

STANDARD CONSTRUCTION SPECIFICATIONS FOR STORM DRAIN SYSTEMS

DIVISION 800

INDEX

SECTION 801	GENERAL	Page
801.1	General-----	141
801.2	Applicable Standards-----	141
801.3	Surveys -----	142
801.4	Concrete and Mortar -----	142
SECTION 802	FURNISH AND INSTALL PIPE	
802.1	General-----	143
802.2	Material -----	143
802.3	Construction -----	145
802.4	Method of Measurement -----	146
802.5	Basis of Payment -----	146
SECTION 803	SUBDRAINS	
803.1	General -----	147
803.2	Material -----	147
803.3	Construction -----	147
803.4	Method of Measurement -----	147
803.5	Basis of Payment -----	148
SECTION 804	MANHOLES AND CATCH BASIN MANHOLES	
804.1	General -----	149
804.2	Material -----	149
804.3	Construction -----	149
804.4	Method of Measurement -----	150
804.5	Basis of Payment -----	150
SECTION 805	MANHOLE FRAMES AND COVERS	
805.1	General-----	151
805.2	Material -----	151
805.3	Construction -----	151
805.4	Method of Measurement -----	151
805.5	Basis of Payment -----	151

SECTION 806	CONSTRUCT CATCH BASIN	
806.1	General-----	152
806.2	Material -----	152
806.3	Construction -----	152
806.4	Method of Measurement -----	152
806.5	Basis of Payment -----	153
SECTION 807	CONNECTIONS TO EXISTING MANHOLES	
807.1	General-----	154
807.2	Construction -----	154
807.3	Method of Measurement -----	154
807.4	Basis of Payment -----	154

**STANDARD CONSTRUCTION SPECIFICATIONS FOR
STORM DRAIN SYSTEMS DIVISION 800**

.....

SECTION 801 GENERAL

801.1 General

The work covered by these specifications consists of providing all plant, labor, equipment, supplies, transportation, handling, storage, and performance of all operations necessary to complete the construction for pipe laying, jointing, and testing of storm drain systems and culverts.

Requirements for earthwork, including trench excavation and backfill, is specified in *Division 200 Standard Construction Specifications For Earthwork*.

801.2 Applicable Standards

The latest revision of the following standards of the American Society for Testing and Materials (ASTM), the American Association for State Highway and Transportation Officials (AASHTO), the American Water Works Association (AWWA), and the State of Alaska Department of Transportation and Public Facilities, Standard Specifications for Highway construction, 1988 Edition are hereby made a part of these specifications.

ASTM A-48 and ASTM A-438	Strength Requirements for Manhole Frames and Covers
ASTM C-76	Specification for Reinforced Concrete
ASTM C-150	Specification for Portland Cement
ASTM C-478 – (AASHTO-199)	Specification for Precast Reinforced Concrete
ASTM A-746 – (AWWA C-145)	Ductile Iron Pipe
AASHTO M-36	Corrugated Steel Pipe and Fittings
AASHTO M-45	Sand for Cement Mortar
AASHTO M-190	Bituminous Coating of CMP
AASHTO M-196	Corrugated Aluminum Pipe & Fittings

801.3 Surveys

The Contractor shall be responsible for the preservation of all line stakes, grade stakes, and hubs. In the event of their loss or destruction, the Contractor shall pay all costs for their proper replacement. The line and grade for pipe lines shall be given from reference hubs offset from each manhole or cleanout. The Contractor shall be responsible for the transfer of the control points from the reference hubs to such hubs or batter boards as he may desire or need for the prosecution of the work. A ground line profile shall be run prior to construction and made available immediately to the Engineer. The ground line profile centerline of pipe and the grade line refers to the elevation of the invert of pipe, except where otherwise noted.

801.4 Concrete and Mortar

a. Miscellaneous Concrete

All concrete used in the construction of storm drains, with the exception of precast manholes, manhole risers, cones, and catch basin barrels, shall be Class A-3. Concrete work shall conform to *Division 300 Portland Cement Concrete* of the specifications.

b. Cement for Mortar

Cement for mortar used in the construction of storm drains shall conform with the requirements of ASTM C-150, Type II. Sand shall conform with the requirements of AASHTO M-45. The mortar shall be composed of one (1) part cement and three (3) parts sand. The addition of lime is not permitted.

SECTION 802

FURNISH AND INSTALL PIPE

802.1 General

The work under this section consists of the performance of all operations pertaining to furnishing and installing pipe for storm drain systems and culverts.

In the case of City-furnished pipe, the City shall allot to the project pipe to accomplish the work in amounts exactly matching the Contractor's pay quantities for pipe. Any surplus pipe left over from this allotment at the end of the project shall be returned from the Contractor's job sites to the City's designated pipe yard. If the Contractor withdraws from the City's pipe yard more than the amount required to match the payment quantities, the Contractor shall pay the City on the basis of the City's invoice price for pipe (including freight), plus 10% overhead to reimburse the City for handling, warehousing, inspection, and administration.

802.2 Material

a. General

All piping shall be in accordance with the contract documents conforming to the size and class shown and specified. Changes in class shall be made within one pipe length of the station indicated on the drawings.

b. Corrugated Metal Pipe (CMP)

Corrugated metal pipe is intended to refer to both steel and aluminum. The pipe shall conform to the following specifications:

- 1. Steel:** Corrugated steel pipe shall conform to the requirements of AASHTO M-36.
- 2. Aluminum:** Corrugated aluminum pipe shall conform to the requirements of AASHTO M-196.

All CMP fittings shall be fabricated in a workmanship-like manner, develop the full strength of the material being joined, and when finished, will conform to the appropriate requirements of AASHTO M-36 and AASHTO M-196.

The joining of corrugated steel and aluminum pipe shall be made through the use of coupling bands applied as recommended by the manufacturer and approved by the Engineer. The minimum width of corrugated culvert bands shall be 12 inches for pipe 12 inches or less, and 24 inches for pipe greater than 12 inches in diameter. The Engineer allows dimple bands only with prior approval.

Dissimilar metals may only be used in extending in-place metal CMPs and reattachment of dissimilar metal end sections, provided an electrical insulating material, at least 1/16 inch in thickness, is used to separate the dissimilar materials.

All angles, bolts, and nuts shall be as recommended by the manufacturer for the type of pipe used.

The metal gauge for pipe to be used shall be in accordance with the contract documents.

If bituminous coating of CMP is required, the bituminous coating shall conform to the requirements of AASHTO M-190.

All Welding performed by the Contractor on aluminum pipe shall incorporate the use of 4043 or 5356 alloy for welding wire. The welding shall be accomplished by either the "TIG" (tungsten, inert gas shielded) or "MIG" (metal arc welding, inert gas shielded) process.

a. End Sections for Corrugated Metal Pipe

Galvanized steel and aluminum end sections shall be flared, beveled, shop-assembled units designed to serve as structural, hydraulic, and aesthetic end treatment to corrugated metal pipe culverts. They may be attached to culverts by threaded bolts or by riveting or bolting in accordance with the manufacturer's standard procedure. End sections shall have a turned-down lip or toe plate at the end to act as a cutoff.

Material for steel end sections shall be galvanized steel conforming to the requirements of AASHTO M-36. The gage shall be as outlined:

16 Ga.:	Through 24" round or 29" X 18" Pipe-arch
14 Ga.:	30" round and 36" X 22" Pipe-arch 36" round and 43" X 27" Pipe-arch
12 Ga.:	Over 36" round and 43" X 27" Pipe-arch (Except that the center panels of 60" round and larger and 72" X 44" Pipe-arch and larger, shall be 10 Ga.)

Galvanized stiffener angles shall supplement the usual reinforced side edges for 60" round and larger, and for 79" X 49" pipe-arch and larger.

If the end section is shop-attached to a stub of pipe, the pipe stub shall not be lighter in gage than the end section.

Materials for aluminum end sections shall conform to the requirements of AASHTO M-196 and fabrications shall comply with the requirements above.

802.3 Construction

a. Pipe Grade and Alignment

Variance of individual pipe sections (20 LF) from established line and grade should not be greater than those listed in the table below, providing that such variance does not result in a level or reverse sloping invert.

Diameter <u>Inches</u>	Allowance Tolerance <u>Feet</u>	Diameter <u>Inches</u>	Allowance Tolerance <u>Feet</u>
8	0.03	14	0.04
10	0.03	16	0.04
12	0.03	18*	0.05

*Note: For all pipe sizes over eighteen inches (18") diameter, tolerance shall not exceed 0.05 feet.

During the progress of the Work, the Contractor shall provide instruments such as transits, levels, laser devices, and other facilities for transferring grades from offset hubs or for setting of batter boards. The Contractor shall provide qualified personnel to use such instruments and they shall have the duty and responsibility for placing and maintaining such construction guides.

If the method of transferring grades from the offset hubs to the pipe requires batter boards, they shall be at least 1" X 6" supported by 2" X 4" stakes or approved metal rods and shall be placed every 25 feet. At least three boards must be in place at any given time to facilitate checking of line and grade. Both line and grade shall be checked for each piece of pipe laid, except at tunnels where methods acceptable to the Engineer shall be used to carry forward line and grade.

The practice of pushing in uncompacted backfill over a section of pipe to provide a platform for transit and level alignment and grade observations shall be subject to approval of the Engineer. If intermittent backfilling is allowed, backfilling shall be accomplished in accordance with *Division 200 Standard Construction Specifications for Earthwork, Section 207 Trench Excavation and Backfill*, of these specifications.

b. Pipe Laying

All pipes shall be laid with Class C Bedding unless otherwise required by the contract documents or directed by the Engineer.

Pipe laying shall, in all cases, proceed upgrade. Each 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. The alignment of the installed pipe shall appear straight to visual observation and shall be such that a full circle of light can be seen between manholes, etc., when sighting along all points of the pipe circumference. Each section of pipe shall be handled carefully and placed accurately. Each section of pipe shall be properly supported to insure true alignment and an invert which is smooth and shall not impede the flow. All seams shall be aligned uniformly for the length of the run. At all times, when work is not in progress, open ends of pipe and fittings shall be securely and satisfactorily closed so that no undesirable substances shall enter the pipes or fittings.

802.4 Method of Measurement

Measurements for all sizes of pipe shall be based on horizontal distances and shall be from center to center of manholes, from the center of manholes to center of catch basins, from center of manholes to center of cleanout wyes, and from center of manhole to the end of pipe excluding flared end sections, and from end of pipe to end of pipe excluding flared end sections.

Culvert connecting bands and bolts are considered incidental to this item of work. Flared end sections shall be measured and paid separately.

802.5 Basis of Payment

Payment for the work shall be in accordance with *Section 10.07 Measurement and Payment* of these specifications and shall include full payment for all work described in *Section 802*.

Payment shall be made under the following units:

<u>ITEM</u>	<u>DESCRIPTION</u>	<u>UNIT</u>
802	Furnish and Install CMP Size	Linear Foot
802-E	Furnish and Install CMP End Section	Each

SECTION 803 SUBDRAINS

803.1 General

The work under this section consists of the performance of all operations pertaining to furnishing and installing subdrains.

803.2 Material

The Contractor shall use perforated steel, perforated aluminum, polyethylene, or corrugated metal pipe as noted.

Corrugated metal pipe shall conform to the provisions of *Section 802 Furnish and Install Pipe* of this division. Perforations shall be located and sized in accordance with the requirements of AASHTO M-36. The top row of holes shall not be less than 22 ½ degrees below the horizontal axis.

Polyethylene pipe shall be corrugated single-wall pipe as manufactured by Advanced Drainage Systems, Inc. or approved equal and shall conform to AASHTO M-252 for material and perforation specifications. Perforations shall be cleanly cut so as not to restrict the inflow of water, and be uniformly spaced along the length and circumference of the pipe. The top row of holes shall not be less than 22 1/2 degrees below the horizontal axis. Perforations shall be centered in the corrugation valleys. The water inlet area shall be a minimum of one square inch per lineal foot of pipe. Perforations may be slots or holes. Slots shall be a maximum of one-tenth of an inch wide. Holes shall not exceed 3/16" diameter.

Geotextile fabric shall conform to *Section 702.B, Geotextile Synthetic Fabric Non-woven Fabric*, of these specifications.

803.3 Construction

Refer to the standard details for construction of subdrains. Each phase of construction shall be accomplished in accordance with the applicable sections of these specifications.

Excavation and backfill for furnishing and installing subdrains shall be in accordance with *Division 200 Standard Specifications for Earthwork, Section 207 Trench Excavation and Backfill*, of these specifications. Furnishing and installing subdrains shall be in accordance with *Section 802 Furnishing and Installing Pipe*.

803.4 Method of Measurement

Subdrains shall be measured per linear foot. The price shall include all work and materials necessary to furnish and install the subdrain, filter sock, connecting appurtenances, and to provide the filter gravel as shown on the drawings.

803.5 Method of Payment

Payment shall be made under the following unit:

<u>ITEM</u>	<u>DESCRIPTION</u>	<u>UNIT</u>
803	Install Subdrain (Size)	Linear Foot

SECTION 804

MANHOLES AND CATCH BASIN MANHOLES

804.1 General

The work under this section consists of performance of all work required for the construction of storm drain manholes and catch basins, complete with frames and covers.

804.2 Material

Materials used in the construction of manholes shall conform to the requirements of ASTM C-478 and the standard details of these specifications. Cones shall be Type (b), eccentric, unless otherwise approved.

Each precast concrete barrel section shall be set and sealed by the use of a pre-molded plastic gasket pipe joint sealer as manufactured by K.T. Snyder Co., Inc. Ram-Nek Gasket Division, 2100 Travis Street, Houston, Texas, or equal.

Cement for mortar used in the construction of manholes shall conform to the requirements of ASTM C-150, Type II. Sand shall be composed of one (1) part cement and three (3) parts sand. The joints shall be constructed so as to produce a smooth, regular watertight surface. Water shall be added in minimum amounts to provide plasticity in placing the mortar. The addition of lime is not allowed.

The requirement for tensile strength of the gray cast iron shall be 30,000 PSI minimum in accordance with the requirements of ASTM A-48 and the requirement for transverse breaking load shall be 2,000 pounds in accordance with the requirements of ASTM A-438. Contact surfaces between frames and covers shall conform to the standard details of these specifications.

Refer to *Division 300 Standard Construction Specifications for Portland Cement Concrete Section 301, Article 301.4 Mix Requirements for Classes of Concrete*, for specifications pertaining to Class A-3 concrete as required in forming manhole inverts. Catch basin manhole castings shall be in accordance with the standard details of these specifications.

804.3 Construction

a. General

Excavation and backfill for the construction of storm drain manholes and catch basin manholes shall be in accordance with *Division 200 Standard Specifications for Earthwork, Section 207 Trench Excavation and Backfill*, of these specifications. The manhole rings and covers shall be brought to the grades shown on the Drawings unless otherwise approved by the Engineer. Manhole rings shall be set in a full bed of mortar and made secure.

All portions of precast manholes must be approved by the Engineer prior to installation in the storm drain system. The contractor shall provide timely notice (at least two working days in advance of casting) to allow time for the Engineer to arrange for necessary tests. Installation of manhole sections without the Engineer's written approval shall not be allowed. This approval does not relieve the Contractor of the responsibility for protection of manholes against damage during handling and installation.

Manholes shall be installed at the location shown on the drawings. The primary leads shall enter radially at the invert elevations specified. The base section shall be set plumb, upon a prepared surface.

Where indicated on the drawings, a stub shall be provided for future connections to the manhole. The stub shall be sized and positioned as indicated. The end of the stub shall be stoppered with a wooden plug, concrete biscuit, or other adequate methods to prevent water, earth, or other substances from entering the pipe. Manholes up to 12 feet in depth shall have 9-foot stubouts; over 12-feet in dept shall have 18-foot stubouts.

Manholes with poured-in-place bases shall utilize keyed construction joints in non-continuous pours. Precast concrete barrel sections shall be set and sealed with a premolded plastic gasket. Pre-molded plastic gaskets for sealing pre-cast concrete barrel sections for manholes shall be installed in accordance with the manufacturer's recommendations. Gaskets shall be trimmed on the inside of the manhole to prevent the excess gasket material from entering the storm sewer line.

b. Storm Drain Manholes and Catch Basin Manholes

Storm drain manholes shall be constructed in accordance with the drawings, details and standard details. Pipe sections shall extend inside the manhole structure wall so that the pipe will be flush with the cement mortar used in providing a smooth, regular, watertight surface. The pipe shall project outside the manhole sufficiently for proper connection with the next pipe section. Masonry shall fit neatly and tightly around the pipe.

804.4 Method of Measurement

Manholes and catch basin manholes shall be measured as units complete in place. Depth of manholes and catch basin manholes shall be based upon a measurement to the nearest foot from top of casting to the top of the base slab.

804.5 Basis of Payment

Payment for this work shall include payment for all work described in *Section 804*.

Payment shall be made under the following units:

<u>ITEM</u>	<u>DESCRIPTION</u>	<u>UNIT</u>
804	Storm Drain Manhole	Each

SECTION 805 MANHOLE FRAMES AND COVER

805.1 General

The work under this section consists of the performance of all work required for the construction of manhole frames and covers.

805.2 Material

Frames and covers for manholes and similar appurtenances shall be of cast iron and conform to the dimensions shown on the standard details of these specifications. The requirement of tensile strength of the gray iron shall be 30,000 PSI minimum in accordance with the requirements of ASTM 48 and the requirement for transverse breaking load shall be 2,000 pounds in accordance with the requirements of ASTM A-438.

Contact surfaces between frames and covers shall be machined to provide a uniform contact surface. Manhole covers shall have identification letters as shown in the standard details.

805.3 Construction

Provide manhole frames and covers as indicated on the drawings and in accordance with the standard details of these specifications.

805.4 Method of Measurement

No measurement will be made for this item of work. This item shall be considered incidental to *Section 804 Manholes and Catch Basin Manholes*.

805.5 Basis of Payment

None

SECTION 806 CONSTRUCT CATCH BASIN

806.1 General

The work under this section consists of the performance of all operations pertaining to the construction and installation of catch basins.

806.2 Materials

Materials used in the construction of catch basins shall conform to the requirements of ASTM M-478 and as shown on the plans.

Cement for mortar used in the construction of catch basins shall conform to the requirements of ASTM C-150, Type II. Sand shall conform to the requirements of AASHTO M-45.

806.3 Construction

Excavation and backfill for the construction of catch basins shall be in accordance with *Division 200 for Earthwork, Section 207 Trench Excavation and Backfill*, of these specifications. Pipe sections shall extend inside the manhole structure wall so that the pipe will be flush with the cement mortar used to in providing a smooth, regular, watertight surface. The pipe shall project outside the manhole sufficiently for proper connection with the next pipe section. Masonry shall fit neatly and tightly around the pipe.

The catch basin rings and covers shall be brought to the grades shown on the drawings unless otherwise approved by the Engineer. The Contractor may accomplish final setting of the casting by wedging it up with masonry materials as approved by the Engineer. The casting shall then be set in a full bed of mortar and made secure.

Mortar used in the construction of catch basins shall be composed of one (1) part cement and three (3) parts sand. All joint and connections are to be mortared. The joints shall be made so as to produce a smooth, regular, watertight surface. Water shall be added in minimum amounts to provide plasticity in placing the mortar. The addition of lime is not allowed.

Refer to *Division 300 Standard construction Specifications for Portland Cement Concrete Section 301, Article 301.4 Mix Requirements for Classes of Concrete for Specification Pertaining to Class A-3 Concrete*, which shall be used in the formation of catch basing base slabs.

806.4 Method of Measurement

Catch Basins shall be measured as units complete in place.

806.5 Basis of Payment

Payment shall be made under the following units:

<u>ITEM</u>	<u>DESCRIPTION</u>	<u>UNIT</u>
806	Construct Catch Basin	Each

SECTION 807

CONNECTIONS TO EXISTING MANHOLES

807.1 General

The work under this section consists of the performance of all operations pertaining to the construction required for connections to existing manholes.

807.2 Construction

Excavation and backfill for the construction required for connections to existing manholes should be in accordance with *Division 200 Standard Specifications for Earthwork, Section 207 Trench Excavation and Backfill*, of these specifications. Connections to existing manholes shall be made in a workmanlike manner. The invert shall be brought in to the existing manhole at the elevation shown on the plans. The downstream pipe in manholes shall be screened to prevent entry of mortar or other debris from entering the system.

Pipe sections shall extend inside the manhole structure wall so that the pipe will be flush with the cement mortar used to in providing a smooth, regular, watertight surface. The pipe shall project outside the manhole sufficiently for proper connection with the next pipe section. Masonry shall fit neatly and tightly around the pipe.

807.3 Method of Measurement

Connection to existing manholes shall be measured as complete units in place.

807.4 Basis of Payment

Where the connection is made to a pipe stubbed out of the existing manhole, no payment shall be allowed for the connection.

Payment shall be made under the following unit:

<u>ITEM</u>	<u>DESCRIPTION</u>	<u>UNIT</u>
807	Connect to Existing Storm Drain Manhole	Each