CITY OF MEMPHIS – STANDARD CONSTRUCTION SPECIFICATIONS
SECTION 02640 MANHOLES, INLETS, AND SPECIAL STRUCTURES

PART 1 – SCOPE

This work shall consist of the construction of manholes, inlets, junction boxes, headwalls, wingwalls, skirts, brick radius, poured-in-place radius and other special drainage structures of the kinds and dimensions shown on the Plans, stipulated in the Contract Documents, or as directed by the Owner. The construction shall be accomplished in accordance with these Specifications and in conformity with the lines, grades, cross-sections, and details shown on the Plans or established by the Owner. The work shall include such labor, material, equipment, removal and abandonment of structures, brick masonry, cast-in-place concrete construction, precast concrete construction, rims and covers, frames and grates, miscellaneous iron castings, and all other items as may be necessary to complete the structures as shown on the Plans.

PART 2 – MATERIALS AND EQUIPMENT

2.01 MATERIAL

A. New Material.

All materials shall be subject to sampling, testing, and approval or rejection by the Owner. Unless otherwise specified, all materials incorporated into the work shall be new and unused in previous construction. Used materials, acceptable to the Owner, may be used for bracing, forms, falsework, and similar uses.

B. Manufacturer's Qualifications.

The source of supply for each material to be supplied by the Contractor shall be subject to approval by the Owner before delivery. Precast concrete manhole sections, steel reinforcement, and iron castings shall be the standard product of a manufacturer of established reputation in the industry and manufactured in a permanent plant adapted to meet the specified design requirements of the material being supplied.

C. Inspection and Testing.

1. Representative samples of materials intended for incorporation in the work shall be submitted for examination when so specified or requested by the Owner. All materials to be used in the work shall be sampled, inspected, and tested in accordance with current ASTM specifications, or other specified standard specifications. The Contractor shall furnish the Owner with three copies of certified reports from a reputable testing laboratory showing the results of the tests carried out on representative samples of materials delivered and to be used in the project. The performance or cost of all testing is incidental to the work and shall be done at no cost to the City.

2. The Contractor shall notify the Owner in advance of any deliveries of the materials and shall make whatever provisions are necessary, including the furnishing of such labor as may be required to aid the Owner in the examination, inspection and culling of the materials on the site prior to installation in the work.

3. All materials not conforming to the requirements of these Specifications shall be considered as defective and rejected for use and shall be removed from the site of the work.

D. Storage.

The Contractor shall provide such storage facilities and exercise such measures as will insure the preservation of the specified quality and fitness of materials to be incorporated in the work.

E. Portland Cement Concrete.

Portland cement concrete shall be of the class and dimensions, and at the designated locations shown on the Plans, or as directed by the Owner. The classes of concrete are referred to as Class A and Class C. Class A concrete is intended principally for concrete structures designed for high strength. Class C concrete is intended principally for low strength concrete used for

foundation stabilization, pipe cradles, and encasement and other general purpose uses. All portland cement, coarse aggregate, fine aggregate, water, air entraining agents and chemical admixtures; their proportioning, mixing, and delivery shall be as specified in Specification Section 03050.

F. Steel Reinforcement.

Deformed steel reinforcing bar shall conform to ASTM A 615 for Grade 40 or Grade 60 and shall be of the grades, sizes, and dimensions and at the designated spacings and locations shown on the Plans or as directed by the Owner. Welded wire fabric conforming to ASTM A 185 shall have a minimum yield strength of 65,000 psi and fabric conforming to ASTM A 497 shall have a minimum yield strength of 70,000 psi and shall be of the size, design, and weight and at the locations shown on the Plans or as directed by the Owner. All steel reinforcement and its storage shall be as specified in Specification Section 03310.

G. Mortar.

1. Mortar shall be composed of the following mixture by volume: 1 part portland cement, 2 parts sand, hydrated lime not to exceed 10 percent of the cement used, and 4 parts water. All ingredients shall be proportioned by measurement and not by estimation. All portland cement, sand, and water shall be as specified in Specification Section 03050. All hydrated lime shall be as specified by ASTM C 6.

2. The mortar shall be hand mixed or machine mixed. In the preparation of hand-mixed mortar, the sand, cement and hydrated lime shall be thoroughly mixed together in a clean, tight, mortar box until the mixture is of uniform color, after which water shall be added. Machine-mixed mortar shall be prepared in an approved mixer and shall be mixed not less than 1 ½ minutes. Mortar shall be used within 30 minutes after mixing.

H. Brick.

1. All brick shall conform to the Specifications for Concrete Building Brick, ASTM C 55 for Grade A. Bricks shall conform to the following dimensions, unless otherwise approved by the Owner.

	Depth Inches	Width Inches	Length Inches
Standard Size	2 ¼	3 ¾	8
Allowable Variation	+ ¼	+ ¼	+ ½

All brick shall be new and whole, of uniform standard size and with substantially straight and parallel edges and square corners. Bricks shall be tough and strong and free from injurious cracks and flaws. Brick shall be culled after delivery, if required, and all culls shall be removed from the work site.

2. The Contractor may be required to furnish the Owner with at least five bricks of the character and make he proposes to use, at least one week before any bricks are delivered for use. All brick shall be of the same quality as the accepted samples.

I. Gray Iron Castings

Castings shall be of the standard Memphis type as detailed on the Plans and Design Standards. Castings shall be made of good quality, strong, tough, even grained cast iron and shall be smooth, free from scale, lumps, blisters, sand holes, and defects of any nature which would render them unfit for the service for which they are intended. They shall be thoroughly cleaned and subjected to a careful hammer inspection. Castings shall meet the requirements of ASTM A 48, Specifications for Gray Iron Castings, Class No. 30, or ASTM A 536, Standard Specification for Ductile Iron Castings, Grade 65-45-12. In either case, manhole rims and covers and inlet

frames and grates shall be designed to withstand HS 20-44 loading as defined by AASHTO Specifications. Before being shipped from the foundry, castings shall be given one coat of coal tar pitch varnish applied in a satisfactory manner so as to make a smooth coating, tough, tenacious and not brittle or with any tendency to scale off. Frames and covers shall be machined or ground at touching surfaces so as to seat firmly and prevent rocking. Any set not matching perfectly shall be removed and replaced at no additional cost to the City. The Contractor shall provide the Owner with invoices, bills of lading or other necessary documentation as proof of purchase of all castings. Documentation shall be submitted along with each request for payment.

J. Manhole Steps.

Cast iron steps shall be of the standard Memphis type as detailed on the Plans and Design Standards. Cast iron shall conform to the requirements of Paragraph I above. Rubber or plastic coated steel manhole steps shall meet the requirements of ASTM C 478. The steel shall be completely encapsulated in corrosion resistant rubber or plastic. All steps shall be cast integral with manhole walls or grouted into manhole walls. Manhole steps can be driven in the manhole wall while concrete is still green and grouted around.

K. Structural Steel.

Structural steel for sidewalk drains, inlets, and other structures shall be of the grades, thickness, shapes, and dimensions shown on the Plans and Design Standards or as directed by the Owner. Top plates for sidewalk drains shall be JAL-TREAD floor plate or equal. All surfaces of sidewalk drains shall be given one coat of coal tar varnish applied in a satisfactory manner as to make a smooth coating, tough, tenacious and not brittle or with any tendency to scale off.

L. Precast Concrete Manhole Sections.

1. All precast reinforced concrete manhole risers, cones, grade rings, flat slabtops, and bases shall conform to the requirements of ASTM C 478 for the specified diameter and strength class. All cone sections and transition sections shall be eccentric in shape. Rings shall be custom made with openings to meet indicated pipe alignment conditions and invert elevations. The Contractor shall submit shop drawings for each individual structure on the Plans for review by the Owner before placing his order for structures.

2. The interior surfaces of the sections shall be a smooth, true cylindrical surface free from undulations or corrugations. Lifting holes when provided shall be cast in the wall of the pipe to receive a precast truncated conical concrete plug of such size as will allow 1/8 inch cementing material on the sides of the joining surfaces of the plug and will fill at least 50 percent of the lifting hole depth. Cement shall meet all requirements of the Specifications for Portland Cement, ASTM C 150, Type II.

3. Joints between manhole sections shall be installed using rope type flexible plastic gasket material meeting the requirements for Type B gaskets or rope type flexible butyl gasket material meeting the requirements the requirements for Type A gaskets, as defined by AASHTO M-198 unless otherwise specified on the Plans or Design Standards. Joint contact surfaces shall be formed with machined castings; they shall be exactly parallel with a 2^{o} slope and nominal 1/16 inch clearance. Joints between a manhole section and precast concrete flat tops shall be mortar joints conforming to the requirements of this Specification.

M. Sand.

Sand for structure abandonment shall consist of sand, all of which passes a 3/8 sieve and not more than 10 percent passes a no. 200 sieve.

N. Crushed Limestone.

Crushed limestone for precast manhole base bedding shall meet the requirements of Specification Section 02632.

O. Nonshrinking Grout.

Grout shall be mixed in small quantities as needed and shall not be retempered or used after it has begun to set. Unless otherwise specified or directed, the grout shall consist of one part portland cement and two parts sand by volume and a nonshrinking admixture mixed with sufficient water to form a grout of proper consistency. When nonshrinking or nonshrinking, fast setting grout is specified, it shall be formulated by the incorporation of an admixture or a premixed grout may be used. The formulation and the admixture of the premixed grout used will be subject to the review of the Owner and shall be mixed and used in accordance with the recommendations of the manufacturer. These special grouts will be classified as follows:

Type I - Nonshrinking Grout
Type II - Nonshrinking, Fast Setting Grout

Portland cement, sand, and water shall conform to the requirements of Specification Section 03050

2.02 EQUIPMENT

A. The equipment provided by the Contractor shall include hoisting equipment capable of handling and placing precast items in final position without damage. Mechanical tamps shall also be provided.

B. All of the above equipment, as well as any additional equipment necessary for the satisfactory performance of this construction, shall be on the project and inspected by the Owner before work will be permitted to begin.

PART 3 – CONSTRUCTION REQUIREMENTS

3.01 MODIFICATION OF EXISTING STRUCTURES.

A. Removal

Existing structures to be removed shall be as indicated on the Plans or directed by the Owner. The City reserves the right to retain or reject salvage of any materials encountered. Unless otherwise directed by the Owner, all castings shall be retained by the City. All salvage materials retained by the City shall be delivered to the appropriate City storage yard as directed by the Owner. All remaining materials become the property of the Contractor who will be responsible for disposing of same. The excavation shall be backfilled in accordance with Specification Section 02631 Paragraph 3.04. Removal of existing structures within the limits of excavation for new drainage facilities will not be measured or paid for separately but included in the price of the new drainage facility.

B. Abandonment.

1. Existing structures to be abandoned in place shall be as shown on the Plans or as identified by the Owner.

2. After removing structure frames, covers, grates, and similar items, all incoming and outgoing pipes shall be bulkheaded as specified in Specification Section 02632 Paragraph 3.01. The walls shall be lowered to 2 feet below final grade if in earth or to 12 inches below subgrade if in pavement. The remaining structure shall be filled with sand to the limits previously mentioned. The sand shall be placed in approximately 12 inch layers and each layer compacted to 95 percent of maximum density. A 12 inch thick plain concrete slab shall be installed over the manhole or structure top that extends 12 inches beyond the outside face of the manhole of structure. The City reserves the right to retain or reject salvage of any materials encountered. All remaining materials become the property of the Contractor who will be responsible for disposing of same.

3.02 STORM DRAIN PIPE INSTALLATION

A. General.

1. The structures will be either of concrete (plain or reinforced as required) or of brick masonry. Where the top elevation is not shown on the Plans, the structure or appurtenance shall be built to conform to the elevation ordered by the Owner.

2. The various structures shall be built as the pipe laying progresses. The Owner, at this discretion, may stop the laying of pipe or the building of other structures until the structure just passed has been completed. Completion of the structure shall include connections to pipes, placing of castings and other construction as shown on the Plans or as directed by the Owner.

3. Inlet and outlet pipes shall extend through the walls of structures only a sufficient distance beyond the outside surface to allow for connections and shall cut off flush with the inside surface of the wall as shown on the Plans or otherwise directed. The pipe shall intersect at the structures so that the invert between the inlet and outlet pipe can be smoothly formed such that counterflow is prevented.

4. Inverts shall be of Class C concrete and shall conform to the shapes indicated on the Design Standards or otherwise directed. The inverts shall be so constructed as to cause the least possible resistance to flow. The shape of the inverts shall conform uniformly to inlet and outlet pipes. A smooth and uniform finish will be required.

5. All rims and frames shall be placed in the positions shown in the Design Standards or as directed by the Owner and shall be set true to line and to correct elevation. Rims and frames shall be set concentric with the masonry and in a full be of mortar so that the space between the top of the masonry and the bottom flanges of the rim or frame shall be completely filled and made watertight. A ring of mortar at least 1 inch thick and pitched to shed water away from the rim or frame shall be placed around the outside of the bottom flange. Mortar shall extend to the outer edge of the masonry and shall be finished smooth and flush with the top of the flange. If rims or frames are to be bolted or anchored in concrete or brick masonry, all anchors or bolts shall be set and held in place before the concrete or mortar is placed. The unit shall not be disturbed until the mortar or concrete has hardened to adequate strength.

6. All manholes, inlets, and junction structures deeper than 4 feet, as measured from the top of the rim or frame to the invert of the structure, shall be provided with steps unless otherwise shown on the Plans or directed by the Owner.

7. Steps shall be spaced not more than 16 inches vertically and staggered at 12 inches laterally and shall be so arranged that the lowest step shall not be more than 18 inches above the bench. The top step shall not be more than 18 inches below the structure rim or frame. If precast sections are used, steps are not required to be staggered laterally.

B. Brick Masonry Construction.

1. Construction Methods.

a. All bricks shall be thoroughly clean. The bed which is to receive the bricks shall be thoroughly cleaned and damp, but should be free of water before placing mortar thereon. All bricks shall be laid in courses in freshly made mortar, using the shoved-joint method so as to thoroughly bond them into the mortar and always with the joints completely filled with mortar. The bricks shall be laid in a workmanlike manner and true to the lines and grades indicated on the Plans and Design Standards. The arrangement of headers and stretchers shall be such as will thoroughly bond the masonry. Unless otherwise

indicated, brick masonry for inlets shall have a header course every fifth course. In manholes, all bricks in each course shall be headers. The course shall be laid continuously with joints broken or alternating evenly with the joints in the preceding courses. Horizontal joints shall average 3/8 inch but shall be not less than ¼ inch nor more than ½ inch in thickness. Face joints shall be flush and neatly struck, and all joints on unexposed faces shall be solidly filled. No spalls or bats shall be used except in shaping around irregular openings or connections or when unavoidable to finish out a course. In this case, a full brick shall be used at the corner with the bat in the interior of the course. If any brick is moved or a joint broken during laying, the brick shall be removed, the mortar thoroughly cleaned from the brick, bed, and joints and the brick relaid in fresh mortar.

b. In brick manholes, inlets, or junction structures, a row lock arch shall be placed over all incoming and outgoing pipes in such a manner to provide full continuous contact between masonry and outside of pipe, to prevent leakage and to form a neat connection.

c. Brick manholes, inlets, junction structures, brick radius wall, and special structures shall be plastered on the outside with a coating of mortar not less than ½ inch thick of the same composition used in laying brick to prevent excessive infiltration of water. On the inside of the manholes the vertical portion of the walls shall be plastered and the sloping section neatly pointed with trowel.

d. The inside of brick inlet, junction structure, or brick radius walls shall be plastered with not less than ½ inch of mortar of the same composition used in laying brick.

e. Brick masonry, plastering, and mortar shall be protected against damage from freezing or lack of moisture. Brick masonry shall not be constructed when the temperature is 40 degrees F or lower without permission of the Owner nor without adequate approved means for protection against freezing. Brick masonry shall have sufficient moisture for proper curing and be protected from drying. Requirements for protection of brick masonry and masonry materials are the same as required for concrete structures in Specification Section 03310.

f. A prepared concrete slab shall be placed for all brick structures after the foundation excavation is completed. This shall be of the materials and dimensions shown in the Design Standards. The slabs shall be built of Class A concrete. The construction shall conform to the methods, forms, placement, protection, and curing for concrete as specified in Specification Section 03310.

g. Any required reinforcement shall be of the kind, type, and size and shall be located, spaced, bent, and fastened as shown in the Plans. Concrete reinforcing in place shall be approved by the Owner before any concrete is placed.

h. Steps constructed in brick walls shall be installed at the specified spacing as the brick laying progresses. Steps shall be placed in a full bed of mortar between brick courses.

2. Brick Manholes.

Brick manholes shall be neatly and accurately built, according to Design Standards or as directed by the Owner. Manholes with brick walls shall have walls not less than 9 inches thick for manholes up to 6 feet deep and not less than 13 inches thick throughout the structure for extra depth manholes.

3. Brick Inlets.

a. Brick inlets shall be neatly and accurately built, according to Design Standard or as directed by the Owner. Inlets with brick walls shall have walls not less than 9 inches thick

for inlets up to 6 feet deep and not less than 13 inches thick for inlets between 6 to 11 feet deep maximum throughout the structure for extra depth inlets.

b. Top slabs (when required) shall be uniform in thickness as shown on the Plans and be constructed of Class A concrete. Exposed surfaces shall have a troweled finish.

4. Brick Junction Structures.

Brick junction structures shall be neatly and accurately built in accordance with details included in the Plans or as directed by the Owner. Access to all junction structures shall be provided by an access shaft with a manhole rim and cover at the proposed finished grade as detailed on the Plans.

5. Brick Radius.

a. Brick radius shall be neatly and accurately built, according to the Plans and Design Standards, or as directed by the Owner. Brick radius walls shall not be less than 9 inches thick. The Contractor may at his option construct radius walls of reinforced concrete in lieu of brick conforming to the requirements of Specification Section 02640 Paragraph 3.02.C.4.

b. The radius of construction as shown on the Plans shall be as measured along the centerline of the structure and shall be constant throughout its length unless specified otherwise. The minimum radius shall be 5 times the inside diameter of the larger pipe at either end of the radius.

c. The base slab and top slab of a brick radius shall be uniform in thickness as shown on the Plans and Design Standards and be constructed of Class A concrete reinforced as detailed. In lieu of cast-in-place top slabs, precast units may be used if approved by the Owner. These units shall be set securely on the brick walls using steel dowels, a mortar bed and mortared around dowels and between precast units. Care shall be exercised to set precast slabs with reinforcement on bottom side of panel when in final position.

d. Pipe at both ends of the radius shall be laid in the final position and firmly bedded prior to commencement of brick radius construction. Longitudinal reinforcement shall extend from the normal radius section into a concrete pipe collar. The collar shall extend a minimum of 1 foot over each pipe end. Precast top slabs shall not be allowed over the pipe collars.

e. Inverts shall be constructed of Class C concrete and form a smooth radius conforming with the larger of the two pipes which they adjoin.

C. Cast-In-Place Concrete Construction.

1. Construction Methods.

a. All cast-in-place structures shall be built as shown on the Plans and of Class A concrete. The structures shall be built on prepared foundations and conform to the dimensions and shapes shown on the Plans. The construction shall conform to the methods, forms, placement, protection, and curing for concrete as specified in Specification Section 03310.

b. Any required reinforcement shall be of the kind, type, and size and shall be located, spaced, bent, and fastened as shown in the Plans and Design Standards. Concrete reinforcing in place shall be approved by the Owner before any concrete is placed.

c. Connections for inlet and outlet pipes shall conform to the sizes, alignments, and elevations shown on the Plans.

d. Steps, when required, shall be cast into the full depth of the wall section at spacings as previously specified. The Contractor may at his option construct steps after removing concrete forms. Under this option, holes shall be drilled of sufficient size to allow ½ inch to 3/4inch of nonshrinking grout on all sides of the prongs and sufficient depth to allow full embedment of the prongs.

2. Cast-In-Place Manholes.

Cast-in-place manholes shall be neatly and accurately built according to the Plans or as directed by the Owner. Wall thicknesses shall be as detailed on the Plans and Design Standards but not less than 6 inch thick. All cast-in-place manholes shall be of eccentric construction as shown on the Plans and Design Standards. The access steps shall be located on the vertical wall and staggered either side of a single vertical alignment in accordance with Specification Section 02640 Paragraph 3.02.A.

3. Cast-In-Place Inlets.

Inlet walls may be built of concrete in lieu of brick at the Contractor's option. Concrete shall be Class A having a minimum wall thickness of 6 inches. Cast-in-place inlets shall be constructed with the same inside dimensions as shown in the Plans and Design Standards.

4. Junction Structures.

Junction structure walls may be built of concrete in lieu of brick at the Contractor's option. Concrete shall be Class A having a minimum wall thickness of 6 inches. Cast-in-place junction structures shall be constructed to the inside dimensions shown on the Plans and Design Standard or as directed by the Owner.

5. Cast-In-Place Radius.

Concrete walls shall be Class A having a minimum wall thickness of 6 inches. Cast-in-place radius shall be constructed to the radius and inside dimensions as shown in the Plans and Design Standards. Cast-in-place radius may also be constructed with a precast top slab set in a mortar bed and dowels if approved by the Owner.

6. Headwalls, Wingwalls, and Aprons.

All headwalls, wingwalls, and aprons used with drainage pipe, box culverts, and concrete channel lining shall be constructed of Class A concrete and to the lines and dimensions shown on the Plans and Design Standards or as directed by the Owner.

7. Sidewalk Drains.

Sidewalk drains shall be constructed to the dimensions and of the materials shown on the Plans and Design Standard or as directed by the Owner. Fillet welds shall be provided between the steel channels and steel plates as shown on the design Standard for Prefabricated Sidewalk Drain. Sidewalk drains shall be securely bedded on an earth subgrade at the same elevation and slope as adjacent sidewalk prior to pouring adjacent sidewalk. Concrete for sidewalk shall be placed uniformly on either side of the drain to prevent dislocation of the drain. Drains shall be held firmly in place by suitable means to prevent movement during placement of concrete. Sidewalk drains shall have positive drainage away from the drain. The drain shall be constructed through the curb and be terminated neatly and flush with the face of curb. Drains shall be placed with tread plate up and matching the sidewalk surface.

D. Precast Concrete Construction.

1. Precast concrete manholes shall be neatly and accurately built according to the Plans or as directed by the Owner. All precast concrete manholes shall have a 10 inch concrete base

slab constructed of Class "A" concrete, shall be cast integrally with the base section and the inlet and outlet pipes as shown on the Design Standard. Precast concrete base shall not be used.

2. Precast concrete sections shall be set so the structure will be vertical and with sections in true alignment. Joint surfaces of the base or previously installed section shall have a flexible plastic gasket as described in Specification Section 02640 Paragraph 2.01.L installed in the recess after being primed with an asphaltic cement material recommended by the manufacturer. Each joint shall be completely filled with plastic gasket material on the inside and outside of the manhole after sections have been placed.

3. All holes in precast sections used for their handling and the annular space between the wall and entering pipes shall be thoroughly plugged with nonshrinking grout, applied so that there will be no leakage through openings and around pipes. The grout shall be finished smooth and flush with the adjoining interior and exterior manhole wall surfaces.

4. All precast concrete manhole cones shall be of eccentric construction as shown on the Plans. The access steps shall be located on the vertical wall and shall be aligned with the riser steps.

5. All flat top slabs on drain manholes shall have a minimum thickness of 8 inches and the manhole rim and cover shall be located eccentrically in slab as shown on the Plans.

E. Test Specimens.

The Contractor shall furnish the concrete necessary for casting test specimens in the field. The City will supply all molds and labor necessary to cast and test the specimens. The Owner will designate the frequency of sampling the fresh concrete. The method of making and curing test specimens will be in accordance with AASHTO Designation T 23. Test cores shall be drilled by the Contractor at this expense if required by the Owner at locations selected by the Owner.

PART 4 – MEASUREMENT

4.01 STANDARD DEPTH MANHOLES.

Standard depth manholes will be measured per each, for the various diameters and types less manhole rim and cover. Standard depth is defined as a manhole depth between 0 and 6 feet as measured vertically from the top of the manhole rim to the invert of the outlet drain.

4.02 EXTRA DEPTH MANHOLES.

Extra depth manhole will be measured per vertical foot from a point 6.0 feet below the top of the manhole rim to the invert of the outlet drain for the various diameters and type. Only manholes greater than 6.0 feet in depth will be considered for extra depth measurement.

4.03 INLETS.

A. Standard Depth Inlets: Inlets will be measured per each, for the various types less frame and grate.

B. Extra Depth Inlets: Extra depth inlets will be measured per vertical foot from a point 6.0 feet below the top of the inlet grate to the outlet drain. Only inlets greater than 6.0 feet will be considered for extra depth measurement.

4.04 MANHOLE RIMS AND COVERS.

Manhole rims and covers will be measured per each matching set consisting of one rim and one cover for the various types.

4.05 INLET FRAMES AND GRATES.

Inlet frames and grates will be measured per each set consisting of one frame and the required number of matching grates for one frame for the various types.

4.06 SIDEWALK DRAINS.
Sidewalk drains will be measured per pound of fabricated steel.

4.07 JUNCTION STRUCTURES
Junction structures will be measured per each including access shaft regardless of depth but not including manhole rim and cover or inlet frame and grate.

4.08 RADIUS STRUCTURES.
Radius structures will be measured per linear foot along the centerline of the structure from the face of the adjoining pipe section for the various types, widths, and heights.

4.09 HEADWALLS, WINGWALLS, AND SKIRTS.
Headwalls, wingwalls, and skirts will be measured per each for the various types.

4.10 STRUCTURE REMOVAL.
Removal of existing structures will be measured per each.

4.11 BACKFILL FOR STRUCTURE ABNANDONMENT.
Backfill for structure abandonment will be measured per tone of material placed.

PART 5 – PAYMENT

5.01 STANDARD DEPTH MANHOLES.
The accepted quantities of standard depth manholes will be paid for at the contract unit price per each complete in place for the various diameters and types less rim and cover which price will be full compensation for materials and materials' testing; excavation; special protection; placing, protection and curing of concrete; laying, plastering, protection and curing of brick work; placing and jointing precast sections; construction of steps and inverts; connection of inlet and outlet pipes; cleaning and inspection; removal and/or abandonment of existing pipe or structures within the limits of excavation; and backfilling.

5.02 EXTRA DEPTH MANHOLES.
The accepted quantities of extra depth manhole will be paid for at the contract unit price per vertical foot complete in place which price will be full compensation for materials and materials' testing; excavation; special protection; placing, protection and curing of concrete; laying, plastering, protection and curing of brick work; placing and jointing precast sections; construction of steps; cleaning and inspection, and backfilling.

5.03 INLETS.

A. Standard Depth Inlets: The accepted quantities of inlets will be paid for at the contract unit price per each complete in place for the various types less frame and grate which price will be full compensation for materials and materials' testing; excavation; special protection; placing, protection and curing of concrete; laying, plastering, protection and curing of brick work; construction of steps and invert; connection of inlet and outlet pipes; cleaning and inspection; removal and/or abandonment of existing pipe or structures within the limits of excavation; and backfilling.

B. Extra Depth Inlets: The accepted quantities of extra depth inlet will be paid for at the contract unit price per vertical foot complete in place which price will be full compensation for materials and materials' testing; excavation; special protection; placing protection and curing of concrete; laying, plastering, inspection, and backfilling.

5.04 MANHOLE RIMS AND COVERS.

The accepted quantities of manhole rim and cover will be paid for at the contract unit price per each complete in place for the various types which price will be full compensation for materials and materials' testing; setting rim and cover; protection and curing of mortar; and cleaning and inspection.

5.05 INLET FRAMES AND GRATES.
The accepted quantities of inlet frames and grates will be paid for at the contract unit price per each complete in place for the various types which price will be full compensation for materials and materials' testing; setting frames and grates; protection and curing of mortar; and cleaning and inspection.

5.06 SIDEWALK DRAINS.
The accepted quantities of sidewalk drains will be paid for at the contract unit price per pound of fabricated steel complete in place which price will be full compensation for materials; fabrication of channels and plates; setting of sidewalk drains; and cleaning and inspection.

5.07 JUNCTION STRUCTURES.
The accepted quantities of junction structures will be paid for at the contract unit price per each complete in place which price will be full compensation for materials and materials' testing; excavation; special protection; placing, protection, and curing of concrete; laying, plastering, protection and curing of brick work; construction of steps and inverts; construction of access shaft; connection of inlet and outlet pipes; cleaning and inspection; removal and/or abandonment of existing pipe or structures within the limits of excavations; and backfilling.

5.08 RADIUS STRUCTURES.
The accepted quantities of radius structures will be paid for at the contract unit price per linear foot complete in place for the various types, widths, and heights which price will be full compensation for materials testing; excavation; special protection; placing, protection, and curing of concrete; laying, plastering, protection and curing of brick work; construction of inverts; connection of inlet and outlet pipes; cleaning and inspection; removal and/or abandonment of existing pipe or structures within the limits of excavation; and backfilling.

5.09 HEADWALLS, WINGWALLS, AND SKIRTS.
The accepted quantities of headwalls, wingwalls, and skirts will be paid for at the contract unit price per each complete in place which price will be full compensation for materials and materials' testing; excavation; special protection; placing, protection and curing of concrete; connection to pipes, channel lining or structure; cleaning and inspection; and backfilling.

5.10 STRUCTURE REMOVAL.
The accepted quantities of structure removal will be paid for at the contract unit price per each, complete which price will be full compensation for excavation, special protection, protection of existing utilities, structure removal, disposal of debris, handling and delivery of salvage material, and backfilling.

5.11 BACKFILL FOR STRUCTURE ABANDONMENT.
The accepted quantities of sand for backfilling abandoned structures will be paid for at the contract unit price per ton furnished and placed which price will be full compensation for preparing the structure for abandonment; bulkheading inlet and outlet pipes; disposal of debris; furnishing and placing backfill material; compaction; and handling and delivery of salvageable material.

5.12 PAYMENT WILL BE MADE UNDER THE FOLLOWING ITEMS:

Item No.	Pay Item	Pay Unit
02640-01	STANDARD DEPTH MANHOLES	Each
02640-01.01.__	__'Diameter Standard Depth Cast-in-Place Manhole (0' – 6' Deep) Less Rim and Cover	Each
02640-01.02.__	__' Diameter Standard Depth Brick Manhole	Each

	(0' – 6' Deep) Less Rim and Cover	
02640-01.03.__	__' Diameter Standard Depth Precast Concrete Manhole (0' – 6' Deep) Less Rim and Cover	Each
Item No.	Pay Item	Pay Unit
02640-02	EXTRA DEPTH MANHOLES	Vertical Foot
02640-02.01.__	__' Diameter Extra Depth Cast-in-Place Manhole	Vertical Foot
02640-02.02.__	__' Diameter Extra Depth Brick Manhole	Vertical Foot
02640-02.03.__	__' Diameter Extra Depth Precast Concrete Manhole	Vertical Foot
02640-03	INLETS	Each
02640-03.01	6-72 Inlet Less Frame and Grate	Each
02640-03.02	Twin 6-72 Inlet Less Frame and Grate	Each
02640-03.03	3' x 3' Inlet Less Rim and Cover	Each
02640-03.04	#S-11 Inlet Less Frame and Grate	Each
02640-03.05	#11 Inlet Less Frame and Grate	Each
02640-03.06	#10 Inlet Less Frame and Grate	Each
02640-03.07	Extra Depth 6-72 Inlet	Vertical Foot
02640-03.08	Adjust 6-72 Inlet	Each
02640-03.09	Extra Depth Twin 6-72 Inlet	Vertical Foot
02640-03.10	Extra Depth 3' x 3' Inlet	Vertical Foot
02640-03.11	Extra Depth #10 Inlet	Vertical Foot
02640-03.12	Extra Depth #11 Inlet	Vertical Foot
02640-03.13	Extra Depth #S-11 Inlet	Vertical Foot
02640-03.14	#3070 Inlet Less Frame/Grate	Each
02640-03.15	Extra Depth #3070 Inlet	Vertical Foot
02640-04	MANHOLE RIMS AND COVERS	Each
02640-04.01	No. 7A Manhole Rim and Cover	Each
02640-04.02	No. 7A-Alt. Manhole Rim and Cover	Each
02640-04.03	No. 6 Manhole Rim and Cover	Each
02640-05	INLET FRAMES AND GRATES	Each
02640-05.01	Tapered 6-72 Frame and Grate	Each
02640-05.02	Standard Adapter Frame for No. 6 and No. 6-72 Inlet	Each
02640-05.03	#11 Frame and Grate	Each
02640-05.04	#10 Frame and Grate	Each
02640-05.05	#12 Frame and Grate	Each
02640-05.06	3' x 3' Rim and Cover	Each
02640-05.07	#S-11 Frame and Grate	Each
02640-05.08	#3070 Frame and Grate	Each
02640-06	SIDEWALK DRAINS	Pounds
02640-07	JUNCTION STRUCTURES	Each
02640-08	RADIUS STRUCTURES	Linear Foot
02640-08.01.__.__	H" x W" Brick Radius Structure	Linear Foot
02640-08.02.__.__	H" x W" Cast-in-Place Radius Structure	Linear Foot
02640-09	HEADWALLS, WINGWALLS, AND SKIRTS	Each
02640-09.01	Type "A" Headwall	Each
02640-09.02	Type "B" Headwall	Each
02640-09.03	Type "C" Headwall and Spillway	Each
02640-09.04	Type "D" Headwall and Wingwalls	Each
02640-09.05	Type "E" Headwall and Wingwalls	Each

02640-09.06	Headwall as per Detail	Each
02640-09.07	Wingwalls as per Detail	Each
02640-09.08	Skirt as per Detail	Each
02640-10	STRUCTURE REMOVAL	Each
02640-11	BACKFILL FOR STRUCTURE ABANDONMENT	Ton

END OF SECTION 02640