SECTION 02305
PRECAST CONCRETE MANHOLES

PART I: GENERAL

1.1 GENERAL REQUIREMENTS

A. Precast concrete manholes for sanitary sewers and storm sewers.

B. Precast concrete sanitary sewer manholes with PVC liner where corrosion resistant manholes are specifically indicated in the Drawings.

C. Pile-supported concrete foundation used for unstable subgrade treatment for manhole base.

1.2 MEASUREMENT AND PAYMENT

A. Unit Prices:

1. Payment for normal depth manholes, up to eight feet (8 Ft) deep, is on a unit price basis for each manhole installed. Manhole depth is measured from top of cover to sewer invert. Air release manhole depth is measured from top of cover to inside base for air release or vacuum release manholes.
2. Payment for shallow depth manholes is on a unit price basis for each manhole installed. Shallow manholes have a depth of five feet (5 Ft) or less measured from top of cover to sewer invert.
3. Payment for extra depth manholes is on a unit price basis per vertical foot for each foot of depth greater than eight feet (8 Ft). Sewer manhole depth is measured from top of cover to sewer invert. Air release manhole depth is measured from top of cover to inside base for air release or vacuum release manholes.
4. Payment for normal depth corrosion resistant manholes is on a unit price basis for each manhole installed.
5. Payment for standard manhole drops is on a unit price basis for each drop installed. Standard manhole drops include both internal and external drops.
6. Payment for watertight manholes, including external vent pipe is on a unit price basis for each.
7. Payment for air-release manhole with valves and fittings installed is on a unit price basis for each manhole with air-release valves and fittings installed.
8. Payment for pile-supported concrete foundation used for unstable subgrade treatment for manhole base is on a unit price basis for each foundation installed.
9. Payment for sanitary sewer manholes shall be authorized when manhole has been tested as specified in Section 02525 – Acceptance Testing of Gravity Sanitary Sewer Lines.
10. Refer to Section 01270 – Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum):
   1. If Contract is Stipulated Price Contract, payment for Work in this Section is included in Total Stipulated Price.

1.3 REFERENCES
A. AASHTO – American Association of State Highway and Transportation Officials.
B. ASME – American Society of Mechanical Engineers.
   1. ASME B16.1 – Cast Iron Pipe Flanges and Flanged Fittings.
C. ASTM – American Society for Testing and Materials.
   1. ASTM A307 – Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile.
   2. ASTM A615 – Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
   3. ASTM C270 – Standard Specification for Mortar for Unit Masonry.
   4. ASTM C443 – Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.
   5. ASTM C478 – Standard Specification for Precast Reinforced Concrete Manhole Sections.
   6. ASTM C923 – Standard Specifications for Resilient Connectors Between Reinforced Concrete Manhole Structures and Pipes.
   7. ASTM C1107 – Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
   8. ASTM D698 – Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lb/ft3).
   9. ASTM D2665 – Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste and Vent Pipe and Fittings.
   10. ASTM D2996 – Standard Specification for Filament-Wound “Fiberglass” (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe.
   11. ASTM D2997 – Standard Specification for Centrifugally Cast “Fiberglass” (Glass-Fiber-Reinforced Thermosetting Resin) Pipe.
D. AWWA – American Water Works Association.
   1. AWWA C213 – Standard for Fusion Bonded Epoxy Coating for Interior and Exterior of Steel Water Pipelines.
E. CFTS – City of Friendswood Technical Specifications.

1.4 SUBMITTALS
A. Conform to requirements of Section 01330 – Submittal Procedures.
B. Submit manufacturer's data and details of following items for approval:
   1. Shop drawings of manhole sections, base units and construction details, including reinforcement, jointing methods, materials and dimensions.

2. Summary of criteria used in manhole design including as a minimum; material properties, loadings, load combinations and dimensions assumed. Include certification from manufacturer that precast manhole design is in full accordance with ASTM C478 and design criteria as established in Paragraph 2.1.E of this Specification.
3. Frames, grates, rings and covers.
4. Materials to be used in fabricating drop connections.
5. Materials to be used for pipe connections at manhole walls.
6. Materials to be used for stubs and stub plugs, if required.
7. Materials and procedures for corrosion-resistant liner and coatings, if required.
8. Plugs to be used for sanitary sewer hydrostatic testing.
9. Manufacturer's data for pre-mix (bag) concrete, if used for channel inverts and benches.

C. Seal submittal drawings by a Professional Engineer licensed by the State of Texas.

PART II: PRODUCTS

2.1 PRECAST CONCRETE MANHOLES

A. Provide manhole sections, base sections and related components conforming to ASTM C478. Provide base riser section with integral floors, unless shown otherwise. Provide adjustment rings which are standard components of manufacturer of manhole sections. Mark date of manufacture and name or trademark of manufacturer on inside of barrel.

B. Construct barrels for precast manholes from standard reinforced concrete manhole sections of diameter indicated on the Drawings. Use various lengths of manhole sections in combination to provide correct height with fewest joints. Design wall sections for depth and loading conditions in Paragraph 2.1.E, with minimum thickness of five inches (5 In). Base section shall have minimum thickness of twelve inches (12 In) under invert.

C. Provide tops to support HS-20 vehicle loading and receive cast iron frame covers, as indicated on the Drawings.

D. Where manholes larger than forty-eight inch (48 In) diameter are indicated on the Drawings, provide precast base sections with flat slab top precast sections used to transition to forty-eight inch (48 In) diameter manhole access riser sections. Transition can be concentric or eccentric unless otherwise shown on the Drawings. Locate transition to provide minimum of seven foot (7 Ft) head clearance from base to underside of transition unless otherwise approved by the Project Manager.

E. Design Loading Criteria: Manhole walls, transition slabs, cone tops and manhole base slab shall be designed, by manufacturer, to requirements

of ASTM C478 for depth as shown on the Drawings and to resist following loads.

1. AASHTO HS-20 vehicle loading applied to manhole cover and transmitted down to transition and base slabs.
2. Unit soil weight of one hundred twenty pounds per cubic foot (120 pcf) located above portions of manhole, including base slab projections.
3. Lateral soil pressure based on saturated soil conditions producing an at-rest equivalent fluid pressure of one hundred pounds per cubic foot (100 pcf).
4. Internal liquid pressure based on unit weight of sixty-three pounds per cubic foot (63 pcf).
5. Dead load of manhole sections fully supported by transition and base slabs.

F. Design: Manhole walls, transition slabs, cone tops and manhole base slab shall be designed according to requirements of ASTM C478 and following:
   1. Design additional reinforcing steel to transfer stresses at openings. Area of steel to be no less than shown on the Drawings.
   2. Wall loading conditions:
      a. Saturated soil pressure acting on empty manhole.
      b. Manhole filled with liquid to a halfway depth as measured from invert to cover, with no balancing external soil pressure.
   3. Minimum clear distance between two (2) wall penetrations shall be twelve inches (12 In) or half diameter of smaller penetration, whichever is greater.

G. Provide joints between sections with O-ring gaskets conforming to ASTM C443.

H. When base is cast monolithic with portion of vertical section, extend reinforcing in vertical section into base.

I. Precast Concrete Base: Suitable cutouts or holes to receive pipe and connections.

2.2 CONCRETE

A. Conform to requirements of Section 03300 – Structural Concrete.

B. Channel Inverts: Use five (5) sack premix (bag) concrete or Class A concrete for inverts not integrally formed with manhole base, with minimum compressive strength of four thousand pounds per square inch (4000 psi).

C. Cement-Stabilized Sand Foundation: Provide cement-stabilized sand foundation under base section in lieu of foundation slab, as shown on the Drawings, conforming to requirements of Section 02145 – Cement-Stabilized Sand.

D. Concrete Foundation: Provide Class A concrete with minimum compressive strength of four thousand pounds per square inch (4000 psi) for concrete foundation slab under manhole base section where indicated on the Drawings.

2.3 REINFORCING STEEL

A. Conform to requirements of Section 03200 – Reinforcing Steel.

2.4 MORTAR

A. Conform to requirements of Section 03100 – Mortar.

2.5 MISCELLANEOUS METALS

A. Provide cast-iron frames, rings and covers conforming to requirements of Section 02315 – Frames, Grates, Rings and Covers.

2.6 DROP CONNECTIONS AND STUBS

A. Provide drop connections and stubs conforming to same pipe material requirements used in main pipe, unless otherwise indicated on the Drawings.

2.7 PIPE CONNECTIONS TO MANHOLE

A. Sanitary Sewers.
   1. Provide resilient connectors conforming to requirements of ASTM C923. Use the following materials for metallic mechanical devices as defined in ASTM C923:
      a. External clamps: Type 304 stainless steel.
      b. Internal, expandable clamps on standard manholes: Type 304 stainless steel, eleven (11) gauge minimum.
      c. Internal, expandable clamps on corrosion-resistant manholes:
         1) Type 316 stainless steel, eleven (11) gauge minimum.
         2) Type 304 stainless steel, eleven (11) gauge minimum, coated with minimum sixteen (16) mil fusion-bonded epoxy conforming to AWWA C213.
   2. Where rigid joints between pipe and cast-in-place manhole base are specified or shown on the Drawings, provide polyethylene-isoprene water-stop meeting physical property requirements of ASTM C923, such as Press-Seal WS Series or approved equal.

B. Storm Sewer Connections:
   1. Provide watertight connections in accordance with ASTM C923.

2.8 SEALANT MATERIALS

A. Approved products in accordance with Section 01630 – Product Substitution.

B. Provide sealing materials between precast concrete adjustment ring and manhole cover frame, Adeka Ultraseal P201 or approved equal.
C. Provide approved external sealing material from Canusa Wrapid Seal manhole encapsulation system or approved equal.
D. Provide Butyl Sealant: Provide Press-Seal EZ Stick or equal, for HDPE rings.

2.9 CORROSION RESISTANT MANHOLE MATERIALS
A. Where corrosion-resistant manholes or PVC-lined manholes are indicated on the Drawings, provide one of following:
1. PVC liner for precast cylindrical manhole section, base sections and cone sections.

2.10 BACKFILL MATERIALS
A. Conform to requirements of Section 02125 – Excavation and Backfill for Utilities.

2.11 NON-SHRINK GROUT
A. Provide prepackaged, inorganic, flowable, non-gas-liberating, non-metallic, cement-based grout requiring only addition of water.
B. Meet requirements of ASTM C1107 and have minimum twenty-eight day (28 D) compressive strength of seven thousand pounds per square inch (7000 psi).

2.12 VENT PIPES
A. Provide external vent pipes for manholes where indicated on the Drawings.
B. Buried Vent Pipes: Provide three inch (3 In) or four inch (4 In) PVC Drain, waste and Vent (DWV) pipe conforming to ASTM D2665. Alternatively, provide Fiberglass Reinforced Plastic (FRP) pipe as specified for vent outlet assembly.
C. Vent Outlet Assembly: Provide vent outlet assembly as shown on the Drawings, constructed of following specified materials:
1. FRP Pipe: Provide filament wound FRP conforming to ASTM D2996 or centrifugally cast FRP conforming to ASTM D2997. Seal cut ends in accordance with manufacturer's recommendations.
2. Joints and Fittings: Provide epoxy bodied fittings and join pipe to fittings with epoxy adhesive.
3. Flanges: Provide socket-flange fittings for epoxy adhesive bonding to pipe ends where shown on the Drawings. Meet bolt pattern and dimensions for ASME B16.l, one hundred twenty-five pound (125 Lb) flanges. Flange bolts shall be Type 304 stainless steel or hot-dip zinc coated, conforming to ASTM A307, Class A or B.

4. Coating: Provide approved two (2) component, aliphatic polyurethane coating using primer or tie coat recommended by manufacturer. Provide two (2) or more coats to yield dry film thickness of at least three (3) mils. Color shall be selected by the Project Manager from manufacturer's standard colors.

2.13 PROHIBITED MATERIALS

A. Do not use brick masonry for construction of sanitary sewer manholes or storm sewer manholes, including adjustment of manholes to grade. Use only specified materials listed above.

PART III: E X E C U T I O N

3.1 EXAMINATION

A. Verify that lines and grades are correct.

B. Determine if subgrade, when scarified and recompacted, can be compacted to ninety-five percent (95%) of maximum Standard Proctor Density according to ASTM D698 prior to placement of foundation material and base section. When proper density is not reached, moisture condition subgrade until that density is reached or treat as unstable subgrade.

C. Do not build manholes in ditches, swales or drainage paths unless approved by the Project Manager.

3.2 PLACEMENT

A. Install precast manholes to conform to locations and dimensions shown on the Drawings.

B. Place sanitary and storm manholes at points of change in alignment, grade, size, pipe intersections and end of sewer unless otherwise shown on the Drawings.

3.3 MANHOLE BASE SECTIONS AND FOUNDATIONS

A. Place precast base on twelve inch (12 In) thick (minimum) foundation of crushed stone wrapped in filter fabric, cement-stabilized sand or concrete foundation slab. Compact cement-stabilized sand in accordance with requirements of Section 02145 – Cement-Stabilized Sand.

B. Unstable Subgrade Treatment: When unstable subgrade is encountered, notify the Project Manager for examination of subgrade to determine if subgrade has heaved upwards after being excavated. When heaving has not occurred, over-excavate subgrade to allow for twenty-four inch (24 In) thick layer of crushed stone wrapped in filter fabric as foundation material under manhole base. When there is evidence of heaving, provide pile-supported concrete foundation, as detailed on the Drawings, under manhole base.

3.4 PRECAST MANHOLE SECTIONS

A. Install sections, joints and gaskets in accordance with manufacturer's printed recommendations.

B. Install precast adjustment rings above tops of cones or flat-top sections as required to adjust finished elevation and to support manhole frame.

C. Seal any lifting holes with non-shrink grout.

D. Where PVC liners are required, seal joints between sections in accordance with manufacturer's recommendations.

E. Place at least two (2) precast concrete grade rings with thickness of twelve inches (12 In) or less, under casting.

3.5 PIPE CONNECTIONS AT MANHOLES

A. Install approved resilient connectors at each pipe entering and exiting manholes in accordance with manufacturer's instructions.

1. Where smooth exterior pipes, i.e. steel, ductile iron or PVC pipes are connected to manhole base or barrel, space between pipe and manhole wall shall be sealed with an assembly consisting of rubber gaskets or links mechanically compressed to form watertight barrier. Assemblies: "Press-Wedge," "Res-Seal," "Thunderline Link-Seals," or approved equal. See the Drawings for placement of assembly in manhole sections.
2. When connecting concrete or cement mortar coated steel pipes or as an option for connecting smooth exterior pipes to manhole base or barrel, space between pipe and manhole wall may be sealed with an assembly consisting of stainless steel power sleeve, stainless steel take-up clamp and rubber gasket. Take-up clamp: Minimum of nine-sixteenths inch (9/16 In) wide. Provide PSX positive seal gasket system by Press-Seal Gasket Corporation or approved equal.

B. Grout storm sewer connections to manhole unless otherwise shown on the Drawings. Grout pipe penetration in place on both inside and outside of manhole. Pipes are to be flush with interior of the manhole.

C. Ensure no concrete, cement-stabilized sand, fill or other rigid material is allowed to enter space between pipe and edge of wall opening at and around resilient connector on either interior or exterior of manhole. If necessary, fill space with compressible material to ensure full flexibility provided by resilient connector.

D. Where new manhole is constructed on existing sewer, rigid joint pipe may be used. Install waterstop gasket around existing pipe at center of cast-in-place wall. Join ends of split waterstop material at pipe springline using an adhesive recommended and supplied by waterstop manufacturer.

1. Field verify the elevations of all manholes to be constructed on existing sewer before the start of any related work.
2. Failure to field verify existing conditions before start of work shall be the responsibility of the Contractor should elevations not

match and the work shall be completed with no additional cost to the City.

E. Test connection for watertight seal before backfilling.

F. All connection to existing manholes shall be core drilled. Making openings to existing manholes by any other means shall not be accepted.

3.6 INVERTS FOR SANITARY SEWERS

A. Construct invert channels to provide smooth flow transition waterway with no disruption of flow at pipe-manhole connections. Conform to following criteria:

1. Slope of invert bench: one inch per foot (1 In/Ft) minimum; one and one-half inches per foot (1-1/2 In/Ft) maximum.
2. Depth of bench to invert:
   a. Pipes smaller than fifteen inches (15 In): one-half (1/2) of largest pipe diameter.
   b. Pipes fifteen inches (15 In) to twenty-four inches (24 In): three-quarters (3/4) of largest pipe diameter.
   c. Pipes larger than twenty-four inches (24 In): equal to largest pipe diameter.
3. Invert slope through manhole: one-tenth foot (0.1 Ft) drop across manhole with smooth transition of invert through manhole, unless otherwise indicated on the Drawings.

B. Form invert channels with concrete if not integral with manhole base section. For direction changes of mains, construct channels tangent to mains with maximum possible radius of curvature. Provide curves for side inlets and smooth invert fillets for flow transition between pipe inverts.

3.7. DROP CONNECTIONS FOR SANITARY SEWERS

A. Backfill drop assembly with crushed stone wrapped in filter fabric, cement-stabilized sand or Class A concrete to form solid mass. Extend cement-stabilized sand or concrete encasement minimum of four inches (4 In) outside bells.

B. Install drop connection when sewer line enters manhole higher than twenty-four inches (24 In) above invert of manhole.

3.8 STUBS FOR FUTURE CONNECTIONS

A. In manholes, where future connections are indicated on the Drawings, install resilient connectors and pipe stubs with approved watertight plugs.

3.9 MANHOLE FRAME AND ADJUSTMENT RINGS

A. Combine precast concrete or HDPE adjustment rings so elevation of installed casting cover matches pavement surface. Seal between concrete adjustment ring and precast top section with non-shrink grout; do not use mortar between adjustment rings. Apply latex-based bonding agent to precast concrete surfaces joined with non-shrink grout. Set cast

iron frame on adjustment ring in bed of approved sealant material. Install sealant bed consisting of two (2) beads of sealant, each bead having minimum dimensions of one-half inch (1/2 In) and one-half inch (1/2 In) wide.

B. Wrap manhole frame and adjustment rings with external sealing material, minimum three inches (3 In) beyond joint between ring and frame and adjustment rings and precast section.

C. For manholes in unpaved areas, set top of frame a minimum of six inches (6 In) above existing ground line unless otherwise indicated on the Drawings. In unpaved areas, encase manhole frame in mortar or non-shrink grout placed flush with face of manhole ring and top edge of frame. Provide rounded corner around perimeter.

3.10 BACKFILL

A. Place and compact backfill materials in area of excavation surrounding manholes in accordance with requirements of Section 02125 – Excavation and Backfill for Utilities. Provide embedment zone backfill material, as specified for adjacent utilities, from manhole foundation up to an elevation twelve inches (12 In) over each pipe connected to manhole. Provide trench zone backfill, as specified for adjacent utilities, above embedment zone backfill.

B. Where rigid joints are used for connecting existing sewers to manhole, backfill under existing sewer up to springline of pipe with Class B concrete or flowable fill.

C. In unpaved areas, provide positive drainage away from manhole frame to natural grade. Provide minimum of four inches (4 In) of topsoil conforming to requirements of Section 02905 – Topsoil. Seed in accordance with Section 02910 – Hydromulch Seeding. When shown on the Drawings, sod disturbed areas in accordance with Section 02915 – Sodding.

D. For Manholes in paved areas, set manhole cover is flush with surrounding pavement. Form a six foot by six foot (6 Ft x 6 Ft) area, full depth to subgrade and parallel to the roadway centerline, centered on the manhole. Install expansion joint material on the perimeter of the form. Install reinforcing bar and concrete typical of road paving. Ensure that manhole is flush with surrounding pavement before applying final finish and curing compound.

3.11 FIELD QUALITY CONTROL

A. Conduct leakage testing of sanitary sewer manholes in accordance with requirements of Section 02525 – Acceptance Testing of Gravity Sanitary Sewer Lines.

3.12 PROTECTION

A. Protect manholes from damage until work has been accepted. Repair damage to manholes at no additional cost to the City.

B. Damaged manholes that have been repaired or replaced shall be retested at no additional cost to the City.

END OF SECTION