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MATERIALS – STORM DRAIN PIPE

One type of storm drain pipe and joint has been specified on the plans. Any of the type of storm drain pipe or joints listed below may be substituted upon approval of the Owner, provided the flow capability and pipe (external load supporting) strength is equal to or exceeds that of the pipe specified on the plans.

The burden of proof for a pipe substitution shall be the Contractor's responsibility, and shall only be permitted provided the Owner shares in any material cost savings.

1. TYPES OF STORM DRAIN PIPE AND JOINTS

- a. Reinforced Concrete Pipe (ASTM C 76), as specified on the plans.
 - (1) Modified groove tongue joint or profile shaped joint with approved rubber gasket (meeting ASTM C 443 or C 361, except as such specifications relate to infiltration limitations).
 - (2) Lubricant, as supplied by the pipe manufacturer, shall be used on the groove and on the tongue in making up joints. The joints shall be assembled in accordance with the pipe manufacturer's requirements.
- b. Reinforced Concrete Elliptical Culvert Storm Drain, ASTM Designation C 507, Class HE-1 through HE-IV or VE-II through VE-VI, as specified on the plans.
 - (1) Tongue and groove joint with external sealing bands in accordance with ASTM C 877.
 - (2) Modified groove tongue joint or profile shaped joint with approved rubber gasket (meeting ASTM C 443 or C 361, except as such specifications relate to infiltration limitations).
- c. Non reinforced Concrete Pipe (ASTM C 14), as specified on the plans.
 - (1) Modified groove tongue with approved rubber gasket (ASTM C 443 or C 361, except as such specifications relate to infiltration limitations).
 - (2) Lubricant, as supplied by the pipe manufacturer, shall be used on the groove and on the tongue in making up joints. The joints shall be assembled in accordance with the pipe manufacturer's requirements.
- d. Corrugated Steel Pipe
 - (1) Corrugated steel pipe shall be provided, corresponding to the diameter or arch shape (rise and span) as specified on the plans.
 - (2) Unless otherwise indicated on plans, the following minimum gauges for CMP shall be required:

MATERIALS – STORM DRAIN PIPE

Min. Gauge Thickness Requirements, in inches, for Corrugated Steel Culvert and Sewer Pipe Based on Diameter and Pipe Cover and Size of Corrugations

Diameter Inches	Depth of Cover											
	ZERO TO 8.0 FT			8.1 FT TO 14.0 FT			14.1 FT TO 25.0 FT			GREATER THAN 25 FT		
	2 2/3 X 1/2	3 X 1	5 X 1	2 2/3 X 1/2	3 X 1	5 X 1	2 2/3 X 1/2	3 X 1	5 X 1	2 2/3 X 1/2	3 X 1	5 X 1
12,16, 18, 21	16	-	16	-	-	16	-	-	-	16	-	-
24	16	-	14	-	-	14	-	-	-	14	-	-
30	14	-	14	-	-	14	-	-	-	14	-	-
36	14	16	14	14	14	10	12	12	10	10	12	8
42	14	14	12	14	14	10	10	10	10	8	10	8
48	12	14	12	12	12	8	10	10	10	8	8	8
54	10	14	10	12	10	8	10	10	8	-	8	-
60	8	12	8	10	10	8	8	8	8	-	-	-
66	8	12	8	10	10	8	8	8	-	-	-	-
72	8	10	8	10	10	-	-	-	-	-	-	-
78	-	10	-	10	8	-	-	-	-	-	-	-
84	-	10	-	8	8	-	-	-	-	-	-	-
90	-	10	-	8	8	-	-	-	-	-	-	-
96	-	10	-	8	-	-	-	-	-	-	-	-
102	-	8	-	8	-	-	-	-	-	-	-	-
108	-	8	-	-	-	-	-	-	-	-	-	-
114,120	-	8	-	-	-	-	-	-	-	-	-	-

- (3) All corrugated steel pipe shall be galvanized and coated with a polymer coating to retard corrosion.
- (4) All corrugated steel pipe shall be joined together with a watertight circumferentially corrugated steel coupling band furnished with two (2) rubber gaskets.
- (5) Corrugated steel pipe shall have welded spiral seams with helical corrugations. Each end of the helical corrugated pipe shall be re-rolled to an annular configuration to accommodate the watertight coupling band described herein. Riveted or lock seam steel pipe is unacceptable without prior approval of Engineer.
- (6) All pipe connections to the side wall of main-line corrugated steel pipe shall be of the diameter specified on the plans, and shall consist of similar steel pipe that connects or taps into the main-line pipe wall using a pre-fabricated steel saddle plate. Side wall connection with prior approval of Engineer only.
- (7) No cutting or burning of corrugated steel pipe is allowed.
- (8) Do not use dissimilar types of base metal or dissimilar types of coatings in a single line of pipe.
- (9) Attach metal end sections to the ends of corrugated metal pipe by means of standard metal bands or other connecting devices as detailed on the plans or as approved by the Engineer. Furnish and install toe plates on the metal end sections as indicated on the plans.

MATERIALS – STORM DRAIN PIPE

- e. Truss and Solid Wall ABS Pipe (for foundation drains, storm water sump pump outlets, and four inch (4") to ten inch (10") diameter stubs).
 - (1) ABS Composite (Truss) Pipe - ASTM D 2680
 - (2) ABS Solid Plastic Pipe - ASTM D 2751, SDR 23.5
 - (3) Joints for ABS Truss Pipe and ABS Solid Wall Pipe and fittings shall be sleeve coupling type "SC" chemically welded joint as specified in ASTM Standard D 2680.
- f. Polyvinyl Chloride (PVC) Pipe (for foundation drains, storm water sump pump outlets, and four inch (4") to ten inch (10") diameter stubs).
 - (1) PVC Composite (Contech Truss) Pipe - ASTM D 2680
 - (2) PVC Solid Plastic Pipe - ASTM D 3034, SDR 35, SDR 26, SDR 23.5
 - (3) PVC (Contech A2000) Pipe - ASTM F 949
 - (4) Joints for PVC pipe and fittings shall be of the elastomeric type. Gasket joints shall be installed in accordance with procedures specified by the pipe manufacturer. Care should be taken to insure all joints being pushed to the full home position and held tightly in home position during any grade or line adjustments.
- g. Corrugated High Density Polyethylene Pipe (for foundation drains, storm water sump pump outlets, and four inch (4") to ten inch (10") diameter stubs).
 - (1) ADS N-12 WT (watertight joints).

2. MANHOLE, CATCH BASIN AND INLET BLOCK AND BRICK

Brick shall be made of clay or shale, and shall be whole, thoroughly and evenly burned, of close and uniform texture, free from cracks and warps, with true even faces and uniform in shape and size. Brick shall show a minimum average compressive strength of 2,000 pounds per square inch and an average absorption of water in twenty-four (24) hours of not more than 25% of the dry weight.

Concrete brick shall conform to the requirements for concrete building brick of ASTM C 55 Grade, normal weight.

Concrete block for manholes, catch basins, and inlets shall conform to ASTM C 139 with the following exceptions:

a. Shape

The blocks shall be solid curved blocks with the inside and outside surfaces curved to the required radii. The blocks shall have tongue and groove or other approved type of joint at the ends so that the units interlock to form a strong, rigid structure. Curved blocks shall have the inside and outside surfaces parallel.

2. MANHOLE, CATCH BASIN AND INLET BLOCK AND BRICK (continued)

b. Size

The nominal dimensions of the block shall be 18 inches maximum for length, 8" maximum for depth (height), and 6 inches minimum for width (thickness) or as shown on the plans. The length shall be measured along the chord on the outside face of the block. The tolerances of ASTM C 139 shall apply. Where the specified wall thickness on the standard plans is 12 inches, a multiple block wall of two 6-inch wide blocks is permitted. All blocks in one structure shall be of the same height dimension. The blocks shall be designed for length so that only full length or half-length blocks are required to lay the circular wall of any one course.

Blocks intended for use in the cones or tops of manholes or other structures shall have such shape as may be required to form the structure as shown on the plans with inside and outside joints not to exceed 1/4 inch in thickness.

The mortar shall be composed of one (1) part of a combination of Portland Cement and hydrated lime and three (3) parts of fine aggregate, by volume. The combination of cement and lime shall consist of 90% of Portland Cement and 10% of hydrated lime, by volume. In lieu of the above combination of cement and lime, standard brick mortar cement may be used if approved by the Engineer.

c. Steps

All Manhole, Catch Basin or Inlet Structure Steps shall be M.A. Industries, Inc., Numbers PS-1-B or PS-2-PFS or approved equal.

3. PRECAST MANHOLES

All precast manhole sections and bases shall be 4000 lb. per square inch concrete as determined by core test or cylinders.

Unless otherwise noted on the drawings or in the supplemental specifications, precast reinforced concrete manhole sections shall meet the requirements of current ASTM C 478, with C 443 joints.

Precast manhole tees for 48" and larger storm drains shall be the same class of pipe as that specified on the plans, but shall be a minimum ASTM C 76 Class IV. The manhole riser shall meet the requirements of ASTM C 478.

4. STORM DRAIN STUBS

Four inch (4") to ten inch (10") diameter stubs shall be ABS or PVC Composite (Contech Truss) Pipe or ABS or PVC Solid Plastic Pipe as specified under Section 1, Types of Storm Drain Pipe and Joints, Paragraphs e. and f., or as otherwise noted.

Stubs twelve inches (12") and larger shall be ASTM C76 Class IV Reinforced Concrete Pipe or as otherwise noted. Concrete stubs 12" or larger shall be assembled in the factory if possible. Taps into an existing RCP line shall be done by coring a hole into the existing pipe, or saw cutting if large enough core bits are not available. Jack hammering holes is not permitted. Kor-N-Tee flexible connections (or approved equal) shall be used to connect small diameter plastic pipe to concrete pipe when possible. Factory fittings shall be used to connect pipe of similar materials, if possible.

5. STORM WATER MANUFACTURED TREATMENT SYSTEMS

Description – Manufactured treatment systems are devices used to remove sediment and other pollutants from storm water runoff.

a. Performance

- (1) The system must treat up to the peak flow rate for the 10-year storm event.
- (2) The chamber must accumulate and store settleable solids without re-suspension of previously captured particulates.
- (3) The treatment system must include the capability to partition flows, causing all runoff to be diverted into the manufactured treatment system during 10-year flow events. Flows exceeding the treatment capacity of the unit shall bypass the treatment chamber to prevent re-suspension and washout of previously trapped pollutants.
- (4) All manufactured treatment systems should be placed off-line, such that flows in excess of those from the 10-year storm event are bypassed external to the system. For best results, the system should not be placed on the trunk line of the storm water pipeline.
- (5) The system must remove a minimum of 80% of the Total Suspended Solids (TSS) based on a 75-micron particle size and 90% of the floatable free oil.
- (6) The systems shall be designed to not allow surcharge of the upstream piping network.
- (7) Direct access allowing H₂O loading or greater must be provided to the sediment and floatable contaminant chambers to facilitate maintenance.

b. Materials and Design

- (1) Manufactured treatment systems must be constructed from pre-cast or cast-in-place concrete. Concrete for pre-cast storm water treatment systems must conform to ASTM 857 and C 858.
- (2) The minimum wall thickness shall be no less than the minimum thickness to sustain HS25 loading requirements as determined by a licensed Professional Engineer.
- (3) Sections must have tongue and groove or ship-lap joints with a butyl mastic sealant conforming to ASTM C 990.
- (4) Cement must be Type II Portland cement conforming to ASTM C 150.
- (5) All sections shall be cured by an approved method. Sections shall not be shipped until the concrete has attained a compressive strength of 4,000-psi at the end of seven days or 5000-psi at the end of 28 days after fabrication.
- (6) Pipe openings shall be sized to accept pipes of the specified size and material, and shall be sealed by the contractor with hydraulic cement conforming to ASTM C 595M.

5. STORM WATER MANUFACTURED TREATMENT SYSTEMS (continued)

- (7) Concrete and reinforced concrete for cast-in-place manufactured treatment systems must conform to current Oakland County specifications for structural concrete.
- (8) Internal aluminum plate components shall be alloy 5052-H32 in accordance with ASTM B 209.
- (9) A bitumen sealant in conformance with ASTM C 990 must be utilized in affixing the aluminum swirl chamber to the concrete vault.
- (10) Accepted Manufacturers
 - i. Stormceptor, tel: 1-800-909-7763, website: <http://www.stormceptor.com>
 - ii. Vortechs by Contech, tel: 1-800-338-1122 or 1-888-279-8826, website: <http://www.contech-cpi.com>
 - iii. Or approved equal

c. Installation

- (1) The manufactured treatment system must be constructed to serve the capacity shown on the drawings and as specified in the approved plans. The system must be installed at elevations and locations shown on the Drawings, or as otherwise directed by the Engineer.
- (2) Place the pre-cast base unit on a granular sub-base of a minimum thickness of six-inches or greater after compaction by the "Controlled Density Method" to 95% of the Maximum Unit Weight. The granular sub-base shall be checked for level prior to setting and the pre-cast base section of the trap shall be checked for level at all four corners after it is set. If the slope from any corner to any other corner exceeds 0.5%, the base section must be removed and the granular sub-base material re-leveled.
- (3) Prior to setting subsequent sections, place bitumen sealant in conformance with ASTM C 990 along the construction joint in the section that is already in place. Pre-cast sections shall be set in the manner that will result in a watertight joint. In all instances, installation of Storm Water Treatment Systems shall conform to ASTM specifications C 891 "Standard Practice for Installation of Underground Pre-cast Utility Structures".
- (4) Holes made in the concrete sections for handling or other purposes shall be plugged with non-shrink grout or by using grout in combination with concrete plugs.
- (5) Where holes must be cored in the pre-cast sections to accommodate pipes, do all coring before setting the sections in place. The contractor shall make all pipe connections.

d. Maintenance

- (1) Manufactured treatment systems shall be maintained in accordance with the manufacturers recommended schedule.
- (2) Manufactured treatment systems shall be cleaned prior to final acceptance.

6. TEST OF PIPE

a. Concrete Pipe

All pipe and pipe joints material shall meet the current American Society for Testing and Materials (ASTM) specifications as called for on the plans or elsewhere in these contract documents.

The manufacturer or seller shall furnish specimens for testing equal to 0.5% of order, but not less than 2 specimens of each size and type. The specimens may be selected from the job by the testing laboratory or by the Engineer if he so chooses.

Pipe 54" in diameter and over may be tested by taking suitable core samples and subjecting the cores to strength tests.

When approved by the owner, tests may be conducted at the pipe manufacturer's yard by the independent testing laboratory. The Engineer may choose to witness the tests.

Pipe shall be tested at the expense of the manufacturer by an independent testing laboratory approved by the Owner. Copies of the tests shall be furnished to the Owner, Manufacturer, Inspector and the Engineer. The signature of the representative of the independent testing laboratory must appear on the test reports.

The Engineer reserves the right to visually inspect and reject any pipe at the site of the work that appears to have defects or imperfections.

b. Plastic Pipe

All pipe shall be certified by the manufacturer to meet applicable ASTM specification requirements. Certification forms, together with a report of the test results, shall be provided the inspector with pipe deliveries and copies shall be forwarded to the Engineer or Owner.

Certification forms shall include project name, location, contractor and test lot number. Lot sizes shall be acceptable to the Engineer.

All pipe fittings shall be suitably marked to provide manufacturer's name, lot or production number. ASTM Designation, ABS or PVC, nominal diameter, and SDR number, where applicable. Fittings, however, need not contain lot or production number. Pipe shall have a "home" mark. Truss Pipe with an absence of filler material at the ends greater than one-fourth (1/4) inch deep shall be subject to rejection or acceptable repair.

The completed installation shall at no point have out-of-round pipe deflections greater than 5% of normal diameter of pipe. Deflectometer or go non-go gauging tests shall be required prior to acceptance of pipelines. Deflection testing shall be done with a nine point mandrel, a minimum of 30 days after installation. A proving ring to verify mandrel dimensions must be provided to the Engineer prior to testing.