESTRAINT

Hydrant assemblies constructed with ductile iron pipe shall be restrained with mechanical joint restraint gland such as EBAA Iron Megalug Series 1100 or approved equal.

Hydrant assemblies that modify existing cast iron hydrant branch pipe shall be restrained with two ¾ inch diameter steel shackle rods as shown on Standard Plan nos. 310a and 311a.

Threads shall be cut at the ends or where rod couplers are needed. Slip joint pipe and fittings will not be allowed.

Shackle rods, nuts, washers, and couplers shall be completely coated pursuant to Section 9-30.15.

7-14.3(2)C AUXILIARY GATE VALVE AND VALVE BOX

Auxiliary gate valves and boxes shall be installed in accordance with Section 7-12. When an auxiliary valve called for in a 311b installation is located within an area subject to lawful vehicle parking, a second auxiliary valve shall be used in place of the MJ x flange adapter at the inlet of the hydrant. See Standard Plan nos. 310b and 311b for additional hydrant valve requirements.

7-14.3(3) RESETTING EXISTING HYDRANTS

Resetting hydrants, or moving an existing hydrant closer to or farther away from a Water Main on an existing hydrant connection, will be performed by SPU Water Operations.

When the Contract specifies the resetting of an existing hydrant, the hydrant shall be reset without disturbing the location of the hydrant lateral tee at the Water Main.

The hydrant shall be shackled as specified in Section 7-14.3(2)B.

This work shall be in accordance with Section 7-14.3(1).

7-14.3(4) RELOCATING EXISTING HYDRANTS

Relocating hydrants, or moving an existing hydrant and connection pipe to a new location, will be done by SPU Water Operations crews.

7-14.3(5) RESERVED

7-14.3(6) HYDRANT BARREL EXTENSIONS

The minimum requirements for hydrant barrel extensions, operating stems, and flanged adapters shall conform to AWWA C502 in design, Material, and workmanship. The drilling of the flanges on the extensions shall match the drilling of the flange that joins the hydrant foot section to the factory-supplied barrel section on the hydrant. All bolts used with barrel connection flanges shall engage the flanges through drilled bolt holes. Slotted bolt holes shall only be used on above-grade breakaway flange connections when the function of the breakaway feature requires their use.

7-14.3(7) RESERVED

7-14.3(8) RESERVED

7-14.3(9) RETAINING WALLS FOR HYDRANTS

Where indicated on the Drawings, the Contractor shall furnish and place a rock facing wall around hydrants in accordance with Standard Plan no. 313 and Standard Plan no. 141.

7-14.3(10) HYDRANTS ON WATER MAINS THAT ARE POLYETHYLENE ENCASED, MULTI-LAYERED POLYETHYLENE ENCASED, OR SPECIALLY COATED

Unless the Contract specifies otherwise, hydrants installed on special coated Water Mains, such as polyethylene encased, multi-layered polyethylene encased, thermoplastic coated, or other special pipe coating per Contract, the following shall be required:

1. Hydrant Connections up to and not including the hydrant (See Section 7-14.3(2)) shall have the same coating as the Water Mains to which they are connected, and shall have Class B bedding in accordance with Section 7-10.3(9);
2. Hydrant barrels below ground shall have the same special coating as the Water Main to which they are connected with the exception of thermoplastic coating;
3. Hydrants connected to thermoplastic coated Water Mains shall have the hydrant barrel below ground polyethylene encased. Thermoplastic coating of the hydrant will not be allowed; and
4. Hydrant connection shall be installed as specified in Section 7-11.3(6).

7-14.3(11) HYDRANT FIELD PAINTING

7-14.3(11)A BELOW GROUND COATING

Following hydrant installation and prior to backfill, any damaged coating on the below-ground portion of the hydrant shall be repaired with the same coating as recommended by the coating manufacturer and approved by the Engineer.

7-14.3(11)B ABOVE GROUND COATING

After construction of the concrete shear block, the hydrant curb stand section including all exposed surfaces of the sidewalk flange shall receive two coats of oil based gloss enamel paint (Kelly-Moore Luxlite or approved equal) in Caterpillar yellow. Based on the elevation of the hydrant within the surrounding pressure zone, if the maximum static pressure at the hydrant is less than 60 psi, the engine port cap on the hydrant shall be painted with two coats of oil based gloss enamel paint (Kelly-Moore Luxlite or approved equal) as indicated by the notes on Standard Plan nos. 310a and 311a.

7-14.4 MEASUREMENT

Bid items of Work completed pursuant to the Contract will be measured as provided in Section 1-09.1, Measurement of Quantities, unless otherwise provided for by individual measurement paragraphs herein this Section.

Measurement for rock facing walls will be in accordance with Section 2-13.4 as for the Bid item "Rock Facing".

Measurement for hydrant and hydrant connection will be per each.

Measurement for Mineral Aggregate for hydrant walls will be in accordance with by the ton.

7-14.5 PAYMENT

Compensation for the cost necessary to complete the work described in Section 7-14 will be made at the Bid item prices Bid only for the Bid items listed or referenced as follows:

1. "**Hydrant, 6-Inch Connection (Type)",** per each.

The Bid item price for "Hydrant, 6-Inch Connection (Type)" shall include all costs for the work required to pickup, deliver and install a Type 310 or Type 311 hydrant, and furnish and install on new Water Main (or existing Water Main with existing tee) complete including but not limited to excavation; backfill and compaction with suitable material; disposal of material; furnishing and installing auxiliary valve, valve box, restraint system and shackles, barrel extension, gravel drain, concrete blocks, bleeder, special coating, field painting, shear block and rebar, marker posts, the 6-inch ductile iron pipe connection between the hydrant and the Water Main, any hydrant marker or quick connect adapter required; and obtaining the hydrant and hydrant extension.

2. **Other payment information**.

Payment for rock facing, will be as specified in Section 2-13.5.

Payment for Mineral Aggregate will be as specified in Section 4-01.5.All costs in connection with furnishing and installing coatings and field painting as specified in this 7-14 Specification Section shall be included in the hydrant Bid item price(s).

Payment for bedding for polyethylene encased, multi-layered polyethylene encased, or special tape coated hydrant connection pipe will be in accordance with Section 7-11.5.

All costs associated with installing and removing temporary blocking, and removing existing blocking when indicated in the Contract shall be incidental to the various Bid items and no separate or additional payment will be made therefore.

SECTION 7-15 WATER SERVICE CONNECTION TRANSFERS

7-15.1 RESERVED

7-15.2 RESERVED

7-15.3 CONSTRUCTION REQUIREMENTS

The Contractor shall provide the Engineer at least 10 Working Days advance notice when transfer of existing water service is required.

Service transfers may not be done until the new Water Main has been tested and accepted, and then connected.

For service transfers:

1. SPU will, at no cost to the Contractor, mark the exact field locations of service taps and tees on services 2 inch and smaller. Locations of services larger than 2 inch will be identified on the Drawings,
2. Contractor shall make all excavations for the water service connections, including shoring and dewatering; and
3. Contractor shall furnish and compact backfill including furnishing and placing temporary pavement patch.

The Contractor shall not remove or abandon existing pipe until either all existing service connections have been transferred to the new Water Main or temporary service has been provided, and the Engineer approves. The Contractor shall maintain the temporary pavement patch until completion of all work by SPU Water Operations. Adequate provisions shall be made by the Contractor during construction for the care and protection of both Water Mains and water services in use.

Actual scheduling of water service connections and related work will be addressed at the Preconstruction Conference to take into account the actual number of connections required, least inconvenience to existing water service customers, sequencing of work, and other operation and construction activity needs.

Where the Contract indicates 4 inch, 6 inch, or 8 inch service connections, the Contractor shall furnish and install tees, valves, plugs, and valve boxes. A 3 inch water service shall be considered a 4 inch water service. The tees shall be mechanical joint (MJ) x mechanical joint x flange (FLG). Valves shall be MJ x FLG, and removable plugs shall be MJ for the service connection. The MJ plugs will be returned to the Contractor after SPU Water Operations completes the service connections.

If existing water service material to be reconnected to the new Water Main is considered substandard material (such as plastic, cast iron, or galvanized iron pipe, SPU will replace with copper (2 inch and smaller) or ductile iron (3 inch and larger) from the water service union to the new Water Main.

Upon completion of work by SPU Water Operations, the Contractor shall make all final adjustments of valve boxes, water meter boxes, and rings and covers to final grade at no cost to the Owner, and shall then make the final surface restorations in accordance with the Contract.

7-15.4 RESERVED

7-15.5 PAYMENT

All costs associated with water service connection transfers shall be included in the Bid item prices for the applicable Bid items and no separate or additional payment will be made.

SECTION 7-16 FLOW CONTROL STRUCTURE AND DETENTION PIPE

7-16.1 DESCRIPTION

Section 7-16 describes work consisting of a flow control structure and detention pipe for storm water storage. The flow control structure shall consist of maintenance hole structure with a flow control device assembly.

7-16.2 MATERIALS

Materials shall meet the requirements of the following Sections:

Flow Control Structure, Conduit, Fittings, and Related	9-05
Maintenance Hole Components	9-12
Non-Shrink Cement Sand Grout	9-04.3(2)

Corrugated metal pipe (CMP) flow control systems and detention systems will not be allowed in any landslide-prone area as defined in SMC 25.05.908, or underneath buildings.

Corrugated metal detention pipe and flow control systems per Standard Plan nos. 271a through 271d are for private ownership and maintenance as approved by DPD. Corrugated metal detention pipe shall be aluminized. Galvanized materials shall not be constructed or placed in the Storm Drain system.

Detention pipe to be owned, or to be maintained, by the City shall be reinforced concrete, ductile iron, polypropylene, or steel reinforced polyethylene pipe.

7-16.3 CONSTRUCTION REQUIREMENTS

7-16.3(1) GENERAL

All work including bedding, pipe installing and jointing for the construction of detention pipe and flow control Structure shall be in accordance with Section 7-05 and Section 7-17.

Excavation, backfill and compaction shall be in accordance with Sections 2-04, 2-10 and 2-11.

Work in trench excavations over 4 feet deep is subject to the provisions of Section 2-07 Protective Systems.

7-16.3(2) FLOW CONTROL DEVICES

7-16.3(2)A FLOW CONTROL DEVICE ASSEMBLY

Flow control device assembly shall be per Standard Plan nos. 272a through 272b. The flow control device assembly and all control elevations shall be per the Drawings. The limit of variance at each orifice or weir elevation shall not exceed plus or minus 0.03 foot.

Polyvinyl Chloride (PVC) pipe shall be per ASTM D1785, Schedule 40.

The PVC orifice plate(s) shall be fusion-welded to the PVC cross or tee and elbow with an orifice of the diameter indicated on the Drawings in its center.

The top of PVC pipe is the overflow weir and its elevation shall be per the Drawings. The v-notch weir shall be dimensioned per the Drawings.

Shear gates shall be per Section 7-16.3(2)B.

7-16.3(2)B PVC SHEAR GATE

PVC shear gate per Standard Plan no. 272b shall be constructed as part of the flow control device assembly within public flow contol structures within the Right-of-Way.

The lift handle shall be located to allow operation of the shear gate by reaching from the surface without entering the flow control structure. The orifice 2 elbow shall be offset to provide clear operation of the lift handle and oriented so it will not interfere with use of the ladder to enter the structure.

7-16.3(3) CORRUGATED METAL DETENTION PIPE

Seams in pipes and bands shall be gasketed in accordance with AASHTO M 196.

The end plate shall be welded to the end of the detention pipe with a watertight continuous weld.

The end of the detention pipe inside the flow control structure shall be ground smooth of all burrs and sharp edges.

Aluminum that is to be in contact with a Portland cement product (CDF, concrete, grout, mortar, and other similar products) shall be protected as specified in Section 9-05.6(1).

See Section 7-16.2 regarding limitations on uses of several Materials.

Bedding for the aluminized corrugated metal detention pipe shall be Class B, using Mineral Aggregate Type 22 as indicated on the Drawings.

Coupling bands for steel detention pipes shall be in conformance with Drawings, Specifications, or the WSDOT Standard Plan(s).

7-16.3(4) TEE CONNECTION TO CORRUGATED PIPE

Drainage pipes connected to corrugated detention pipe shall be made through a shop fabricated tee as shown on the Drawings and shall be installed in accordance to Section 7-17.3(2)C2. Tee shall be made to conform to size of detention pipe and sized to accept only rubber joint pipe.

7-16.3(5) TESTING

Testing of flow control structure and detention pipe for leakage shall be in accordance with Section 7-17.3(4)B Exfiltration Test.

All detention systems shall be tested in accordance with Section 7-17.3(4)B. Approval will not be given unless the detention system passes this test. The Contractor shall notify the Engineer at least 5 Working Days in advance of testing.

7-16.4 MEASUREMENT

Bid items of Work completed pursuant to the Contract will be measured as provided in Section 1-09.1, Measurement of Quantities, unless otherwise provided for by individual measurement paragraphs herein this Section.

Measurement for “Flow Control Device Assembly” will be by each device complete in place.

Measurement for the “Pipe, Detention, (Material) (Size)” will be by linear foot for the actual length of pipe installed from inside face of flow control Structure to center of upstream maintenance hole.

Measurement for ”Detention Pipe Outlet Connection” will be in accordance with Section 7-08.4.

Measurement for the Maintenance Hole(s) required for the flow control structure or system will be in accordance with Section 7-05.4.

Measurement for protective systems will be in accordance with Section 2-07.4.

7-16.5 PAYMENT

Compensation for the cost necessary to complete the work described in Section 7-16 will be made at the Bid item prices Bid only for the Bid items listed or referenced as follows:

1. “**Flow Control Device Assembly**”, per each.

The Bid item price for “Flow Control Device” shall include all costs for the work required to furnish and construct the flow control device, all orifice and weirs, shear gate and lift handle, making the connection with outlet pipe, and flexible adapter coupling.

2. “**Pipe, Detention, (Material), (Size)**”, per linear foot.

The Bid item price for “Pipe, Detention, (Material), (Size)” shall include all costs for the work required to furnish, install, and test for leakage the detention pipe and all applicable work listed for the Bid item "Pipe, (Use), (Material), (Class), (Size)" of Section 7-17.5.

3. **Other payment information**.

The outlet pipe of the flow control device will be paid as “Pipe, Detention Pipe Outlet Connection (Material), (Class), (Size)” per Section 7-08.5.

The Maintenance hole(s) required for the flow control structure or system will be paid as specified in Section 7-05.5.

Tees required outside the flow control structure will be paid as specified in Section 7-17.5.

Payment for protective systems will be as specified in Section 2-07.5.

SECTION 7-17 STORM DRAINS AND SANITARY SEWERS

7-17.1 DESCRIPTION

Section 7-17 describes work consisting of foundation preparation, bedding, cut-in tees, pipe installing, jointing, and testing for the construction of Storm Drain, and sanitary and combined Sewer.

All reference to “Sewer” in Specification Section 7-17 shall apply equally to construction of sanitary Sewer, combined Sewer, and Storm Drain. Side Sewer is addressed in Section 7-18.

This work shall also include excavation, backfilling and compaction as specified in Sections 2-04, 2-10 and 2-11.

Work in excavations over 4 feet deep shall comply with Section 2-07 Protective Systems.

7-17.2 MATERIALS

7-17.2(1) GENERAL

Pipe Material used for sanitary Sewers, combined Sewers, and Storm Drains will be specified on the Drawings and may be one or more of the following:

Flexible Pipe Material	Rigid Pipe Material
Polyvinyl Chloride (PVC)	All Concrete
Acrylonitrile butadiene styrene (ABS)	Ductile Iron
Corrugated Metal	Vitrified Clay
Spiral Rib	
Polyethylene (PE)	
Polypropylene (PP)	

It is not intended that Materials listed be considered equal or generally interchangeable for all applications. The Engineer will determine from the Materials listed, those that are suitable for the project and will so specify in the Contract.

Pipe shall have flexible gasketed joints unless otherwise specified in the Contract.

Materials shall meet the requirements of the following sections:

Joint Materials and Non-Shrink Cement Sand Grout	9-04
Pipe	9-05
Pipe Bedding & Trench Backfill	2-10

All pipe shall be clearly marked with the name of the manufacturer, class of pipe, date of manufacture and location of manufacturing plant. Concrete pipe shall also be marked with the wall thickness of the pipe. Lettering shall be legible and permanent under normal conditions of handling and storage. Concrete pipe with elliptical reinforcement shall be clearly marked on the inside and outside of the pipe along the minor axis to identify top and bottom.

After installation, pipe shall be tested in accordance with Section 7-17.3(4).

7-17.2(2) PROOF TESTS (PREQUALIFICATION)

The intent of this requirement is to pre-qualify a joint system, components of which meet the above requirements, as to the water tightness of that joint system. This proof test shall apply to all pipes which are to be tested for water tightness prior to acceptance. Materials and test equipment for proof testing shall be provided by the manufacturer. When approved by the Engineer, internal hydrostatic pressure may be applied by a suitable joint tester. See test requirements in Sections 9-04.

7-17.2(3) MATERIAL CERTIFICATION

The manufacturer or fabricator shall furnish a Manufacturer's Certificate of Compliance, based on manufacturer's routine quality control tests, that the pipe meets or exceeds the requirements of the pertinent ASTM or ANSI specification.

7-17.3 CONSTRUCTION REQUIREMENTS

7-17.3(1) PIPE BEDDING

7-17.3(1)A RESERVED

7-17.3(1)B PIPE BEDDING

7-17.3(1)B1 GENERAL

Bedding, of the class or classes shown on the Drawings, shall be installed in accordance with Standard Plan no. 285, and shall include all the Materials and work within the limits of the bedding zones indicated on Standard Plan no. 285.

Unless otherwise specified in the Contract, bedding for rigid and flexible pipe shall be Class B except bedding for ductile iron pipe shall be Class D.

All classes of bedding shall provide uniform support along the entire pipe barrel, without load concentration at joint collars or bells. No blocking of any kind shall be used to adjust the pipe to grade except when used with embedment concrete. Bell holes shall be excavated as required to ensure uniform support along the pipe barrel. Bedding disturbed by pipe movement or by removal of shoring or movement of a trench shield or box shall be reconsolidated prior to backfill. Special care shall be taken to provide adequate bedding support at wye or tee connections and adjacent to maintenance holes or other Structures, so as to avoid bending or shearing stresses at these critical points.

7-17.3(1)B2 BEDDING FOR CONCRETE PIPE

Bedding shall be classified as Class B and Class C. The requirements and limits for the various classes of bedding are as shown on Standard Plan no. 285 and are described as follows:

1. **Class B Bedding**: Class B bedding of Type 9 Mineral Aggregate shall be placed in at least three lifts. The first lift shall be placed before the pipe is installed and shall be a minimum of 4 to 6 inches in thickness (see dimension "A" on Standard Plan no. 285). The Material shall be spread smoothly so that the pipe is uniformly supported along the barrel with bell holes provided at each joint. Subsequent lifts of not more than 6 inches shall be brought up to a point 6 inches above the top of the pipe. Each lift shall be brought up on

both sides of the pipe and shall be carefully worked under the pipe haunches by means of slicing with a shovel, vibration, or other procedures approved by the Engineer. Compaction of bedding shall be to 90% maximum dry density as determined by methods specified in Section 2-11.

2. **Class C Bedding**: Class C bedding shall be the same as for Class B except that the Type 9 Mineral Aggregate shall extend only to the springline of the pipe. Selected native Material shall then be placed in 6 inch lifts to 6 inches above the pipe, using the same methods as those required for Class B bedding. Compaction of Mineral Aggregate Type 9 shall be to 90% maximum dry density as determined by methods specified in Section 2-11. Compaction of native Material shall be as specified in Section 2-11.

Where unauthorized excavation has been made below the established grade, the Contractor shall provide, place and compact, suitable bedding Material to the proper grade and elevation, at no cost to the Owner. If the Engineer substitutes imported Mineral Aggregate Type 9, in lieu of the selected native Material shown for Class C bedding on Standard Plan no. 285, the bedding will be measured and paid for as “Bedding, Class B, (Size) Pipe”.

7-17.3(1)B3 BEDDING FOR FLEXIBLE PIPE

Bedding for flexible pipe shall be as specified in Section 7-17.3(1)B2 for concrete pipe except for the following:

Bedding Material shall be Mineral Aggregate Type 22.

7-17.3(1)B4 BEDDING FOR VITRIFIED CLAY PIPE

Bedding for vitrified clay pipe shall be as specified in Section 7-17.3(1)B2 for concrete pipe except for the following:

Bedding Material shall be Mineral Aggregate Type 22.

Class B bedding shall have a load factor of 2.2.

Class C bedding shall have a load factor of 1.9.

7-17.3(1)B5 BEDDING FOR DUCTILE IRON PIPE

Bedding for ductile iron pipe shall be as specified in Section 7-17.3(1)B2 for concrete pipe except for the following:

1. **Class D Bedding**: Class D bedding shall be attained by carefully excavating the trench to proper grade, overexcavating at the bell sections, and placing and compacting selected native Material around the pipe. Class D bedding, backfill and compaction shall be in accordance with Sections 2-10 and 2-11.

If the Engineer substitutes imported Mineral Aggregate Type in lieu of the selected native Material shown for Class C and for Class D bedding on Standard Plan no. 285, the bedding will be measured and paid for as “Bedding, Class B, (Size) Pipe”.

7-17.3(2) INSTALLING SEWER PIPE

7-17.3(2)A SURVEY LINE AND GRADE

Pipe shall be installed to the true line and grade indicated in the Contract at the invert of the pipe. The limit of variance at the invert shall not exceed plus or minus 0.03 foot from true line and grade at the time of backfill, and in no case shall result in reverse flow or have a sag. Checking of the invert elevation of the pipe may be made by calculations from measurements on the top of the pipe.

The Contractor may use any method, such as “laser beam”, etc., which would allow accurate transfer of the control points provided by the Engineer to installing the pipe to the designated alignment and grade.

When using a laser beam to set pipe alignment and grade, the Contractor shall constantly check position of laser beam from surface hubs provided by the Contractor to verify laser beam alignment and grade. In the event the laser beam is found out of position, the Contractor shall stop work and make necessary corrections to the laser beam equipment and to pipe installed.

7-17.3(2)B PIPE INSTALLATION AND JOINTING

7-17.3(2)B1 PIPE INSTALLATION

After an accurate grade line has been established, the pipe shall be installed in the properly dewatered trench. Mud, silt, gravel, and other foreign Material shall be kept out of the pipe. Pipe joints shall be kept clean and protected at all times, and shall be lubricated as recommended by the pipe manufacturer before joining.

All pipe installed in the trench shall be kept in longitudinal compression until the bedding has been placed and compacted around and over the pipe.

The Contractor shall exercise care in matching pipe joints for concentricity and compatibility. In no case shall two pipes be joined together with ends exceeding the maximum manufacturer’s tolerance.

The pipe shall be installed in the up-grade direction from the point of connection from either the existing pipe or the designated Structure as the starting point. The pipe shall be installed with the bell end forward or upgrade.

When pipe installation is not in progress, any open end of the pipe shall be sealed with an approved temporary watertight plug.

7-17.3(2)B2 JOINTS ON CURVES

Where pipelines are to be installed on specified curves of sufficiently short radius to deflect the pipe joints in an amount greater than recommended by the pipe manufacturer, the curves shall be achieved with a series of tangents and

shop-fabricated bends complying with the pipe manufacturer's recommendations as approved by the Engineer. The Contractor shall submit the pipe manufacturer's recommendations at least 5 Working Days in advance.

Hand mortared pipe joints will not be allowed. All joints shall be water tight and meet the applicable test requirement(s) of Section 7-17.3(4).

See Section 7-17.3(2)E for gasketed and compression sealed jointing.

7-17.3(2)C PLUGS AND CONNECTIONS

7-17.3(2)C1 GENERAL

Connections to new and existing pipe shall be made with a tee, unless indicated otherwise in the Contract. Except for concrete pipe, all tees on new pipe less than 24 inch inside diameter shall be prefabricated.

Connections to existing pipe shall follow Seattle Public Utility Core Tap Procedures, whether Seattle Public Utilities or the Contractor is coring and installing a new tee. Seattle Public Utilities will core and install tees on existing pipe when indicated on the Drawings and the Contractor shall schedule the work and provide all materials and support functions

Fittings shall be sized to maintain smooth transitions and inside diameter of the mainline pipe. If reducers are indicated on the drawings, coupling shall maintain a smooth and continuous pipe invert.

All fittings shall be capped or plugged with a plug of an approved Material gasketed with the same gasket Material as the pipe unit, or shall have an integrally cast knock-out plug.. If the Contractor wishes to substitute a mechanical stopper; the manufacturer's catalog cuts and installation recommendations shall be submitted to the Engineer at least 5 Working Days in advance. The plug shall be able to withstand all test pressures without leaking, and when later removed, shall permit continuation of piping with jointing similar to joints in the installed line.

7-17.3(2)C2 TEE FITTINGS

Unless otherwise specified in the Contract, tee fittings shall be provided in the Sewer and Storm Drains for side Sewers, catch basin connections and service drains. Tees shall be 8 inches inside diameter, except tees for side Sewers shall be 6 inches inside diameter unless indicated otherwise in the Contract. All fittings shall be of sufficient strength to withstand all handling and load stresses normally encountered. All fittings shall be of the same Materials as the pipe, except when core drilling to insert a tee, which shall be per Section 7-17.3(2)C3. Material joining the fittings to the pipe shall be free from cracks and shall adhere tightly to each joining surface. Fittings shall make for a water tight connection meeting the requirement(s) of Section 7-17.3(4).

The Contractor shall install the tee at locations and alignments shown on the Drawings. When tee alignment is not shown on the Drawings, the tee shall be positioned no higher than a 45 degree angle above springline and no lower than a 30 degree angle above springline.

7-17.3(2)C3 CUT-IN TEE ON EXISTING OR NEW PIPE

For information on Seattle Public Utility Core Tap Procedures, go to:

http://www.seattle.gov/util/groups/public/@spu/@esb/documents/webcontent/spu01_002534.pdf

Unless the Contract indicates otherwise, the Contractor shall locate and cut a hole in the existing or new pipe centered at 30 to 45 degree angle to the springline and sized for proper fit of the lateral tee material. Springline is defined as the widest cross-section of the host pipe measured horizontally. Coring shall be done such that the cored out piece or other materials do not drop into the pipe. The Contractor shall notify the Engineer at least 2 Working Days in advance of cut-in tee operation. For manufactured tee products, installation shall be per the manufacturer's recommendations for the specific host pipe material and size for the specific lateral pipe material and size. For pipe connection types not specified in the Drawings, in this Section, or the Seattle Public Utility Core Tap Procedures, the Contractor shall submit a proposed method of connection to the Engineer for review.

Cut-in tees shall be installed in accordance with the following:

1. **Concrete Pipe Tee To Concrete Pipe**: A concrete tee may be installed on an existing concrete pipe 18 inches in diameter or larger by placing a short length of concrete pipe into the core-drilled hole with its bell end against the outside face of the pipe and the barrel end inserted just to the inside face of the pipe. The Contractor shall thoroughly clean the bonding areas between the tee and the pipe so that the surfaces are free of dirt, dust, grease, oil or other contaminants that may reduce the bond between the grout and the pipe surfaces. Both surfaces shall first be coated with a concrete bonding agent submitted for review and accepted by the Engineer. The annular space between the tee and the core-drilled surfaces shall then be tightly packed with non-shrink cement sand grout meeting the requirements of Section 9-04.3(2). The connection shall be neatly finished inside and outside the existing concrete pipe.
2. **Ductile Iron Tee To Existing Concrete Pipe**: The existing concrete pipe shall be core-drilled with a hole large enough to accommodate the barrel of the specified size of ductile iron pipe and provide a 1-inch space between ductile iron pipe and the existing concrete pipe for application of grout. A length of ductile iron pipe shall be cut so that it can be placed in the core-drilled hole with its bell end against the outside face of the existing pipe without the barrel protruding beyond the inside face of the existing pipe. The Contractor shall clean the outside of the ductile iron pipe, removing loose particles (dust, dirt, oil, or film of any sort) that may reduce the bond between the grout and the pipe. After core drilling, the exposed surface of the existing concrete pipe shall be rough and clean. Both surfaces shall be coated with a bonding agent submitted for review and approved by the Engineer. The annular space between the pipe and core drilled surfaces shall

be tightly packed with non-shrink cement sand grout meeting the requirements of Section 9-04.3(2). The connection shall be neatly finished inside and outside the existing concrete pipe.

3. **Corrugated Metal Tee To Corrugated Metal Pipe**: In corrugated steel and aluminum pipes, a hole shall be sawcut to match a shop fabricated tee as indicated in Standard Plan no. 279.
The flange plate of the fabricated tee shall be corrugated to match corrugation of the pipe to which it is attached. A neoprene gasket or approved equal shall be inserted between the outside face of the existing pipe and the flange plate of the tee and connected by bolting. Corrosion protection shall be provided if the pipe section of the tee is non-corrugated aluminum pipe.
The incoming pipe and the tee shall be connected with stainless steel rigid walled flexible coupling. If the pipe section of the tee is aluminum, corrosion protection shall be provided by isolating the aluminum from the steel by extending the gasket 1 inch beyond the edge of the stainless steel coupling.

4. **Inserta Tee To Clay, or Concrete Pipe**: The Contractor shall submit the method and type tee recommended by the tee manufacturer to the Engineer for approval at least 5 Working Days in advance. The Contractor shall core drill a full size hole in one operation to accommodate an Engineer approved PVC tee insert with a coupling fitting.

All existing pipe, 24 inch and smaller diameter, shall be fully exposed for inspection and securing the coring machine to the pipe.

The bedding shall be restored per Section 7-17.3(1)B. The Contractor shall notify the Engineer at least 2 Working Days before beginning cut-in operations Existing pipe shall be inspected by the Engineer for defects before the drilling or cutting operation starts, again during drilling or cutting operations, and after installation of the tee is completed to make certain that no defective parts or work remain undetected and uncorrected. If the exposed pipe is found cracked or deformed, the Engineer will arrange for either roll in of a new pipe, or repair of the damage at no cost to the Contractor, provided the damage was not caused by the Contractor's operations. If the Engineer rolls in a new pipe with a tee already on it, no fitting will be required.

7-17.3(2)D RESERVED

7-17.3(2)E GASKETED AND COMPRESSION SEALED JOINTS

Pipe handling after the gasket has been affixed shall be carefully controlled to avoid disturbing the gasket and knocking it out of position, or contaminating it with dirt or other foreign Material. Any gaskets so disturbed shall be removed, cleaned, replaced, and relubricated before joining the sections.

Pipe with bonded compression seals shall be handled so that no damage occurs to the seal or its bond with the pipe. Pipe shall be stored such that the pipe shall not rest on the compression seal. Pipe with bonded compression seals determined by the Engineer to be damaged in any way shall be rejected and not incorporated in the work.

Care shall be taken to properly align the pipe before joints are entirely forced home. During insertion of the tongue or spigot, the pipe shall be partially supported by hand, sling, or crane to minimize unequal lateral pressure on the gasket and to maintain concentricity until the gasket is properly positioned. Since most joints tend to creep apart when the end pipe is deflected and straightened, such movement shall be held to a minimum once the joint is home.

Sufficient pressure shall be applied in making the joint to ensure that it is home, as described in the standard installation instructions provided by the pipe manufacturer. Sufficient restraint shall be applied to the line to ensure that joints once home are held so, until fill Material under and alongside the pipe has been sufficiently compacted. At the end of the work Day, the last pipe shall be blocked in an effective way to prevent creep.

Where pipe must be deflected to accommodate required horizontal or vertical curvature, it shall first be joined in straight alignment and then deflected as required. See Section 7-17.3(2)B2 for hand mortar joints and joints on curved pipe.

7-17.3(2)F JOINTING – BREAK-OUT AND RECONNECT & MISMATCHED WALL THICKNESS

Where it is necessary to break out or connect to an existing pipe, only new pipe having the same inside diameter shall be used in reconnecting the pipeline. Inverts, grade, and alignments are to match. Where joints must be made between pipes with a mismatched wall thickness, the Contractor shall use a shielded, flexible gasketed coupling, adapter or coupling-adapter to make a watertight joint. Couplings shall be those manufactured by Romac, Smith-Blair, Fernco Strongback, Mission ARC or approved equal.

7-17.3(2)G STORM DRAIN AND SEWER CONNECTIONS

Catch basin installation shall be per Section 7-08. Service drain and side Sewer connections shall be per Section 7-18.

Catch basin, service drain, or side Sewer connections to Sewer and Storm Drain trunks, mains, or laterals, shall be left uncovered until after the Engineer has inspected and approved the work. After approval of the connection, the bedding and trench backfill work shall be completed.

7-17.3(2)H RESERVED

7-17.3(2)I PROTECTION OF EXISTING SEWER FACILITIES

All existing live Sewers including septic tanks and drain fields shall be kept in service at all times. Provision shall be made for disposal of sewage flow if any existing Sewer is damaged.

Water accumulating during construction shall be removed from the new pipeline but shall not be permitted to enter the existing system. The Contractor shall be responsible for flushing out and cleaning any existing pipeline into which gravel,

rocks, or other debris has entered as a result of his/her operations, and shall repair lift stations or other facilities damaged by his/her operations.

The physical connection to an existing maintenance hole or pipeline shall not be made until authorized by the Engineer. Such authorization will not be given until all upstream lines have been completely cleaned, all debris removed and, where applicable, a pipe has been temporarily placed in the existing channel and sealed.

7-17.3(2)J TRENCHLESS CONSTRUCTION AND CASING PIPE

7-17.3(2)J1 GENERAL

Directional drilling shall be in accordance with Section 2-16. Trenchless construction other than directional drilling shall be as specified in the Contract. Qualifications of the trenchless construction Contractor shall be as specified in the Contract. Casing pipe shall be as specified in the Contract. Carrier pipe, spacers and end seals shall be as specified in the Contract.

7-17.3(2)J2 CASING PIPE, SPACERS AND END SEALING

When casing pipe is required, and the size and gauge of pipe has not been specified in the Contract, the Contractor shall select the gauge and size of the casing pipe compatible with the construction operation and surrounding loading conditions. The Contractor shall take care to prevent caving ahead or around the casing, which would create voids outside the casing pipe.

When the Contract does not specify spacers and end seal, the carrier pipe shall be carefully skidded through the casing pipe and adjusted to the line and grade shown on the Drawing. The annular space between the casing and carrier pipes shall be filled with Material specified in the Contract.

When the Contract specifies using spacers and end seals, the Contractor shall submit the spacer type and layout and method of adjustment to maintain the line and grade shown on the Drawing. The Contractor shall submit spacer and end seal manufacturer's catalog cuts and installation instructions to the Engineer at least 5 Working Days in advance of this work.

7-17.3(2)J3 TRENCHLESS CONSTRUCTION

Where indicated on the Drawings, the Contractor shall install pipe by trenchless construction methods including jacking, augering, tunneling, microtunneling, pipe bursting, or any other trenchless technology method or use of rapid excavation machine other than directional drilling, including installing the pipe in a casing pipe, or by any combination of these methods.

Ground support in portal areas, shafts, and pits, whether launch, intermediate, or receiving, shall be designed to support adjacent structures, the sides of excavation, and withstand all forces from jacking and other operations.

Safety Rules and Standards shall comply with Section 1-07.1(2). At least one designated person shall be on duty above ground whenever any employee is working underground. The Contractor shall have in place communications, hoisting equipment, emergency provisions, air quality monitoring, and ventilation equipment as necessary.

For other than directional drilling per Section 2-16, at least 20 Working Days in advance of underground construction activities, the Contractor shall submit 8 sets of a single Shop Drawing and all necessary calculations describing these activities, including:

1. Dimensions of shaft, pit, or portal;
2. Method of shaft excavation, shoring installation, maintenance and removal, and all supporting equipment;
3. Method of trenchless construction and all supporting equipment;
4. Control and monitoring equipment, including provisions to maintain line and grade, minimize over excavation and control the face of the excavation;
5. Staging and surface support, including waste disposal, including slurry handling and disposal, when applicable, in accordance with the requirements of Section 1-05.3.;
6. Qualifications of trenchless construction Contractor; The submittal shall include the name of the designated person.

The material, procedure, and equipment employed by the Contractor shall not relieve the Contractor of responsibilities nor waive or modify any provisions of the Contract.

7-17.3(2)K TEMPORARY SEWER BYPASS

The Contractor shall install a temporary bypass to maintain uninterrupted Sewer service on projects calling for reconstruction of existing Sewer mains or on projects where construction Work will interfere with sewage flow in the existing Sewer. The bypass shall be made by diverting the effluent flow at an upstream access maintenance hole and pumping it through a separate conduit to a downstream reentry point or to an adjacent Sewer system. The pump and bypass conduit shall be of adequate size and capacity to handle the flow. The effluent level in the bypass pumping maintenance hole shall not be allowed to rise more than 1 foot above the crown of the incoming Sewer pipe. Work shall be conducted in such a manner as to comply with the requirements of Section 1-07.

A written proposal for bypassing the remaining portion of the Sewer system and the list of all equipment to be used for the Work shall be submitted by the Contractor to the Engineer, allowing at least 10 Working Days for review and return of comments. The Engineer's review shall not relieve the Contractor of its responsibilities or of any public liability for sewage spills under this Contract.

7-17.3(3) RESERVED

7-17.3(4) CLEANING AND TESTING

7-17.3(4)A GENERAL

Pipelines and appurtenances shall be cleaned, be television inspected and tested, after backfilling, by the low pressure air method. The Contractor may substitute with exfiltration testing, or the Engineer may direct use of the infiltration test if the ground water table is in the pipe zone.

All work involved in cleaning and testing pipelines between maintenance holes or rodding inlets as required herein shall be completed within 15 Working Days after backfilling of pipelines and Structures. Any delay shall be submitted to the Engineer well in advance and requires the written consent of the Engineer. The Contractor shall furnish all labor, Materials, tools, and equipment necessary to make the test, clean the lines, and perform all Work incidental thereto. The Contractor shall perform the tests in the presence of the Engineer. All testing shall be accepted by the Engineer, prior to final pavement restorations. Precautions shall be taken to prevent joints from drawing apart during tests. Any damage resulting from these tests shall be repaired by the Contractor. The manner and time of testing shall be subject to approval by the Engineer.

All wyes, tees, and stubs shall be plugged using test tees, or acceptable alternate, securely fastened to withstand the internal test pressure. Such test tees shall be readily removable, and their removal shall provide a socket suitable for making a flexible jointed lateral connection or extension.

Flexible pipe shall follow the deflection testing requirements of Section 7-17.3(4)H**.**

Testing of side Sewers including runoff and downspout connections shall comply with the requirements of Section 7-18.3(6).

Follow television inspection requirements in Section 7-17.3(4)I.

7-17.3(4)A1 PIPE NOT PASSING TESTING

If any pipeline installation fails to meet the requirements of the test method used, or is indicated as defective by television inspection, the Contractor shall determine the source or sources of leakage and shall replace all defective pipe. A new test method cannot be substituted to demonstrate passing, except with the written consent of the Engineer.

Should the Contractor believe the pipe which is damaged, or which failed the test, can be repaired by other than remove and replace, the Contractor shall submit a repair method for approval by the Engineer, at least 5 Working Days in advance. Replacement or repair of defective pipe shall not commence until the Contractor has received approval of the method from the Engineer. The replaced, or repaired pipe, shall again be inspected and tested.

All lateral or side Sewer branches included in the test section shall be taken into account in computing allowable leakage.

Upon final acceptance of the Work, all Sewers, side Sewers and fittings shall be open, clean, and free draining.

7-17.3(4)B EXFILTRATION TEST

Prior to making exfiltration leakage tests, the Contractor may fill the pipe with clear water to permit normal absorption into the pipe walls, provided that after filling the pipe the leakage test is completed within twenty-four hours. When under test, the allowable leakage shall be limited according to the provisions that follow. Specified allowances assume pre-wetted pipe.

Leakage shall be no more than 0.28 gallons per hour ("gph") per inch inside diameter ("inch dia") per 100 linear feet ("LF") of pipe, with a hydrostatic head of 6 feet above the crown at the upper end of the test section, or above the natural groundwater table at the time of test, whichever is higher. The length of pipe tested shall be limited so that the pressure at the lower end of the section tested does not exceed 16 feet of head above the invert, and in no case shall the length be greater than 700 linear feet or the distance between maintenance holes when greater than 700 linear feet.

Where the test head is other than 6 feet, the measured leakage shall not exceed 0.28 gph per inch inside diameter per 100 linear feet times the ratio of the square root of the test head to the square root of 6.

Leakage maximum = $0.28 \times \frac{\sqrt{H}}{\sqrt{6}} = 0.114 \times \sqrt{H}$ where leakage is in gph/inch dia/100 LF.

When the test is to be made one joint at a time, the leakage per joint shall not exceed the computed allowable leakage per length of pipe.

An allowance of 0.2 gallons per hour per foot of head above invert shall be made for each maintenance hole included in a test section.

All pipe and detention systems in, or near as indicated in the Contract, Environmentally Critical Areas designated geologically hazardous areas, shall require exfiltration testing. Approval will not be given unless the detention system passes this test. The Contractor shall notify the Engineer at least 5 Working Days in advance of proposed testing.

7-17.3(4)C INFILTRATION TEST

Infiltration test leakage shall not exceed 0.16 gallons per hour (gph) per inch inside diameter (inch dia) per 100 linear feet (LF) of pipe tested, when the natural groundwater head over the pipe is 2 feet or less above the crown of the pipe at the upper end of the test section. The length of pipe tested shall not exceed 700 linear feet or the distance between maintenance holes when greater than 700 linear feet.

Where the natural groundwater head is more than 2 feet, the measured leakage shall not exceed 0.16 gph per inch inside diameter per 100 linear feet times the ratio of the square root of the natural groundwater head to the square root of 2.

Leakage maximum $= 0.16 \times \frac{\sqrt{H}}{\sqrt{2}} = 0.114 \times \sqrt{H}$ where leakage is in gph/inch dia/100LF.

When a suitable head of groundwater exists above the crown of the pipe and when the pipe is large enough to perform work inside it, acceptance may be based on there being no visible leakage. Where leakage is indicated, the repair methods shall be submitted in writing to the Engineer by the Contractor for approval (see Section 7-17.3(4)A1).

7-17.3(4)D AIR PRESSURE TEST

Air pressure testing shall be conducted after the pipe has been backfilled and prior to paving.

Pipe with inside diameter of 42 inches and less may be tested from maintenance hole to maintenance hole or on shorter lengths at the Contractor's option. Pipe greater than 42 inches in diameter shall have all joints tested individually and in consecutive order along the entire line.

The test equipment to be used shall be furnished by the Contractor and shall be inspected and approved by the Engineer prior to use. The Engineer may at any time require a calibration test of gauges, other instrumentation, and equipment that is used for this test.

Safety Provisions. Plugs used to close the Sewer pipe for the air test shall be securely braced to prevent the unintentional release or loosening of a plug. Gauges, air piping manifolds, and valves shall be located at the ground surface. No person shall be permitted to enter a maintenance hole where a plugged pipe is pressurized. (Four pounds per square inch gauge (psig) air pressure develops a force against the plug in a 12 inch diameter pipe of approximately 450 pounds, and over 5,000 pounds in a 42 inch diameter pipe. Plug failure may result in injury.) Air testing apparatus shall be equipped with a pressure release device designed to relieve pressure in the pipe at a pressure recommended by the pipe manufacturer. The Contractor shall submit the pipe manufacturer's recommendations to the Engineer including the safety precautions for pipe testing.

7-17.3(4)D1 TEST TIME

Table 1 shows the required test time, T, in minutes/100 feet of pipe for each nominal pipe. Test times are for a 1.0-psi pressure drop from 3.5 to 2.5 psi. If a 1 psi drop does not occur within the test time, the line has passed. If the pressure drop is more than 1 psi during the test time, the line has failed the test.

Minimum Test Time for Pipe Sizes 4" to 42"

Nominal Pipe Size, in	*T* (time) min/100 ft	Nominal Pipe Size, in	*T* (time) min/100 ft
4	0.3	21	3.0
6	0.7	24	3.6
8	1.2	27	4.2
10	1.5	30	4.8
12	1.8	33	5.4
15	2.1	36	6.0
18	2.4	39	6.6
		42	7.3

To calculate test times or allowable air loss for nominal pipe sizes not in the minimum test time table, the Contractor has the option to calculate test times and allowable air loss, or to use the time associated with the next higher pipe size in the table.

Calculate the required test time at a given allowable air loss as follows:

T = K ×(D2L/Q)

Calculate air loss with a timed pressure drop as follows:

Q = K ×(D2L/T)

Symbols:

D = nominal size, inches,

K = 0.371 × 10−3 for inch-pound units,

L = length of line of one pipe size, ft,

Q = air loss, ft3/min, and

T = time for pressure to drop 1.0 psi, min.

7-17.3(4)D2 GENERAL PROCEDURE FOR CONDUCTING ACCEPTANCE TEST BY PRESSURE DROP METHOD

1. Plug all pipe outlets with suitable test plugs. Brace each plug securely.
2. All gauge pressures in the test should be increased by the amount of groundwater pressure at the center of the pipe.
3. Add air slowly to the portion of the pipe installation under test until the internal air pressure is raised to 4.0 psig.
4. After an internal pressure of 4.0 psig is obtained allow at least 2 minutes for air temperature to stabilize, adding only the amount of air required to maintain pressure.
5. After the 2 minute period, disconnect air supply.
6. When pressure has decreased to 3.5 psig, start stop watch. Determine the time in seconds that is required for the internal air pressure to reach 2.5 psig. This time interval should then be compared with the time required by Specification 7-17.3(4)D1.
7. If the pressure has not dropped to 2.5 psig in the time required by Specification 7-17.3(4)D1, then the test may be terminated and the test section has passed the low pressure air test.

7-17.3(4)E RESERVED

7-17.3(4)F HYDROSTATIC TEST FOR SEWER FORCE MAINS

7-17.3(4)F1 GENERAL

All force mains and appurtenances shall be subjected to hydrostatic pressure testing as soon as possible after they are installed and backfilled.

7-17.3(4)F2 EQUIPMENT

The Contractor shall furnish the following equipment for the hydrostatic tests:

Amount	Description
2	Approved graduated containers
2	Pressure gauges
1	Hydraulic force pump approved by the Engineer
	Suitable hose and suction pipe as required

Pressure gauges shall be calibrated within 6 months of hydrostatic testing. The Contractor shall provide a Manufacturer's Certificate of Compliance stating the date of calibration of the pressure gauge to be used within 2 Working Days.

7-17.3(4)F3 PROCEDURE

Clean water or approved reclaimed water shall be used as the hydrostatic test fluid. All parts of the piping system shall be subjected to a minimum test pressure of 50 psi plus pressure head required to overcome pumping height.

Where any section of pipe is provided with concrete thrust blocking, do not make the pressure test until at least 5 Days have elapsed after the thrust blocking is installed. If high-early cement is used for thrust blocking, the time may be reduced to no less than 2 days.

The Contractor shall provide all temporary plugs, caps, and thrust blocking and all closure sections and couplings required to test the pipeline in sections at the specified test pressure.

7-17.3(4)F4 DURATION

The duration of each pressure test shall be a minimum of 1 hour. A leakage test of at least 2 hours duration shall immediately follow the pressure test.

7-17.3(4)F5 EXPELLING AIR AND FILLING PIPE

Before applying the specified test pressure, expel all air from the pipe by slowly filling the pipe with water and allow to stand for 48 hours prior to testing.

7-17.3(4)F6 PRESSURE TEST

Test pressures shall be applied by means of a pump connected to the pipe. Apply the test pressure and operate the pump as necessary to maintain the test pressure at its full value for the entire duration of the pressure test.

Before applying the specified test pressure, expel all air from the pipe by slowly filling the section of pipe to be tested with water and allow to stand for 48 hours prior to the start of testing under slight pressure. The duration of each pressure test shall be 1 hour. A leakage test of 2 hours duration shall immediately follow the pressure test.

7-17.3(4)F7 LEAKAGE TEST

For the leakage test, the pump suction shall be in a barrel or similar device or metered so that the quantity of water put into the pipeline can be accurately measured. Apply the test pressure and operate the pump as necessary to maintain the pressure in the pipeline at a minimum of 90 percent of the test pressure for the entire duration of the leakage test. At the end of the test period operate the pump until the test pressure is again attained. Leakage shall be defined as the quantity of makeup water required to maintain the pipeline pressure during the test and to restore the test pressure at the end of the test

period. No pipe installation will be accepted if the leakage is greater than the number of gallons per hour as determined by the following formula:

$$L = \frac{ND(P)^{1/2}}{1850}$$

In the above formula:
- L = Allowable leakage, in gallons per hour
- N = Number of joints in the length of pipe tested.
- D = Nominal diameter of pipe, in inches.
- P = Average test pressure during the leakage test, in pounds per square inch gauge.

Should any test of pipe disclose leakage greater than that allowed, locate and repair the defective joints or pipe until the leakage from subsequent testing is within the specified allowance. The Contractor shall submit the method of repair to the Engineer for approval at least 3 Working Days in advance.

7-17.3(4)F8 CORRECTION OF EXCESSIVE LEAKAGE

Should any test of pipe disclose leakage greater than that allowed, locate and repair the defective joints or pipe until the leakage from subsequent testing is within the specified allowance. The Contractor shall submit the method of repair to the Engineer for approval at least 3 Working Days in advance.

7-17.3(4)G RESERVED

7-17.3(4)H DEFLECTION TEST FOR FLEXIBLE PIPE

All Sewer and Storm Drain constructed of flexible pipe shall be tested for vertical deflection no less than 30 Days after trench backfill and compaction have been completed, and before pavement restoration. No diameter of the installed pipe shall exceed a tolerance of more than 5 % for 12 inch and smaller nominal diameter pipe, and by no more than 3% for all larger than 12 inch nominal diameter pipe and less than or equal to 30 inch nominal diameter pipe.

For pipes less than or equal to 30 inches nominal diameter, a mandrel shall be pulled through the pipe by hand to ensure that the maximum allowable deflection has not been exceeded. Prior to use, the mandrel shall be measured, inspected for roundness, and certified as being sound and accurate. A Manufacturer's Certificate of Compliance stating the mandrel to be used meets these Specifications, shall be submitted to the Engineer at least 1 Working Day prior to the test. The use of an uncertified mandrel or a mandrel altered or modified after certification will invalidate the test, and a 2 Working Day advance notification to the Engineer of a retest with a certified mandrel shall be complied with. If the mandrel fails to pass through the pipe, the pipe will be deemed overdeflected and unacceptable.

Pipe large enough for a person to work inside it may be accepted on the basis of direct measurements rather than using a mandrel. The Contractor shall submit a method for making deflection measurements including the measurement device(s), how the measurement device(s) is verified as providing reasonably repeatable results, how "mark points" will be placed on the pipe for the deflection measurements, and how the measurement data at each test location is presented to demonstrate that any indicated deflection is within the tolerances allowed. The Engineer reserves the right to determine the number of measurements and the orientations of each measurement at each test location. The minimum number of orientations per test location shall be 3 in equal angle projections (3 orientations at 0°, 60°, and 120°). The Engineer also reserves the right to determine the number of test locations. The minimum number of test locations on any single section of pipe shall be no less than 2, and in no case shall there be less than 3 pipe sections tested, and no less than 3 pipe sections tested per any 100 foot length of pipeline.

Testing shall be conducted on a maintenance hole-to-maintenance hole basis after the line has been thoroughly flushed with water. If testing reveals an overdeflected pipe, it shall be uncovered and, if not damaged from overdeflection or from excavation activities, the pipe may be corrected and reinstalled. If the pipe requires repair, the Contractor shall submit the proposed repair to the Engineer for approval at least 3 Working Days before making the repair. The Contractor shall also provide prior to performing the repair, a Manufacturer's Certificate of Compliance stating that the overdeflected pipe as repaired shall acceptably perform as required by the Specifications. If no repair is recommended, the Contractor shall state that the pipe requires no repair including the reason why the pipe requires no repair, and shall also provide a Manufacturer's Certificate of Compliance stating that the pipe without repair shall acceptably perform as required by the Specifications. Any pipe damaged beyond reasonable repair, due to overdeflection or from any other cause, shall be uncovered and removed from the Project Site and replaced with a new pipe at no cost to the Owner.

The mandrel shall:

1. Be a rigid, nonadjustable, odd-numbering-leg (9 legs minimum) mandrel having an effective length not less than its nominal diameter;
2. Have a minimum diameter at any point along the full length as follows:

Minimum Mandrel Diameter (inches)	Pipe Material	Nominal Size (Inches)
5.619	PVC ASTM D 3034 (SDR 35)	6
7.524		8
9.40		10
11.91		12
13.849		15
16.924	PVC ASTM F 679 (T-1 Wall)	18
19.952		21
22.246		24
25.29		26
28.502		30

3. Be fabricated of steel, be fitted with pulling rings at each end, be stamped or engraved on some segment other than a runner indicating the pipe Material, Material specification, nominal pipe size, and mandrel OD (e.g., PVC, ASTM D 3034, 8 inch, 7.524 inch); and be furnished in a suitable carrying case labeled with the same data as stamped or engraved on the mandrel.

7-17.3(4)I TELEVISION INSPECTION WITH AUDIO ASSESSMENT

After all maintenance holes (MH) have been rechanneled, excavations backfilled with all mineral aggregates and before pavement, the Contractor in the presence of the Engineer, shall perform television inspection of the interior of all mainline Sewer and Storm Drain pipe larger than 6 inches in diameter and all catch basin connection pipe. Seattle Public Utilities will review the television inspection to determine acceptance of this portion of the Work. Pipe larger than 48 inches may also be inspected visually by Seattle Public Utilities, after cleaning and successful testing by the Contractor. Side Sewer and inlet connection pipe will not require television inspection.

Upon written notice by the Engineer, the Contractor shall promptly conduct a second television inspection meeting specified requirements, and shall submit a second recording at no additional or separate cost to the Owner.

Personnel Qualifications: Personnel performing television inspection shall have completed the Pipeline Assessment and Certification Program (PACP). Contractor shall submit said certification to the Engineer at least 3 Working Days in advance of the first television inspection.

Camera Equipment: The camera shall be a 360-degree radial view color television camera (also known as "pan and tilt") with a mechanical footage counter calibrated to indicate video footage consistent with distance traveled in the pipe. Footage shall be zeroed at centerline structure (maintenance hole, vault, etc.) where the video begins and footage shall increase as it travels forward, and decrease when backward camera movement is required. Footage shall be displayed on the video recording and be mentioned on the audio portion (see “audio commentary on recording”). Correct adjustment of the recording apparatus and monitor shall be demonstrated by use of the test video or other device approved by the Engineer. Satisfactory performance of the camera shall be demonstrated by the recording of the appropriate test device at the commencement of each day for a minimum period of 30 seconds [over a minimum of fifteen feet].

Light Source: The camera shall have a light source providing adequate illumination to clearly identify invert, crown, joints, sides, connections, and infiltration/exfiltration. Illumination shall be capable of providing adequate illumination to at least 15 feet in front of the camera.

Camera travel in the pipe: All mainline inspections shall be from the downstream MH (DSMH) to the upstream MH (USMH). The camera shall be positioned to reduce the risk of picture distortion. In circular pipes the camera lens head shall be positioned centrally within the pipe. The camera shall travel along pipe invert to provide the best view of the crown, invert, connections and sides of the pipe, and shall travel at a speed no faster than 25 feet per minute.

Audio commentary on recording: Commentary shall be objective and shall be based on PACP defined assessment conditions. Audio shall be intelligible and shall be as free from interference and background noise as can reasonably be done. Subjective comments (such as “the fault of”, “caused by”, and opinion, etc.) shall not be used. Comment shall include the footage location of the comment, each connection, the starting and ending structure, indicated flaws, areas of infiltration/exfiltration, open joints, outfall, and other features as may be necessary.

Required Labeling on recording and in audio commentary: Each recording shall have audio accompaniment and shall address a single run of pipe between two (2) structures (maintenance holes, vaults, catch basin, tee, or ending in an outfall, etc.) on a single DVD-R disc. The recording shall contain a legible label that clearly states the following, and the audio commentary shall begin with the following:

a. Date and time of day television inspection performed;

b. Names of television inspection crew members;

c. Project name, vault plan number listed on Drawings, and Drawing sheet number;

d. Location with structure labels (for example – maintenance hole 25, vault 2, outfall, etc.), camera travel direction, size of pipe, pipe material (such as "Broad Street, 5th Ave west to midblock, maintenance holes 24 to 25, going upstream, 24 inch reinforced concrete pipe"); and

e. a unique identification number, with these numbers being in consecutive sequence on all DVD-R discs of Project pipe.

Recording quality and characteristics: Television inspections shall be submitted on DVD-R discs. All inspections should be done in a PACP format, with uploadable capability to the SPU Granite database. (Contact SPU for specific database requirements)

1. At the start of each pipe length being surveyed or inspected and each reverse set-up, the length of pipeline from zero footage, the entrance to the pipe, up to the cable calibration point shall be recorded and reported in order to obtain a full record of the pipe length. Only one survey shall be indicated in the final report. All reverse set-ups, blind maintenances, and buried maintenance holes shall be logged on a separate log.
2. The footage reading entered on to the data display at the cable calibration point shall allow for the distance from the start of the survey/inspection to the cable calibration point such that the footage at the start of the survey is zero.
3. At the start of each pipe, a data generator shall electronically generate and clearly display on the viewing monitor and subsequently on the DVD-R recording a record of data in alphanumeric form containing all fields required by the PACP information standard including MH depths.
4. The size and position of the data display shall be such as not to interfere with the main subject of the picture and centered on the viewing screen with white lettering against a black background.
5. Once the survey of the pipe is under way, the following minimum information shall be continually displayed:
   a. Automatic update of the camera's footage position in the pipe line from adjusted zero.
   b. Pipe dimensions in inches
   c. MH-to-MH reference numbers.
   d. Direction of survey, i.e., downstream (D) or upstream (U).
   e. Date
6. Footage and corresponding time elapsed video read out shall be given throughout survey/inspection for all relevant defects and construction features encountered unless otherwise agreed. All continuous defects shall incorporate a start and finish abbreviation in the log report.
7. Recording of a single segment of pipe shall not extend over more than one DVD-R disc. A completed inspection shall be continuous between MH's. An inspection from different directions and overlapping shall not be acceptable.

Required Pre-Notification: The Contractor shall notify the Engineer at least 3 Working Days in advance of the first television inspection.

Pre television inspection preparation: Television inspection shall be performed prior to allowing mainline flow into the pipe from upstream sources. Upstream bypass, when used, shall accommodate television inspection to afford full visibility of pipe inverts (see Section 7-17.3(2)K). See section 7-17.3(4) for pressure testing requirements.

Required Extra Inspection: At all lateral connections, areas of indicated infiltration/exfiltration, open joints, indicated pipe deflection, defects of any kind, and as the Engineer may request, shall require the camera to slow down and fully focus on such areas including having the camera slowly travel backward and forward for multi-directional views. Said areas shall require focused video inspection of not less than 5 seconds. Cameras with telescoping ability shall view the area by telescoping in and out as appropriate for the Engineer to evaluate the condition with certainty.

Reinspection: Should television inspection reveal defective work, the Contractor shall, upon written notice from the Engineer, correct said defects. An additional television inspection ("reinspection") shall then be taken of the corrected pipe run to verify the corrected pipe meets Specifications. The audio portion on this recording shall indicate the same information as specified in "Required Labeling on recording and in audio commentary" also stating "this is an additional television inspection to verify corrections at ___ footage location". Such reinspection shall be considered in accordance with Section 1-05.7.

Temporary breakdowns: Should an occurrence such as camera breakdown or inability to perform as specified, or other condition arise where no camera or television or audio progress can be made, after the initial 30 seconds of such condition, the operator shall make comment on the audio of such condition and the footage location, then shall shut down the camera and the audio. Upon fixing such a condition, the video and audio shall be restarted and the audio shall include a comment to the effect "_____ condition fixed and video and audio restarting at ____ footage location".

Contractor to provide: DVD-R discs of specific pipe lengths shall be furnished to the Engineer within 5 Working Days of each television inspection for acceptance by SPU. All DVD-R discs shall become the property of the Owner. Not more than 6 DVD-R discs shall be provided to the Engineer per day.

7-17.4 MEASUREMENT

Bid items of Work completed pursuant to the Contract will be measured as provided in Section 1-09.1, Measurement of Quantities, unless otherwise provided for by individual measurement paragraphs herein this Section.

Measurement for "Bedding, (Class), (Size) Pipe" and for Sewer, Culvert, and Storm Drain as shown on Standard Plan no. 285, and for Water Main as shown on Standard Plan no. 350, will be by the linear foot of pipe actually installed. For Sewer and Storm Drain, measurement will be from center to center of standard maintenance holes or to the inside face of other Structures. For Water Main, measurement will be to inside face of Structure, to end of pipe, or to centerline of connecting tee. Class D bedding will not be measured. Bedding beyond neatlines shown on the Standard Plans will not be measured.

Measurements for "Pipe, (Use), (Material), (Class), (Size)", , and for "Pipe, (Use), (Material), (Class), (Size), (Trenchless Construction Method)" for other than directional drilling will be by the linear foot of pipe actually installed and successfully tested, and shall be along the centerline of the pipe through the tees or wyes with the exception of pipe ending at a tee or wye. Measurements will be to the center of new maintenance hole or rechanneled existing maintenance hole; or to the inside face of Structure or existing maintenance hole not rechanneled; or to the end of pipe where it meets a maintenance hole stub; or to a wye, or to a tee whether with stub or cut-in. Measurement will be to the nearest 0.1 foot. See Standard Plan no. 010.

Measurement for "Casing Pipe, (Class), (Size), (Construction Method)" will be by the linear foot of pipe actually installed.

Measurement for "Tee, (Material), (Size)" and for "Tee, (Size), Cut-In Existing (Material) Pipe", will be per each where "size" applies to the size of the pipe fitting into the tee branching off the mainline pipe as shown on Standard Plan no. 010, and "Material" is the Material of the mainline pipe with the branching tee.

Measurement for "Temporary Sewer Bypass" will be by lump sum.

Measurement for "Television Inspection" will be for the linear feet of installed mainline Sewer and Storm Drain pipe larger than 6 inches in diameter and all catch basin connection pipe videotaped once during final inspection. Measurement will be made along the pipe centerline through tees from (1) center to center of new or rechanneled maintenance holes, or (2) to the inside face of Structures or maintenance holes not channeled, or (3) to the end of pipe where it dead ends beyond maintenance holes, or (4) from the catch basin to the mainline pipe, or (5) from the flow control structure to the mainline pipe.

Measurement for "Extra Excavation" will be per Section 2-04.

Measurement for foundation Material will be by the cubic yard of Mineral Aggregate required to fill the void made by extra excavation and shall be based on neat line width of trench and depth and length as computed by the Engineer.

Measurement for protective system will be in accordance with Section 2-07.4.

Measurement for "Mineral Aggregate, (Type)" will be by the cubic yard based upon the neat line trench pay width as specified in Section 7-17.3(1) and the Standard Plans, or other neatline dimensions when designated by the Engineer. Imported Mineral Aggregate used beyond these neat line limits shall be at the Contractor's sole expense.

7-17.5 PAYMENT

Compensation for the cost necessary to complete the work described in Section 7-17 will be made at the Bid item prices Bid only for the Bid items listed or referenced as follows:

1. "**Bedding, (Class), (Size) Pipe",** per linear foot.

The Bid item price for "Bedding, (Class), (Size) Pipe" shall include all costs for the work required to furnish and install bedding. Cost of Class D bedding shall be included in the Bid item for the pipe Bid item and therefore no separate or additional payment will be made.

2. "**Pipe, (Use), (Material), (Class), (Size)",** per linear foot.

The Bid item price for "Pipe, (Use), (Material), (Class), (Size)" shall include all costs for the work required to furnish and install the pipe of the type and size specified, and including the following:

a. trench excavation, haul, stockpile and or disposal of soil, backfill, and compact suitable native Material backfill,
b. handling; hauling, storage, removal; off-site disposal of excess suitable and unsuitable excavated native material, or hauling, storage, placement of suitable excess excavated native material elsewhere on the Project Site except where designated for embankment construction,
c. dewatering of the trench,
d. required trench excavation, backfill, and compaction,
e. cleaning and testing per Section 7-17.3(4), except separate payment shall be made for Television Inspection per 7-17.3(4)I
f. Class D bedding,
g. pipe coupling, and
h. removal and disposal of existing pipe within trench neatline limits when pipe replacement is called for in the Contract.

All costs in connection with excavating test pits and for standby time during field density tests for compaction shall be considered as included in the Bid item prices for the applicable pipe Bid items.

Unauthorized excavation below the established trench grade shall be made good by the Contractor at the sole expense of the Contractor by providing, placing and compacting suitable Material to the proper grade elevation as specified in Section 2-09.3(1).

Cost for the work of cleaning, testing, and furnishing and installing caps and plugs for the tests shall be included in the Bid item prices of the pipe Bid items.

Costs for the work required in proof testing the pipe shall be considered included in the Bid item prices for the appropriate pipe Bid items.

Any damage resulting from testing of the Sewers and appurtenances specified in Section 7-17.3(4)A shall be made good by the Contractor at the Contractor's sole expense.

All costs of determining the source or sources of leakage and the cost to repair or replace the Sewer found defective as specified in Section 7-17.3(4), shall be borne by the Contractor in accordance with Section 1-05.7

If the pipe fails the deflection test as specified in Section 7-17.3(4)H, all costs to locate and repair the failed sections and retest the pipe shall be borne by the Contractor in accordance with Section 1-05.7.

All costs for the work required to furnish and install joint coupling devices as specified in Section 7-17.3(2)F shall be considered as included in the Bid item prices for the pipe Bid items.

3. "**Casing Pipe, (Material), (Class), (Size), (Construction Method)",** per linear foot.

The Bid item price for "Casing Pipe, (Material), (Class), (Size), (Construction Method)" for other than directional drilling shall include all costs for the work required to furnish and install casing pipe as specified in Section 7-17.3(2)J, including installation and removal of shoring of any access pit.

Payment for directional drilling installation will be as specified in Section 2-16.5.

4. "**Pipe, (Use), (Material), (Class), (Size), (Trenchless Construction Method)",** per linear foot.

The Bid item price for "Pipe, (Material), (Class), (Size), (Trenchless Construction Method)" for other than directional drilling shall include all costs for the work required to furnish and install the pipe as specified in Section 7-17.3(2)J. Bid item price shall also include the cost for furnishing and installing pipe skids, casing spacers, and pipe end seals. All cost for filling the annular space, when required in the Contract, shall be incidental to this Bid item and no separate or additional payment will be made.

Payment for directional drilling installation will be as specified in Section 2-16.5.

5. "**Tee, (Material), (Size)",** each.

The Bid item price for "Tee, (Material), (Size)" shall include all costs for the work required to furnish and install the tee including plug when required.

6. "**Tee, (Size), Cut-In Existing (Material) Pipe**", each.

The Bid item price for "Tee, (Size), Cut-In Existing (Material) Pipe" shall include all costs for the work required to furnish and install the tee as specified in Section 7-17.3(2)C3. If Seattle Public Utilities installs a tee, no payment will be made.

7. **"Temporary Sewer Bypass",** per lump sum.

The Bid item price for "Temporary Sewer Bypass" shall include all the work required to bypass Sewer flow around the construction work.

8. "**Television Inspection**", per linear foot.

The Bid item price for "Television Inspection" shall include all costs for the work required for television inspection of mainline Sewer and Storm Drain pipe larger than 6 inches in diameter, and all catch basin connection pipe. Costs shall also include furnishing an acceptable DVD-R disc to the Engineer for each segment of pipe. Costs for additional television inspections necessary to verify corrections or replacement of pipe or done solely for the Contractor's convenience shall be borne by the Contractor.

The cost for the Owner's labor and equipment for the videotaping during the final acceptance process and the videotaping 6 to 11 months later to recheck the pipe condition will be borne by the Owner unless additional videotape inspection is necessary to verify corrections or replacement of deficient pipe. The cost of additional television inspection, and cleaning in preparation for television inspection, to verify repairs or replaced pipe shall be borne by the Contractor. The Contractor shall also be responsible for all costs incurred in any television inspection performed solely for the benefit of the Contractor.

If the Contractor calls for an initial TV inspection, and the pipe is not clean or has so many deficiencies that the line cannot be fully inspected, the reinspection will be charged to the Contractor, and the cost withheld from money due to the Contractor.

9. **Other payment information**.

See Section 2-07 for payment of information on protective systems.

Where unauthorized excavation has been made which increases the established trench depth beyond 4 feet, the Contractor shall meet the requirements specified for Protective Systems in Section 2-07 at no additional cost to the Owner.

Payment for imported Material when ordered in lieu of native backfill Material by the Engineer will be paid as "Mineral Aggregate, (Type)", or other imported Material acceptable to the Engineer.

Foundation Material when required will be paid as "Mineral Aggregate, (Type)" per cubic yard, per Section 4-01.5.

Where the Engineer determines that the existing foundation is unsuitable, and foundation Material specified by the Engineer is not in the Contract and no Bid item for "Mineral Aggregate, (Type)" is included in the Bid Form, payment will be made in accordance with Section 1-04.1(2).

The Contractor shall provide all necessary water for construction and testing purposes (see Section 2-12).

No separate or additional compensation will be made for submittals, or for Material used in the jacking operations or for the cost of the backfilling operations, including compaction.

Payment for plugging pipes will be in accordance with Section 2-02.5.

Payment for "Selected Material" will be in accordance with Section 2-10.5.

The Contractor shall, at the Contractor's sole expense, provide pipe of increased strength classification or place a class of bedding of higher load bearing capacity, as required by the Engineer, when the maximum trench width specified in Section 2-04 is exceeded by the Contractor without prior written approval of the Engineer. The Contractor shall furnish and install any approved imported backfill Material required outside the trench neat line limits at no additional cost to the Owner.

SECTION 7-18 SIDE SEWERS

7-18.1 DESCRIPTION

Section 7-18 describes work consisting of locating and placing Side Sewer, locating tees, and testing of side Sewer. This Section also accommodates private construction in the Right of Way under permit by DPD and SDOT Street Use.

Side Sewer shall be considered as pipe labeled as "side sewer", or "combined side sewer" or "service drain" as addressed in Title 21 Seattle Municipal Code and applicable Director's Rules. All privately owned and operated drainage control facilities or service drain facility, whether or not they discharge to a public facility shall be considered Side Sewer. Side Sewer does not include internal building piping or connecting appurtenances.

7-18.2 MATERIALS

Materials for side Sewer shall meet the requirements of the following Sections:

Pipe	9-05
Pipe Bedding & Trench Backfill	2-10

Side Sewer in Right Of Way shall be not less than 6 inches inside diameter unless otherwise specified in the Contract.

All pipe shall be clearly marked with type, class, date of manufacture, location of manufacturing plant, and/or thickness, as applicable. Marking shall be legible and permanent on the outside surface of the pipe, and shall be able to withstand normal wear due to handling and storage.

Approved jointing shall be flexible gasketing. Flexible gasketing shall be construed to include rubber, synthetic rubberlike and plastic Materials specially manufactured for the joint, pipe size, and use intended and shall be furnished by the manufacturer of the pipe to be used.

Mortared joints will not be allowed.

Tees, wyes, couplers, and adapters shall conform to the requirements of this Section.

Bends and transition sections shall be as specified in the Contract.

Couplings to existing pipe and between dissimilar pipe shall be shall have stainless steel shielding to provide shear control.

Side Sewer that may be exposed to hot sewage, steam, or other extreme exposure shall be of a Material and with joints as specified in the Contract, and shall meet the clearance requirements specified in Section 1-07.17(2).

7-18.3 CONSTRUCTION REQUIREMENTS

7-18.3(1) SIDE SEWER CONSTRUCTION

7-18.3(1)A GENERAL

This work shall also include excavation, backfilling and compaction as specified in Sections 2-04, 2-10 and 2-11.

Work in excavations over 4 feet deep shall comply with Section 2-07 Protective Systems.

Unless noted otherwise in the Contract, Side Sewer work within the Right-of-Way shall be performed by a registered side sewer contractor (RSSC).

Side Sewer installation shall be per Standard Plan no. 283.

Where Section 7-18 does not address specific construction requirements, the construction requirements for Sewer in Section 7-17 of these Standard Specifications shall apply.

Side Sewer location shown on the Drawings shall be subject to relocation in the field after construction starts to accommodate site specific conditions. Regardless of the Drawing location, the Contractor shall place the tee or wye branch in the main Sewer or Storm Drain at the location designated by the Engineer.

When the Work requires, the Engineer will establish the depth for the invert elevation of side Sewer at the Right-of-Way margin.

Side Sewer shall be installed in accordance with the clearance requirements specified in Section 1-07.17(2) and other code, law, and regulation.

Where it is necessary to break out an existing Side Sewer during construction due to grade conflict with a newly constructed pipeline, only new pipe shall be used in reconnecting the Side Sewer. New pipe shall be laid so as to minimize bends and as approved by the Engineer.

Separate Side Sewer documentation of all new, re-laid, replaced, or repaired pipe and fittings shall be per SMC 21 and applicable Director's Rules.

7-18.3(1)B RESERVED

7-18.3(1)C SIDE SEWERS SHOWN ON THE DRAWINGS

7-18.3(1)C1 PROTECTION OF EXISTING SIDE SEWER

See Section 1-07.16.

7-18.3(1)C2 REMOVE AND REPLACE EXISTING SIDE SEWER

When the Drawings call for removal and replacement of existing side Sewer, only new pipe shall be used to replace the removed pipe.

7-18.3(2) EXCAVATION, FOUNDATION PREPARATION, BEDDING, AND BACKFILL

Excavation, foundation preparation, bedding and backfill for side Sewer shall conform to the requirements of Division 2, except that bedding shall be limited to that required to hold the pipe in true alignment and to grade prior to backfill. The Contractor shall give the Engineer at least 2 Working Days advance notice for inspection and testing per Section 7-18.3(6) before covering the side Sewer.

7-18.3(3) PIPE INSTALLATION AND JOINTING

7-18.3(3)A GENERAL

Pipe installation and jointing, except as hereinafter provided, shall conform to the requirements of Section 7-17 and Chapter 21.16 of the Seattle Municipal Code.

7-18.3(3)B LINE AND GRADE

Side Sewer shall be installed to a line and grade between the main Sewer or Storm Drain tee branch or wye branch, and the Right of Way margin, so as to best serve the property relative to the following conditions, as approved by the Engineer:

1. Where a vacant property is level with or lower than the street grade, the invert elevation of the proposed side Sewer at the Right of Way margin shall be 1 foot higher than the elevation of the crown of the main Sewer or Storm Drain at the location of its tee or wye branch connection. See Standard Plan no. 283 for additional requirements.
2. Where an occupied property is situated at higher elevation than the street grade and where the slope of the proposed side Sewer is steeper than 50%, the maximum elevation of the side Sewer at the Right of Way margin will be established by the Engineer with due consideration for placing the side Sewer below the invert of any proposed Storm Drain pipe, unless conditions require otherwise. The clearance between the invert of an existing Storm Drain or Sewer and the crown of a side Sewer below it shall be not less than 6 inches. In either of these conditions, the end of the side Sewer at the Right of Way margin shall be placed deep enough to accommodate at least 2-1/2 vertical feet of compacted backfill between the crown of the pipe and finished grade at that point.
3. Side Sewer Pipe shall be installed on a grade not less than 2%

7-18.3(3)C PIPE INSTALLATION

Bell and spigot pipe shall be installed with the bell end facing up grade. All pipe installation shall start and proceed up grade from the point of connection at the Sewer or Storm Drain or other starting point.

Between fittings, pipe shall be installed in a straight line at a uniform grade.

7-18.3(3)D JOINTING – NEW PIPE TO EXISTING PIPE

Where joints cannot be made due to dissimilar pipe Material or mismatched wall thickness, the Contractor shall use a flexible gasketed coupling to make a watertight joint. **All couplings shall have flexible gaskets and stainless steel shielding.**

7-18.3(4) FITTINGS

All fittings shall be factory-produced and shall be designed for installation on the pipe to be used.

The maximum deflection permissible at any one fitting or joint shall not exceed the pipe manufacturer's recommendation, and in no case shall the deflection exceed 2 inches per foot at any joint or fitting. The maximum deflection of any combination of two adjacent fittings or joints shall not exceed 45 degrees (one-eighth bend). Should greater than 45 degree deflection be needed between adjacent joints or fittings, a straight pipe of not less than 2-1/2 feet in length shall be installed between such adjacent fittings or joints, unless either one of such fittings is a wye branch with a cleanout provided on the straight leg or such a wye branch fitting is substituted for a joint.

Side Sewer shall be connected to the tee or wye provided at the main Sewer or Storm Drain where such is available, utilizing approved fittings or couplings. Where no tee or wye is provided or available, connection shall be made by core drilling and installing a connection as specified in Section 7-17.3(2)C3.

When the Side Sewer material is ductile iron pipe and is connecting to a mainline by core drilling and an inserted tee, connection shall include a one foot long plain end by plain end section of ductile iron pipe inserted into the bell end of the tee

manufactured to accept ductile iron pipe. The one foot section shall be connected to the upstream pipe with a shielded flexible gasketed coupling.

The installation of side sewer to a vertical connection at the main Sewer or Storm Drain shall be as shown on Standard Plan no. 234.

7-18.3(5) CLEANOUTS

Refer to Section 7-19.

7-18.3(6) INSPECTION AND TESTING

7-18.3(6)A INSPECTION

As specified in Section 7-18.3(2) side Sewer covered without Engineer inspection shall be uncovered for inspection.

7-18.3(6)B TESTING

All newly installed side Sewer shall be tested after backfill. Side Sewer that is reconstructed or repaired to a length of 10 feet or more shall be tested for watertightness in accordance with Section 7-17.3(4)B. The only exceptions for no testing required shall be:

1. a new reconstruction of side Sewer consisting of a single length of pipe, and
2. existing side Sewer reconnected to the Sewer or Storm Drain.

Testing shall be performed in the presence of the Engineer in accordance with Section 7-17.3(4).

All side Sewer constructed in conjunction with main Sewer or Storm Drain construction, for purposes of testing as specified in Section 7-17.3(4), shall have a 6-inch tee fitting placed at the point where the side Sewer crosses the Right of Way margin as shown on Standard Plan no. 283. The tee opening shall be positioned perpendicular to the side Sewer slope.

When the new side Sewer is connected to a new main Sewer or Storm Drain installed under the same Contract, and the side Sewer is not tested simultaneously with the test of the main Sewer or Storm Drain, the Contractor shall furnish and place an additional 6-inch tee in the first length of pipe out of the tee on the main Sewer or Storm Drain so that an inflatable rubber ball can be inserted for sealing off the side Sewer and thus permit separate side Sewer and mainline tests.

When the new side Sewer is connected to an existing main Sewer or Storm Drain, the Contractor shall furnish and place 2 test tees as shown on Standard Plan no. 283 and as follows:

a) one immediately adjacent to the main Sewer or Storm Drain, and
b) a second at the Right of Way margin.

The ends of side Sewer and test tee openings shall be plugged watertight with Materials and by method acceptable to the Engineer.

Side Sewer installed with pipe extending beyond the Right of Way margin that includes other connection, such as runoff or downspout, and is associated with private construction under the inspection of DPD, shall not be part of the Contract, and may require testing of the entire side sewer system including pipe in the Right of Way.

7-18.3(7) MISCELLANEOUS REQUIREMENTS

7-18.3(7)A PIPE AND CONNECTIONS – PRIVATE PROPERTY

Side Sewer in utility easement shall not be less than 6 inch inside diameter. Side Sewer and/or service drain on private property shall be not less than 4 inches inside diameter. No roof drain, area drain, or subsurface drain shall be connected to a side Sewer which is connected to a separate main line sanitary only Sewer.

Private property roof drains or service drains in areas of mainline combined Sewer shall be run in a separate pipe (not combined with sewage) to the property line before connecting into the side Sewer.

7-18.3(7)B PROXIMITY TO OTHER UNDERGROUND FACILITIES

In private property, clearance between side sewer and/or service drain and water supply lines shall comply with WSDOH requirements and other applicable code and regulation.

In the Right of Way, side Sewer clearances shall be as specified in Section 1-07.17(2).

7-18.3(7)C PLUGS

In the Right of Way, unused side Sewer openings shall be securely sealed with a watertight plug fastened in place, as approved by the Engineer.

The only exception is private construction under permit from DPD and SDOT Street Use where unused side sewer openings in private property and side Sewer openings in the Right of Way, shall be closed with a watertight plug fastened in place as approved by DPD.

7-18.3(7)D SEPTIC TANKS AND CESSPOOLS – PRIVATE PROPERTY

No side sewer shall be constructed through or adjacent to an existing cesspool or septic tank. If site conditions prohibit any other location, the Contractor shall abate the cesspool or septic tank by such means as the DPD inspector may direct

7-18.3(8) RESTORATION, FINISHING, AND CLEANUP – PRIVATE CONSTRUCTION

Restoration, finishing, and cleanup due to private construction in Seattle's street Right of Way under Street Use permit and DPD permit, shall comply with the Street and Sidewalk Pavement Opening and Restoration Rules.

7-18.3(9) EXTENDING SIDE SEWER INTO PRIVATE PROPERTY

Extending side Sewer into private property shall not be part of the Contract and no such work will be allowed.

Unless authorized by Title 21 of the Seattle Municipal Code, private property owners who wish to extend side sewer into the Right of Way or connect with Sewer or Storm Drain, shall do so under permit with DPD and SDOT Street Use.

7-18.3(10) END PIPE MARKER

At the Right of Way margin, a 4 foot long 2-inch x 4-inch stake shall be buried to a 3 foot depth directly over the side Sewer. The exposed 1 foot of stake shall be painted traffic white, and the depth to the invert of the side Sewer from finish grade shall be painted legibly and with black permanent ink or other durable marking agent, on the exposed white portion of stake. The bottom of the stake shall have a 2-inch x 4-inch cleat securely nailed to the stake to prevent withdrawal of the buried stake. In addition, a 12 gauge galvanized wire shall be attached to the tee on the side Sewer, or to the plugged end of the side Sewer if no tee, and shall extend to 6 inches above finished grade at the stake and not attached to the stake.

7-18.4 MEASUREMENT

Bid items of Work completed pursuant to the Contract will be measured as provided in Section 1-09.1, Measurement of Quantities, unless otherwise provided for by individual measurement paragraphs herein this Section.

Measurement for "Pipe, (Use), (Material), (Class), (Size)" will be to the nearest 0.10 foot along the pipe from the tee or wye of the main Sewer or Storm Drain through tees, wyes and other fittings to the Right of Way margin as shown on Standard Plan no. 010, or to the end of pipe when the Contract or Engineer requires.

Measurement for "Tee, Test, (Material), (Size)" shall be per each.

Measurement for protective systems will be in accordance with Section 2-07.4.

7-18.5 PAYMENT

Compensation for the cost necessary to complete the work described in Section 7-18 will be made at the Bid item prices Bid only for the Bid items listed or referenced as follows:

1. **"Pipe, (Use), (Material), (Class), (Size)",** per linear foot.

The Bid item price for "Pipe, (Use), (Material), (Class), (Size)", shall include all costs for the work required to furnish all Material and Supplies necessary to install the side Sewer pipe of the type specified, including, but not limited to, the following:

a. trench excavation, haul, stockpiling, backfill and compaction of suitable native Material;
b. removal and disposal of excess and/or unsuitable excavated native Material;
c. dewatering of the trench;
d. removal and disposal of existing side Sewer pipe encountered in required trench excavation and backfill;
e. temporary bypass of sewage, including pumping,
f. cleaning and testing;
g. end pipe marker, plug, balloon; and
h. Class D Bedding
i. separate documentation per SMC 21 and applicable Director's Rules.

2. "**Tee, Test, (Material), (Size)",** per each.

The Bid item price for "Tee, Test, (Material), (Size)" shall include all costs for the work required to furnish, install, and remove as necessary the test tee.

3. **Other payment information**.

Payment for protective systems will be in accordance with Section 2-07.5.

Payment for "Tee, (Material), (Size)", for "Clay Dam", for "Bedding, CDF, (Size) Pipe", and for "Bedding, (Class), (Size) Pipe" will be in accordance with Section 7-17.5.

All cost associated with uncovering a side Sewer without Engineer inspection and all cost associated with re-constructing any portion of completed Work associated with the uncovering shall be at the Contractor's sole expense and no separate or additional payment will be made.

Remove and re-install side Sewer will be paid as "Pipe, (Use), (Material), (Class), (Size)".

No payment will be made for any expense associated with the Contractor installing an additional tee on the side Sewer and requiring separate tests for purposes of testing as specified in Section 7-18.3(6)B.

All costs relating to construction in private property, and to private construction in Seattle's Right of Way under the jurisdiction of DPD and SDOT Street Use, shall not be part of the Contract and no separate or additional payment will be made therefore.

SECTION 7-19 SEWER CLEANOUT

7-19.1 DESCRIPTION

Section 7-19 describes work consisting of the construction of sanitary Sewer cleanouts in accordance with Standard Plan no. 280 and as indicated in the Contract.

7-19.2 MATERIALS

All Materials incorporated into the total cleanout structure shall meet the requirements of the various applicable Sections of these Standard Specifications.

7-19.3 CONSTRUCTION REQUIREMENTS

A clean out shall be provided at locations shown on the Drawings. All cleanouts located in the Right Of Way shall be extended to finish grade and be locking clean outs.

And, on side Sewers, a cleanout shall be provided for each total change of 90 degrees in grade or alignment. In no case shall the spacing of cleanouts exceed 100 feet. No cleanout will be required at the connection of the side Sewer to a riser on the public Sewer. A suitably located cleanout in the house piping or plumbing may be considered as a cleanout for the side Sewer. Cleanouts shall consist of a wye branch in the side Sewer.

7-19.4 MEASUREMENT

Bid items of Work completed pursuant to the Contract will be measured as provided in Section 1-09.1, Measurement of Quantities, unless otherwise provided for by individual measurement paragraphs herein this Section.

Measurement for "Sewer Cleanout, (Size)" will begin at the wye branch and extend through the casting, as shown on Standard Plan no. 280.

7-19.5 PAYMENT

Compensation for the cost necessary to complete the work described in Section 7-19 will be made at the Bid item price Bid only for the Bid item listed or referenced as follows:

1. "**Sewer Cleanout, (Size)",** per each.

The Bid item price per each for "Sewer Cleanout, (Size)" shall include all costs for the work required for furnishing and installing the wye, Sewer pipe, pipe bands, pipe plug, casting, and concrete collar.

SECTION 7-20 ADJUSTMENT OF NEW AND EXISTING UTILITY STRUCTURES TO FINISH GRADE

7-20.1 DESCRIPTION

Section 7-20 describes work consisting of adjusting new and existing maintenance holes, catch basins, inlets, valve chambers, water meter boxes, handholes, and similar utility Structures encountered during the Work to a new grade elevation. The work shall include adjustment by removing and installing adjustment brick; by removing or adding a vertical riser section to the utility Structure; by removing and rebuilding a portion of the existing Structure; or by any combination of the preceding methods.

Publicly-owned utility Structures shall be adjusted to finished grade by the Contractor. Privately-owned utility agencies are responsible for all adjustments and relocations of their own facilities. The Contractor shall schedule the Work so that utility adjustments by others can be accomplished without undue delay.

The requirements of Section 7-20 apply to utility Structures constructed from precast concrete sections, masonry brick or blocks, and cast-in-place concrete.

Concrete pavement shall be reinforced around castings per Standard Plan no. 406 and Section 5-05.3(9) Castings and Steel Reinforcing Steel in Concrete Pavement.

7-20.2 MATERIALS

Material used in the adjustment of existing utility Structures shall meet the requirements for new construction specified in the Specification Section applicable to the item being adjusted.

7-20.3 CONSTRUCTION REQUIREMENTS

7-20.3(1) ADJUSTMENT OF MAINTENANCE HOLES, CATCH BASINS, AND SIMILAR STRUCTURES

7-20.3(1)A GENERAL

The Contractor shall establish approximate grade elevation for the tops of existing utility Structures requiring adjustment in accordance with Sections 1-05.4 and 1-05.5. The final alignment and grade elevation shall be established from adjacent roadway surfaces, forms, or such offset hubs as may be provided by the Contractor in accordance with section 1-05.4 and 1-05.5.

The Contractor shall remove the pavement around the casting; remove the casting and install or remove leveling or adjustment brick or block; or shall excavate around the utility structure, remove a portion of it as necessary and rebuild the structure to meet the new grade elevation. Pavement removal shall be kept to the minimum amount required to facilitate the adjustment. Adjustment of drainage Structure to finished grade elevation, by whatever method, shall result in a finished Structure meeting the requirements for new construction as specified in Section 7-05.3(1)P, Section 7-05.3(2)C or Section 7-05.3(2)D corresponding to structure type. The overall distance between the top of the casting to the bottom of the adjustment brick shall be not more than 26 inches.

Where a publicly owned casting adjustment is required and a new casting is shown on the Drawings, the Contractor shall furnish and install a new casting. When a new publicly-owned casting is not shown on the Drawings, the utility will be given the opportunity to provide a new casting for Contractor installation. The Contractor shall schedule the Work, so that the public utility has a minimum two (2) Days notice to provide castings. The new casting shall be fitted to the existing frame and ground to rest evenly and without rocking. When adjustment is made by adding or removing leveling bricks, all joints in the

bricks shall be filled with mortar and the casting seated in mortar on the top brick course. When bricks are added, installation shall be per Standard Plan no. 220, running bond pattern.

After the utility Structure has been adjusted to grade, and the Structure made watertight by plastering with mortar cement, all voids around the Structure shall be backfilled and compacted with imported Mineral Aggregate Type 17. The casting shall then be secured in place with a tapered layer of concrete or asphalt, as applicable.

The Contractor shall adjust to finish grade, water meter boxes encountered in the planting strip and sidewalk area.

Should adjustment to a water meter box necessitate adjustment or relocation of the water meter, the Contractor shall notify the Engineer at least five (5) Working Days in advance and the water meter will be adjusted or relocated by SPU Water Operations. The Contractor shall then make final adjustment of the meter box.

Maintenance holes, catch basins, and similar structures shall be raised or lowered to match the finished roadway grade. Structures flush with to no more than 3/8-inch below the finished roadway grade will be accepted by the Engineer. All structures in sidewalks, walkways and trails shall be flush. Utility adjustments not within these tolerances as determined by the Engineer will be considered defective work in accordance with 1-05.7..

7-20.3(1)B RESERVED

7-20.3(1)C CEMENT CONCRETE PAVING PROJECTS

Maintenance holes, catch basins and similar Structures shall be constructed or adjusted in the same manner as outlined in Section 7-20.3(1)A except that the final adjustment shall be made and the cast iron frame set after the forms have been placed and checked. In placing the concrete pavement, extreme care shall be taken not to alter the position of the casting in any way.

All Standard Plan nos. 230 and 361 castings (maintenance holes and valve chambers) installed in and requiring new concrete pavement or rigid concrete base pavement, shall comply with the reinforcing requirements of Standard Plan no. 406 and Section 5-05.3(9).

See Section 7-20.3(1)D for temporary transition tapers around exposed castings.

7-20.3(1)D ASPHALT CONCRETE PAVING PROJECTS

Utility Structures requiring adjustment of frames to match finish grade shall be adjusted prior to the start of the final paving operation.

The tops of existing utility Structure frames shall be raised or lowered to match the finish grade. Immediately after adjustment of the frame to finish grade in lanes that are to remain open to traffic, the Contractor shall install temporary asphalt or temporary pavement patch transition tapers around the Structure frame to prevent a nuisance to traffic. The Contractor shall maintain the asphalt tapers and shall furnish, install, and maintain warning signs and barricades in accordance with Sections 1-07.23 and 1-10. The Contractor shall remove the asphalt tapers immediately prior to the start of paving operations.

Inside surfaces of adjusted Structure frame and bricks or rings which are disturbed or damaged by the adjustment, as well as the new adjustment area, shall be mortared to give a smooth, watertight surface.

7-20.3(1)E ASPHALT RESURFACING PROJECTS

Adjustment of maintenance holes, catch basins, and similar Structures on asphalt resurfacing projects shall meet the requirements of Section 7-20.3(1)D.

7-20.3(2) ADJUSTMENT OF INLETS

The final alignment and grade of frames for new and old inlets to be adjusted to grade shall be established from the forms or from adjacent pavement surfaces. The final adjustment of the inlet frame shall be performed in similar manner to that described in Section 7-20.3(1)A and the adjacent roadway surface shall have the Drainage Transition Zone per Standard Plan no. 260a.

On asphalt concrete paving projects using curbs and gutters, that portion of the frame not embedded in the gutter section shall be solidly embedded in concrete. The concrete shall extend a minimum of 6 inches beyond the edge of the frame and shall be left 1-1/2 inches below the top of the frame so that the wearing course of asphalt concrete pavement butts against the frame. The existing concrete pavement and edge of the casting shall be painted with hot asphalt cement.

Adjustments in the inlet structure frame and frame extension shall be made in the same manner and of the same Material as that required for new inlets. The inside of the inlet frame and frame extension shall be plastered smooth.

7-20.3(3) ADJUSTMENT OF MONUMENTS, AND FRAME AND COVER

Monuments and monument castings shall be adjusted to grade in the same manner as in Section 7-20.3(1)A.

7-20.3(4) ADJUSTMENT OF VALVE BOX CASTINGS

Adjustment of valve box castings and Water Main castings shall be as specified in Sections 7-20.3(1)A and 7-20.3(5).

7-20.3(5) FURNISHING CASTINGS

Where adjustment of existing utility Structures is required and the Drawings indicate that the existing castings be replaced, the Contractor shall furnish new castings of the type specified on the Drawings. Casting shall include frame and grate, or ring and cover unless the Contract specifies otherwise. Salvaged castings shall be cleaned and delivered as specified in Section 2-02.3(7).

7-20.3(6) RESERVED

7-20.3(7) REPLACEMENT OF INLET GRATE

Where the Drawings indicate that existing inlet grates be replaced, the Contractor shall furnish and install the new grates. The inlet frame shall not be replaced.

7-20.4 MEASUREMENT

Bid items of Work completed pursuant to the Contract will be measured as provided in Section 1-09.1, Measurement of Quantities, unless otherwise provided for by individual measurement paragraphs herein this Section.

7-20.5 PAYMENT

Compensation for the cost necessary to complete the work described in Section 7-20 will be made at the Bid item prices Bid only for the Bid items listed or referenced as follows:

1. "**Adjust Existing Maintenance Hole, Catch Basin or Valve Chamber**", per each.
2. "**Adjust Existing Inlet**", per each.
3. "**Adjust Existing Monument Frame and Cover**", per each.
4. "**Adjust Existing Valve Box**", per each.
5. "**Adjust Existing Handhole**", per each.

The Bid item price for "Adjust Existing (Item)" shall include all costs for the work required to adjust the existing utility casting from original grade elevation to finished grade elevation with or without removing or adding adjustment bricks.

6. "**Utility Casting, (Type)",** per each.

The Bid item price for "Utility Casting, (Type)" shall include the costs for all work required to furnish and install new castings of the type specified in the Contract when existing castings are to be replaced.

When a maintenance hole is required to be rebuilt to accommodate a new casting, the cost of the utility casting shall be included in the price Bid for the Bid item "Rebuild (Item)" per Section 7-05.5 where "item" is "maintenance hole".

7. **"Install Casting, Utility Furnished**", per each.

The bid item price for "Install Casting, Utility Furnished," shall include all costs for the Work required to install and adjust to finished grade a casting provided by the utility owner.

8. "**Utility Casting, (Type), Grate"**, per each.

The Bid Item price for "Utility Casting, (Type), Grate" shall include all costs for the Work required to replace the inlet grate with specified grate. Costs shall not include replacing the frame. If the Engineer determines that the existing frame shall be replaced, the cost to replace the frame and grate shall than be paid as "Utility Casting, (Type)".

9. **"Utility Casting, (Type), Cover**", per each.

The Bid Item price for "Utility Casting, (Type), Cover" shall include all costs for the Work required to replace the utility cover with specified cover. Costs shall not include replacing the frame. If the Engineer determines that the existing frame shall be replaced, the cost to replace the frame and cover shall than be paid as "Utility Casting, (Type)".

10. **"Install Grate/Cover, Utility Furnished"**, per each.

The bid item price for "Grate/Cover, Utility Furnished," shall include all costs for the Work required to replace the utility grate or cover provided by the utility owner.

11. **Other Payment Information**.

Costs for adjustment to finish grade of water meter boxes excluding adjustment of the water meter itself; small castings other than inlet, catch basin, maintenance hole, valve chamber, handhole, monument, and water valve box; hydrant valve castings; and private and other public utility castings requiring coordination with the private or public casting owner, shall be included in the Bid item prices for the applicable Bid items and no separate payment will be made.

Mineral Aggregate ordered as backfill in lieu of native Material will be paid as "Mineral Aggregate, (Type)".

Restoration of the roadway surface shall be in accordance with the applicable Section covering the work involved.

The costs for asphalt or cement concrete used to secure castings prior to paving shall be considered incidental to the Work and no separate payment will be made.

All work required to adjust castings of all newly installed or rebuilt utility Structures to finished street grade shall be considered included in the Bid item prices of the Bid items for the appropriate type of utility Structure.

In asphalt resurfacing projects, as specified in Section 7-20.3(1)E, all costs to remove the asphalt concrete and/or concrete base, will be considered included in the Bid item price of the Bid items of work for adjusting the specified Structures.

SECTION 7-21 BIORETENTION

7-21.1 DESCRIPTION

Section 7-21 describes work consisting of the installation of bioretention soil in bioretention cells intended to receive surface water runoff for infiltration.

7-21.2 MATERIALS

Materials shall meet the requirements of the following sections:

Bioretention Soil	9-14.1(3)
Mineral Aggregate	9-03
Geotextile	9-37
Arborist Wood Chip Mulch	9-14.4(5)
Compost	9-14.4(8)

Unless otherwise specified, geotextile shall be Construction Geotextile for Separation, Nonwoven**.**

Unless otherwise specified or shown on the Drawings, aggregates for the discharge subbase gravel shall meet the requirements of Mineral Aggregate Type 26.

7-21.3 CONSTRUCTION REQUIREMENTS

7-21.3(1) GENERAL

1. **Exclude Runoff From Cells Until Completion.** Runoff shall not be allowed to enter the bioretention cell in accordance with Sections 1-07.15 and 8-01, until authorization is given by the Engineer.
2. **Protect Mix From Water.** Bioretention Soil shall be protected from rainfall, surface runoff and other sources of added moisture at the Supplier's site, in covered conveyance, and at the Project Site until incorporated into the Work.
3. **Exclude Heavy Equipment from Cells and Berms.** No heavy equipment shall operate within the cell or earth berm perimeter once bioretention cell excavation has begun, including during excavation, backfilling, tree pit preparation, mulching, or planting.
4. **Exclude Foreign Materials.** No Materials or substances other than the Bioretention Soil shall be mixed or dumped within the cell or earth berm area that may be harmful to plant growth, or prove a hindrance to the planting or maintenance operations.
5. **Water Meter Adjustments.** Relocation and/or adjustments of water meters shall be coordinated per Section 7-15 Water Service Connection Transfers.
6. **Approved Testing Labs.** When the Contract specifies testing by a Contractor provided testing laboratory, the laboratory shall be a Seal of Testing Assurance (STA), AASHTO, ASTM or other standards organization, as designated in the Contract, accredited laboratory with current and maintained certification. The testing laboratory shall be capable of performing all tests to the standards specified, and shall provide test results with an accompanying Manufacturer's Certificate of Compliance.

7-21.3(1)A SUBMITTALS FOR BIORETENTION SOIL MIX DESIGN

At least 10 Working Days prior to placement of Bioretention Soil, the Contractor shall submit to the Engineer the following in accordance with Section 1-05.3:

1. **Aggregate Analysis.** Grain size analysis results of the Mineral Aggregate for Bioretention Soil (Section 9-03.2(2)) performed by an independent laboratory in accordance with ASTM D 422, Standard Test Method for Particle Size Analysis of Soils;
2. **Compost Analysis.** Quality analysis results for the compost for Bioretention Soil performed in accordance with STA standards, as specified in Section 9-14.4(8);
3. **Mix Analysis.** Organic content test results of the Bioretention Soil mix. Organic content test shall be performed in accordance with Testing Methods for the Examination of Compost and Composting (TMECC) 05.07A, "Loss-On-Ignition Organic Matter Method";
4. **Mix Samples.** Two five (5) gallon samples of the Bioretention Soil mix, along with the following information:
   a. The Manufacturer's Certificate(s) of Compliance per Section 1-06.3 from the Supplier of the Bioretention Soil mix, and (if different) the Suppliers of the mineral aggregate and compost components, including their name(s) and address(es);
   b. A description of the equipment and methods to mix the mineral aggregate and compost to produce Bioretention Soil;
5. **Laboratory Information.** Include the following information about the testing laboratories:
   a. name of laboratory(ies) including contact person(s),
   b. address(es),
   c. phone contact(s),
   d. e-mail address(es);
   e. qualifications of laboratory and personnel including date of current certification by STA, ASTM, AASHTO, or approved equal.

7-21.3(2) BIORETENTION CELLS AND EARTH BERMS CONSTRUCTION

Location and dimensions. Bioretention cells and earth berms shall be constructed as shown on the Drawings.

7-21.3(2)A GRADING AND PLACEMENT FOR BIORETENTION CELLS

7-21.3(2)A1 GENERAL

1. **Authorization to Proceed.** The Contractor shall not start bioretention cell grading or placement until all areas of the Project Site draining to the bioretention area have been stabilized and authorization is given by Engineer.
2. **Protection of Existing Trees.** Grading within Zone B of trees to be retained shall be in accordance with the Tree, Vegetation, and Soil Protection Plan (TVSPP) per Sections 1-07.16(2) and 8-01. The Contractor shall notify the Engineer of conflicts with tree protection standards and/or other site conditions prior to proceeding with the Work.
3. **Locate New Trees.** Locations and grading requirements to support new trees as a component of the bioretention system shall be field marked by the Engineer when identified as "field locate by the Engineer" on the Drawings. A minimum advance notice is required for Engineer to locate plantings per Section 8-02.3(5).

7-21.3(2)A2 EXCAVATION

1. **Depth.** At the locations shown on the Drawings, bioretention cells shall be excavated to the depth necessary to accommodate the placement of Bioretention Soil and, if applicable, Mineral Aggregate Type 26 for discharge subbase gravel as shown on the Drawings.
2. **Conditions.** Excavation within 6-inches of final native soil grade shall not be permitted if the Project Site soil is frozen, has standing water, or has been subjected to more than ½ inch of precipitation within 48 hours.
3. **Geotextile.** Where shown on the Drawings, the Contractor shall place Construction Geotextile for Separation in accordance with Section 2-15.
4. I**nspection Prior to Soil Placement.** The Contractor shall provide the Engineer the opportunity to inspect the excavation at least 1 Working day prior to placement of any Materials or subgrade soil scarification.
5. **Protection from Sediment.** After excavation to subgrade, if any sediment laden runoff has entered the cell prior to placement of Bioretention Soil, the sediment deposition shall be removed by overexcavating the cell by a 3-inch minimum and an additional 3-inches of Bioretention Soil shall be placed at the Contractor's expense.

7-21.3(2)A3 SUBGRADE

1. **Scarification.** The Contractor shall scarify the surface of the subgrade to a minimum depth of 3 inches prior to placement of Bioretention Soil or Mineral Aggregate for discharge subbase gravel, if applicable.
2. **Discharge Drainage Course.** Where shown on the Drawings, the Contractor shall place Mineral Aggregate for discharge subbase gravel in loose lifts and hand rake Mineral Aggregate to final grade.
3. **Protection from Sediment.** If applicable, after placement of Mineral Aggregate for discharge subbase gravel, if any sediment laden runoff has entered the cell prior to placement of Bioretention Soil, the sediment deposition shall be removed by excavating Mineral Aggregate in the cell by a 3-inch minimum and replacing it with clean Mineral Aggregate at the Contractor's expense.

7-21.3(2)A4 PLACEMENT OF BIORETENTION SOIL

1. **Acceptance of Mix Prior to Placement.** The Contractor shall not place Bioretention Soil until the Engineer has reviewed and confirmed the following:
   a. **Soil mix delivery ticket(s).** Delivery tickets shall show that the full delivered amount of Bioretention Soil matches the product type, volume and manufacturer named in the submittals.
   b. **Visual match with submitted samples.** Delivered product will be compared to the submitted 5-gallon sample, to verify that it matches the submitted sample. The Engineer may inspect any loads of Bioretention Soil on delivery and stop placement if the soil does not appear to match the submittals; and require sampling and testing of the delivered soil to determine that organic matter content is within the 4-8% target, and approximately equal to that of the approved submittal, before authorizing soil placement. All testing costs shall be the responsibility of the Contractor.
2. **Mix Moisture.** Bioretention Soil placement and consolidation shall not occur when the Bioretention Soil is excessively wet, as determined by the Engineer. There should be no visible free water in the material.
3. **Conditions.** Placing Bioretention Soil shall not be allowed if the area receiving Bioretention Soil is frozen, excessively wet or saturated, or has been subjected to more than ½-inch of precipitation within 48-hours prior to placement. The Engineer will have final authority to determine if wet or saturated conditions exist.
4. **Placement**. The Contractor shall place Bioretention Soil loosely with a conveyor belt, unless otherwise approved by the Engineer, upon a prepared subgrade in accordance with these Specifications and in conformity with the lines, grades, depth, and typical cross-section shown in the Drawings or as established by the Engineer.
5. **Rake soil to final grade.**
6. **Consolidation.** Final soil depth shall be measured and verified only after the soil has been water consolidated, which requires filling the cell with water in a controlled manner, without creating any scour or erosion, to at least 1 inch of ponding. Allowing uncontrolled runoff from adjacent impervious areas to enter cell is not an acceptable method for consolidation. Repeat until final depth is achieved.
7. **Placement and Consolidation In Grass Areas.** Place Bioretention Soil specified for grass areas in loose lifts. Compact Bioretention Soil to a relative compaction of 85- 90 percent of modified maximum dry density (ASTM D 1557), where slopes allow, as determined by the Engineer. Where Bioretention Soil is placed in the 2-foot road shoulder, compact to a minimum relative compaction of 90 percent of modified maximum dry density (ASTM D 1557). Final soil depth shall be measured and verified only after the soil has been compacted.
8. **Inspection Prior to Planting.** After placement of Bioretention Soil, and before planting or mulching, the Contractor shall notify the Engineer at least 1 Working day in advance. The Engineer will perform compaction testing.

Compaction Requirements

Bioretention Area	Relative Compaction
Bottom and side slopes planted	Water consolidation
Bottom and side slopes grassed	85-90 percent of modified dry density (ASTM D 1557), using roller or sprinkler.
2-foot road shoulder	90 percent of modified dry density (ASTM D 1557), using roller or late compaction.
7-foot radius around power poles	No requirement, existing soil untouched
Around water meters and over other utilities	Same as listed for areas above

7-21.3(2)A5 FINAL MULCHING AND PLANTING

1. **The cell shall be planted and mulched as shown on the Drawings.**
2. **Inspection.** At least 1 Working Day prior to placement of compost or arborist wood chip mulch in each cell, as specified in the Drawing, the Contractor shall notify the Engineer to inspect the bioretention cell. If any sediment laden runoff has entered the cell, the Contractor shall remove the top 3 inches of Bioretention Soil and replace with Bioretention Soil per design, at the Contractor's expense.
3. **Finished Grade.** The finished elevation shall be one (1) inch below walks, curbs, pavements and driveways, unless adjacent to a bermed area. Upon completion of finish grading Work, all excess Material shall be removed from the Project Site and disposed of accordingly.

7-21.3(2)B GRADING FOR EARTH BERM

1. **Location.** At the locations shown on the Drawings, the Contractor shall construct earth berms in accordance with these Specifications and in conformity with the lines, grades, depth, and typical cross-section shown in the Drawings or as established by the Engineer.
2. **Soil Placement.** Place Bioretention Soil specified for berm areas in loose lifts.
3. **Compaction**. Compact Bioretention Soil to a maximum relative compaction of 85 percent of modified maximum dry density (ASTM D 1557).
4. **Inspection Prior to Mulching.** Prior to the placement of arborist wood chip mulch, the Contractor shall notify the Engineer at least 1 Working Day in advance for approval of finished grading.

7-21.4 MEASUREMENT

Bid items of Work completed pursuant to the Contract will be measured as provided in Section 1-09.1, Measurement of Quantities, unless otherwise provided for by individual measurement paragraphs here in this Section.

Measurement for "Bioretention Soil" will be by the ton or cubic yard

Measurement for "Mineral Aggregate (type)" for discharge subbase gravel will be by the ton or cubic yard.

Measurement for grading will not be made.

7-21.5 PAYMENT

Compensation for the cost necessary to complete the Work described in Section 7-21 will be made at the Bid item prices Bid only for the Bid items listed or referenced as follows:

1. **"Bioretention Soil** ", per ton or cubic yard.

The Bid item price for "Bioretention Soil " shall include all costs for the work necessary to furnish, place, compact, grade, shape, and mix Bioretention Soil.

2. "**Common Excavation**" per ton or cubic yard per Section 2-04.

3. **"Mineral Aggregate (type)"** per ton or cubic yard per Section 4-01.

4. "**Construction Geotextile for Separation**", per square yard per Section 2-15.

No separate payment will be made for finish grading work required to hand grade Bioretention Cells and Earth Berms to final shape as specified.

SECTION 7-22 DIRECTIONAL DRILLING

See Section 2-16.