TVI shall be required and performed prior to placing asphalt concrete pavement, AND prior to the Notice of Completion for public and private subdivision projects. For commercial projects, which are not part of a subdivision the TVI shall be performed by the Contractor. Costs for said inspection shall be borne by the Contractor. The Construction Inspector shall be notified 48 hours in advance of testing without exception, and shall be present during the television inspection. TVI equipment shall include video cameras, a color monitor, digital recording equipment, sound and voice recording capabilities, gauging tool, cables, power sources, and all equipment necessary to perform a TVI.

The camera shall be a pan and tilt camera with pipe grade verification system (inclinometer), and shall be specifically designed and constructed for storm drain environment. The camera shall include: a solid state color TV camera with a panning and rotational camera head; remote adjustable optical focus and automatic light compensation iris with remote override; camera controller with remote focus, iris and auto centering control; and camera lighting system.

The storm drain system shall be completely cleaned by an approved method prior to TVI. The storm drain system will be rejected if any of the following conditions exist:

a. Sags greater than 1/2-inch in depth
b. Standing water
c. Offset joints
d. Cracked pipes
e. Infiltration
f. Hanging gaskets

SS62-06. MEASUREMENT AND PAYMENT--Measurement of pipe shall be the total distance along the centerline of the pipe as installed from center to center of manholes and shall include the straight run of all wyes and tees where used.

The price per lineal foot of pipe includes the furnishing of all materials for construction of the pipe, fittings and connections and all labor, materials, and equipment necessary to excavate the trench, remove all obstructions, remove and replace all utilities where necessary, bed, place and joint the pipe, backfill the trench, restore the surfaces, test the pipe lines, connect to existing manholes or pipes, furnish preconstruction photographs when applicable, and do all other work necessary to produce a complete and finished job in accordance with the drawings and specifications. The unit price bid shall be the average price for lines of all depths and bedding types of a given size.

SS-63. PRECAST CONCRETE MANHOLES

SS63-01. ITEM--Under these items of the Proposal, the Contractor shall bid a price each for constructing the various sizes and types of precast concrete manholes as indicated on the plans and in the Proposal.

SS63-02. DIMENSIONS--Precast manholes shall consist of cylindrical sections, all with joints and base construction as detailed in the Standard Drawings for sanitary sewer manholes and for drainage manholes.

SS63-03. SPECIFICATION--Precast manhole barrels, risers, cones, flat tops, and grade rings shall conform to ASTM Designation: C478 with the additional requirement that the cement used shall be Type II. Twenty-four inch manholes may be precast or cast-in-place as shown in the Standard Drawings.

Flat slab tops shall be constructed of Class A concrete with Type II cement.

All manholes shall be constructed on a firm non-yielding bed. When water is encountered, or in the opinion of the Engineer, the base material is unsatisfactory, a minimum of 6 inches of crushed rock will be required prior to manhole base construction. The first manhole ring section shall be placed before the concrete is set.

Manhole bases may be precast or cast-in-place. If precast, they shall be placed on a minimum of 4 inches of crushed rock of 3/4 inch maximum size. Elevation differentials of inlets and outlets must conform to the plans. Channelization shall conform to the Standard Drawings and to Section SS63-08 of these specifications. Stubs or couplings provided in precast bases shall be of the same material as the pipe to which they connect unless otherwise approved by the Engineer.

SS63-04. CONES--Standard cones conforming to ASTM Designation: C478 shall be used on all manholes shown on the plans unless otherwise specified. Where depth is insufficient for cones, flat slab tops shall be used. Eccentric cones shall be used where specified on the plans. An 18 inch high cone may be used for a sanitary sewer manhole where the depth is less than 4 feet. The minimum depth of throat shall be 3 inches between the cone and the frame and 12 inch maximum depth except as herein allowed for manholes less than 4 feet in depth.

SS63-05. JOINTS--Joints in precast manhole shafts shall be made by buttering the joint space previously laid with mortar, or shall be made with preformed plastic sealing gaskets conforming to Federal Specifications SS-S-00210 and installed as recommended by the manufacturer. All joint surfaces shall be thoroughly cleaned prior to placing the sealing compound or buttering with mortar. Both the inside and outside of mortared joints shall be plastered with mortar and the inside brushed to a smooth finish with a wet brush. Special precautions shall be taken to see that the entire joint space is filled with mortar and is watertight, particularly between a cast base and precast joints.

SS63-06. FRAMES AND COVERS--Manhole frames and covers shall conform to the Standard Drawings and Section SS-70 of these specifications unless otherwise stated on the plans or in the Special Provisions. Frames and covers shall be set flush with the finish grade unless otherwise herein specified or otherwise stated on the plans or in the Special Provisions. The joint between the manhole frame and the cone or grade ring shall also be made by buttering the joint space with

mortar, except that where a sewer manhole is constructed in a location to remain unpaved, the frame shall in addition be bolted in place using 4-1/2 inch diameter bolts or the joint shall be made using an epoxy adhesive. The adhesive shall be as described in Section 95-2.05 of the State Specifications for Pavement Marker Epoxy Adhesive, Standard Set (Spec. 8040-20J-09). In such unimproved areas, the rim of the frame should be set 12 inches above existing ground level.

SS63-07. CONNECTIONS--Pipe connections to drainage manholes shall be made so that the pipe is flush with the inside face of the manhole. These connections shall be finished so that entrances are smooth. Unless the manhole is cast around the pipe, connections shall be dry packed with cement mortar as directed by the Engineer.

Pipe connections shall not be made into the cone section of the manhole unless approved by the Engineer.

Pipe stubs for lateral sewers shall be built into the structures as shown on the plans. The outer ends of the stubs shall be sealed securely by a cap or stopper of material compatible with the pipe.

SS63-08. FLOW CHANNELIZATION--Unless otherwise indicated, flow channels shall be provided in the sanitary sewer manhole base by fillets as shown the Standard Drawings. Special care shall be taken to form a smooth transition between inlets and outlets, with good hydraulic properties. Any sharp corners or significant departure from the dimensions indicated shall be cause for reconstruction. Pipe may be laid continuously through straight run manholes and the top 1/2 of the pipe subsequently cut out inside the manhole, prior to forming the channelization.

SS63-09. CAST PORTION--The Contractor may, at his option, cast the lower portion of drainage manholes in place. The cast-in-place portion shall not be placed higher than 6 inches above the outside tops of the main incoming and outgoing pipes. Concrete used for construction shall conform to Section SS32-03 of these Specifications. Minimum and maximum wall thickness for the cast-in-place sections shall conform to the following table:

Manhole Diameter	Minimum Wall Thickness	Maximum Wall Thickness
48"	5"	7"
60"	6"	8"
72"	7"	9"

Inside diameters of cast-in-place portions shall equal the diameter of the manhole specified. Standard precast manhole riser sections and/or cones shall be placed above the cast-in-place section to bring the manhole rim up to grade.

Maximum and minimum wall thickness for cast-in-place portion of manholes shall be strictly adhered to. Concrete on the cast portion may be placed neat against the earth, provided wall thickness requirements are met; otherwise, outside forms shall be required.

SS63-10. DROP CONNECTIONS--Outside drop sewer connections are depicted in the Standard Drawings and shall be installed at all manholes where the plans show such sewer connections to be placed. Outside drop connections shall be constructed only at manholes where the plans specifically indicate their construction and as approved by the City Engineer. Inside drop connections shall be allowed only in a 60 inch diameter manhole.

SS63-11. CAST-IN-PLACE GRADE ADJUSTMENT--Grade adjustment may be made by utilization of precast grade rings or in new subdivisions only by a cast-in- place ring. The latter shall have a minimum thickness of 4 inches and a maximum of 12 inches. The concrete pour shall not extend above the top of the base flange of the manhole frame. The minimum height of the ring shall be 3 inches and the maximum 12 inches.

SS63-12. TESTING OF PRECAST MANHOLES--All manholes shall be tested for leakage after assembly but prior to back-filling around the manhole. The Contractor shall furnish all labor, tools and equipment necessary to make the test and to perform any work incidental thereto. The Contractor shall correct any excess leakage, and repair any damage to the manhole and its appurtenances at this own expense.

The manholes shall be tested for leakage by the following method:

> Manhole vacuum test: All lift holes, connections and inside and outside joints shall be sealed as described in these specifications. All pipes entering the manhole shall be plugged, taking care to securely brace the plug from being drawn into the manhole. The test head shall be placed at the inside of the top of the cone section and the seal inflated in accordance with the manufacturer's recommendations. A vacuum of 10 inches of mercury (approximately 5 psi) shall be drawn and the vacuum pump shut off. With the valves closed, the time shall be measured for the vacuum to drop to 9 inches. The manhole shall pass if the time is greater than 60 seconds of 48 inch diameter manholes, 75 seconds for 60 inch manholes, and 90 seconds for 72 inch manholes. If the manhole fails the initial test, necessary repairs shall be made while the vacuum is still being drawn. Retesting shall proceed until a satisfactory test is obtained.

SS63-13. PAYMENT--The contract unit price paid for precast reinforced concrete manholes shall include excavation, precast concrete items, pipe and fittings for stubs and stoppers and for inside and outside drop sewer connections as detailed on the Standard Drawings, flat top covers, cast iron frames and cover (bolt on type where specified), concrete, backfill, restoration of street surfaces, testing and all other labor, equipment and material necessary for completion of the structure in accordance with the drawings and specifications. The unit price bid shall be the average price for manholes of all depths and types indicated on the plans and in the Proposal.