SECTION 31: STORM DRAIN INSTALLATION

31-01 **SCOPE.** This work shall consist of furnishing and installing reinforced pipe, storm drains, manholes, inlets, underdrains, fittings and all other materials and appurtenances in accordance with the Plans and these Standard Provisions.

31-02 **MATERIALS.**

31-02.01 **Reinforced Concrete Pipe.** Reinforced concrete pipe shall conform to the requirements of ASTM C76, as amended to date. The wall design shall be at the option of the manufacturer. The manufacturer shall furnish to the City certificates showing that the pipe conforms to the specified ASTM designation. All pipe shall be Class III unless otherwise shown on the Plans. Nonreinforced concrete pipe meeting all requirements of reinforced concrete pipe may be substituted for all sizes twenty-four inches (24") in diameter and smaller.

Pipe designated by D-Load shall be marked as described in the ASTM Specifications except that the D-Load shall be marked on the pipe. The D-Load shall be determined during tests as described in the ASTM Specifications.

31-02.02 **Reinforced Concrete Pipe Joints.** Pipe shall be constructed with self-centering joints.

31-02.03 **Precast Manhole Sections.** Precast manhole sections shall conform to size, shape and details shown on the Standard Details. Precast reinforced concrete manhole risers, cones and grade rings shall conform to ASTM Designation C478 as amended to date.

31-02.04 **Castings.** Castings for manhole rings, cover and other purposes shall conform accurately to the form and dimensions shown on the Standard Details. The surface of casting shall be reasonably smooth, free from defects of any kind and the castings shall conform to the requirements of ASTM A48, Class 30B as amended to date. Bottom rim of cover and seat of frames shall be machined to form a close fit free from wobble. The combined weight of cover and frame shall exceed two hundred sixty-five (265) pounds.

Before leaving the foundry, all castings shall be thoroughly cleaned and coated by dipping in asphalt applied at a temperature of three hundred degrees (300°) Fahrenheit in such a manner as to provide a firm, durable, tenacious coating.
31-02.05 **Inlets.** All inlets shall conform to size, shape and details as shown on the Standard Details. The type of inlet shall be as specified on the Plans or in the Special Provisions.

31-02.06 **Inlet Grates and Grate Frames.** Inlet grates and grate frames shall conform to size, shape and details as shown on the Standard Details or on the Plans. Rectangular frames shall be fabricated from structural steel conforming to the requirements of ASTM A36. The bar portion of the frames may be fabricated from special quality, hot rolled steel bars conforming to the American Iron and Steel Institute Designation No. C1021. Frames and grates shall be match marked in pairs before delivery to the job site and the grates shall fit into their frames without rocking.

31-02.07 **Reinforcing Bars.** Reinforcing bars shall be deformed billet steel bars conforming to the specifications of ASTM A615, Grade 60, including Supplementary Requirement S1 and shall be of the size shown on the Standard Details or on the Plans. Bars shall be of the round deformed type; free from injurious seams, flaws or cracks; and shall be cleaned of all rust, dirt, grease, loose scale and any other coating of any character that would destroy or reduce the bond.

31-02.08 **Portland Cement Concrete.** Portland cement concrete for manhole bases, inlets and other concrete structures shall conform to the requirements of Section 90, "Portland Cement Concrete," of the Standard Specifications and specified herein.

The concrete shall be Class "A" containing six (6) sacks of Portland cement per cubic yard of concrete. The grading of the combined aggregate shall conform with the requirements of one and one-half inch (1-1/2") maximum. The consistency of the fresh concrete shall be such that the slump does not exceed four inches (4") as determined by Test Method No. California 520. The concrete shall have a minimum compressive strength of 3,300 PSI after twenty-eight (28) days.

31-02.09 **Mortar.** Mortar shall conform to the requirements of Section 65, "Reinforced Concrete Pipe," of the Standard Specifications.

31-02.10 **Underdrains.** Underdrains shall conform to Section 68, "Subsurface Drains," of the Standard Specifications.

31-02.11 **Underdrain Risers.** Underdrain risers shall conform to Section 68, "Subsurface Drains," of the Standard Specifications.

31-02.12 **Curb Drains.** Curb drains shall conform to the Standard Details and shall be located where shown on the Plans.

Three-inch (3") ductile iron pipe for curb drains shall conform to ASTM designation.
31-03 CONSTRUCTION METHODS.

31-03.01 Trenching. Trench excavation, shoring, grade control, backfill and resurfacing shall conform to the requirements of Section 24, "Trench Excavation, Backfill and Resurfacing," of these Standard Provisions.

31-03.02 Handling of Material. Reinforced concrete pipe, precast concrete manhole sections, inlet frames, grates and fittings must be carefully handled at all times. Only suitable and proper equipment and appliances shall be used for the safe loading, hauling, unloading, handling and placing of materials. Any material which is checked, spalled, out of round or damaged shall not be installed and such material must be permanently removed from the job site within twenty-four (24) hours after notification.

31-03.03 Pipe Laying. No pipe shall be laid until the Engineer inspects and approves the condition of the bottom of the trench. Pipe laying shall proceed upgrade with the tongue section of tongue-and-groove pipe pointed in the direction of flow.

Split pipe shall be used through a manhole except for changes in pipe grade, size, type or direction.

Each section of pipe shall be laid true to line and grade and in such a manner as to form a close, concentric joint with the adjoining pipe and to prevent sudden offsets in the flow line. As the work progresses, the interior of the storm drain shall be cleaned of all dirt and debris. Where clearing after laying is difficult because of small pipe size, a suitable swab or squeegee shall be kept in the pipe and pulled forward past every joint immediately after jointing has been completed. Pipe shall not be laid when the condition of the trench or the weather is unsuitable.

After the joint is assembled and if jetting is to be accomplished the same day as the pipe is installed, a moisture-resistant band of polyethylene, heavy-gauge sheeting, "Kordite" or approved equal, shall be placed around the outside of the pipe and centered over the joint to prevent damage to the joint and entry of water and dirt into the pipe.

Concrete pipe with elliptical reinforcement shall be laid with the minor axis of the reinforcement cage in a vertical position.

31-03.04 Joints. The joints shall be completely filled and compacted with mortar so as to make a strong joint. No mortar will be required in the outside joint recesses of self-centering pipe. Unless otherwise approved by the Engineer, all joints shall be finished smooth on the inside of pipe.
In pipe sizes twenty-one inches (21") and larger, inside joint recesses shall be hand-pointed. In pipe sizes eighteen inches (18") and smaller, inside joint recesses shall be buttered prior to closure. After the closure is made, the joint shall be pointed inside the pipe and excess mortar removed by means of a long-handled brush, an inflated swab or squeegee.

**31-03.05 Manholes.** Manholes shall be located as shown on the Plans and installed in accordance with the Standard Details.

**31-03.06 Inlets.** Inlets shall be located as shown on the Plans and installed in accordance with the Standard Details and the following specifications. All the inside and exposed surfaces of concrete shall be smooth and uniform when finished and the concrete shall be thoroughly compacted around all reinforcing bars. Inlets installed in curb returns shall have angle anchors curved to conform to the curb return radius. Precast inlets will be permitted when meeting the above requirements and when approved by the Engineer.

**31-03.07 Television Inspection.** After completion of the pipe installation and cleaning, the storm drain line shall be televised with a color closed-circuit television with tilt-head camera recorded in VHS format. The original video tape and log sheets shall be provided to the Engineer.

**31-04 MEASUREMENT.**

**31-04.01 Reinforced Concrete Pipe.** Reinforced concrete pipe shall be measured horizontally by the linear foot for the various strengths and sizes along the centerline of the pipe less the design distance between the ends of the pipe in manholes and inlets through which the pipe does not continuously pass. Whenever split pipe is required through a manhole, such pipe shall be included in the measurement.

**31-04.02 Manholes.** Manholes shall be measured as one complete installed unit, including base, precast sections, frame and cover.

**31-04.03 Inlets.** Inlets shall be measured as one complete installed unit, including grate and frame.

**31-04.04 Underdrains.** Underdrains shall be measured by the linear foot, including excavation, pipe, fittings, backfill material, building paper and appurtenances.

**31-04.05 Underdrain Risers.** Underdrain risers shall be measured as one complete installed unit, including pipe, ells, fittings, cover and cleanout box, if required.
31-04.06 **Curb Drains.** Curb drains shall be measured as one complete installed unit, including inlet box and frame and grate, installation of outlet through face of curb or connection to existing inlet, pipe and wire mesh or reinforcing bars.

31-04.07 **Trench Surfacing.** Trench surfacing shall not be measured for payment and shall be considered as paid for in the various items of work.

31-04.08 **Rechanneling Manhole Bases.** Rechanneling manhole bases and breaking into manholes shall not be measured for payment and shall be considered as paid for in the various items of work.

31.04.09 **Television Inspection.** Television inspection shall not be measured for payment and shall be considered paid for in the various items of work.

31-05 **PAYMENT.**

31-05.01 **Reinforced Concrete Pipe.** The Contract unit price per linear foot for reinforced concrete pipe shall constitute full compensation for furnishing all labor, materials, tools and equipment and for doing all Work, including excavation, backfill, compaction, resurfacing and televising required to install the reinforced concrete pipe complete as required in the Special Provisions, shown on the Plans and specified herein.

31-05.02 **Manholes.** The Contract unit price paid for each manhole shall include full compensation for all labor, materials, tools and equipment and for doing all Work, including excavation, backfill and compaction and resurfacing, all as required in the Special Provisions, shown on the Plans and specified herein.

31-05.03 **Inlets.** The Contract unit price for each inlet shall include full compensation for labor, materials, tools and equipment and for doing all Work, including excavation, backfill and compaction and resurfacing, all as required in the Special Provisions, shown on the Plans and specified herein.

31-05.04 **Underdrains.** The Contract unit price per linear foot for underdrains shall include full compensation for furnishing labor, materials, tools and equipment and for doing all Work, including excavation, permeable material backfill and compaction required to install the underdrain pipe complete as required in the Special Provisions, shown on the Plans and specified herein.
31-05.05 **Underdrain Riser.** The Contract unit price per each underdrain riser shall include full compensation for labor, materials, tools and equipment and for doing all Work, including pipe, ells, fittings, cover and cleanout box, if required, as required in the Special Provisions, shown on the Plans and specified herein.