

SECTION 02510

UNDERDRAINS

02510.01 GENERAL

A. Description

Underdrain installation shall include, but not necessarily be limited to, constructing underdrains using pipe, filter fabric, and granular filter material; and underdrain pipe outlets and blind drains using granular material in accordance with the Contract Documents.

B. Related Work Included Elsewhere

1. Protection of the environment; Section 01500.
2. Porous backfill; Section 02246.
3. Trench excavation, backfill, and compaction; Section 02250.

C. Quality Assurance

1. Materials
 - a. The County Engineer will inspect all materials before and/or after installation to ensure compliance with the Contract Documents. When specific material tests are called for in the referenced standards and specifications, the County Engineer will have the option of requiring that any or all of these tests be performed for materials furnished for a specific project. When testing is required, it will be specified herein or in the "Special Provisions."
 - b. Corrugated polyethylene drainage tubing and fittings shall be homogeneous throughout and free from foreign inclusions, cracks, creases, or uneven pigmentation.
 - c. Class PS 50 polyvinyl chloride (PVC) pipe and fittings shall be homogeneous throughout and free from foreign inclusions, cracks, creases, flaws, or other injurious defects. Pipe and fittings shall be as uniform as commercially practical in color, opacity, and other physical properties.
 - d. Concrete drain tile shall be free from cracks that extend through the wall and other visible defects.
 - e. Nonreinforced concrete pipe shall be free from fractures and excessive interior surface roughness. The planes of the ends of the pipe shall be perpendicular to the longitudinal axis so that the length of two opposite sides of any section of pipe shall not vary more than 1/4 inch or 2% of the

designated diameter, whichever is larger.

- f. Perforated concrete pipe shall be free from any spall more than 3/4 inch in diameter or 3/16 inch in depth caused by making perforations or slots.
- g. Porous concrete pipe shall be free from fractures or cracks passing through the wall or joints, except that a single crack not exceeding 2 inches in length at either end of a pipe or a single fracture in the joints not exceeding 3 inches in width and not more than 2 inches in length shall not be considered cause for rejection unless these defects exist in more than 5% of the entire shipment or delivery, or any cracks sufficient to impair the strength, durability, or serviceability of the pipe.
- h. Clay drain tile shall be free from cracks, checks, or chips extending into the body of the tile in such a manner as would decrease the strength. There shall be no breaks in the tile that would admit earth into the drain. Drain tile shall be reasonably smooth on the inside and shall be approximately circular in cross-section.
- i. Corrugated metal underdrains shall be free from defects of uneven laps; elliptical shaping; variation from a straight center line; ragged or diagonal sheared edges; loose, unevenly lined or spaced rivets or spot welds; poorly formed rivet heads or lock seams; unfinished ends; illegible brand; lack of rigidity; bruised, scaled, or broken metallic coating; or dents or bends in the metal itself.
- j. Cast iron soil pipe and fittings shall be sound and without defects that might impair its service. Repair of defects by welding or other methods will not be allowed if such repairs adversely affect the serviceability of the pipe or fitting.

2. Field Tests

No testing will be conducted on underdrains installed in accordance with this section; however, the work will be visually inspected. The underdrain lines shall be installed true to line and grade and shall not contain any debris, silt, earth, gravel, rock, or other foreign material. All equipment necessary for the inspection will be furnished by the Contractor. The Contractor shall provide assistance as may be required to enable the County to perform the inspection.

D. Submittals

1. Shop Drawings

Shop drawings shall be submitted as specified in the "General Provisions" for the various types of pipe and fittings intended to be supplied. The shop drawings shall include the following information: product information; material strength, "type," or "class;" joint type; and storage, handling, and installation recommendations.

2. Certificates of Compliance

Certificates of compliance shall be submitted in accordance with the "General

Provisions" for the various types of pipe and fittings intended to be supplied. The certificates shall state that the pipe and/or fitting has been manufactured in accordance with the standard referenced.

02510.02 MATERIALS**A. Materials Furnished by the County**

The County will not furnish any materials for underdrain installation.

B. Contractor's Options

None.

C. Detailed Material Requirements

1. Coarse aggregate for use in constructing underdrains shall meet the gradation requirements of AASHTO M 43, size number 57 as specified in Section 02651.02
2. Fine aggregate for use in constructing underdrains shall meet the gradation requirements of AASHTO M 6 as specified in Section 02651.02.
3. Filter fabric shall conform to Section 921.09 of the "MSHA Standard Specifications for Construction and Materials (1993)".
4. Pipe and/or fittings shall meet the material requirements of the referenced standards or specifications:
 - a. Corrugated polyethylene drainage tubing - AASHTO M 252.
 - b. Class PS 50 polyvinyl chloride pipe - AASHTO M 278.
 - c. Concrete drain tile - AASHTO M 178.
 - d. Nonreinforced concrete pipe - AASHTO M 86, Class 3 with bell and spigot joints and rubber gaskets meeting ASTM C443.
 - e. Perforated concrete pipe - AASHTO M 86, Class 3, and AASHTO M 175, Type 1.
 - f. Porous concrete pipe - AASHTO M 176, Standard strength.
 - g. Clay drain tile - AASHTO M 179.
 - h. Vitrified clay pipe - AASHTO M 65, Standard Strength with an additional requirement that the first and last perforations be 3 inches from the spigot ends.
 - i. Corrugated steel pipe - AASHTO M 36.
 - j. Precoated galvanized steel pipe - AASHTO M 245.

- k. Corrugated aluminum alloy pipe - AASHTO M 196.
 - l. Cast iron soil pipe - ASTM M A 74, Class as specified in the Contract Documents.
5. Spring wire clips used with double spigot pipe shall be designed to maintain a taut but elastic connection between the sections of pipe when laid. The spring clips shall be constructed of No. 9 gage spring wire.

02510.03 EXECUTION

A. General

Where necessary, the precise pattern of the underdrains shall be ascertained from the County Engineer. Trenches shall then be excavated to the dimensions and grade indicated on the Plans.

B. Pipe Assembly

1. Metal pipes shall be connected with metal bands especially made for this purpose which shall be of the same quality as the pipe.
2. Bell and spigot pipe shall be installed with the bell upgrade. Plain (nonperforated) bell and spigot pipe shall be installed with open joints.
3. Plain pipe furnished with other types of ends, such as double spigots, etc., shall be installed with open joints; but for these types of pipe, clips or other approved devices to hold the pipes in line are required.
4. Perforated bell and spigot pipes, other than metal, shall be installed with approved sealed joints, or the bell section shall have self-centering lugs to keep the flow line in correct alignment. On perforated pipe, perforations shall be placed down and arranged symmetrically about the vertical axis.

C. Outlets

Outlets shall be trenched, installed, and constructed generally of the same size and type of material and in the same manner as for the underdrain except that all outlet pipes shall be plain (nonperforated) and the entire depth of the trench backfilled with material equal to embankment in quality as specified in Section 02260. The outlet trench backfill shall generally be constructed to be in accordance with the embankment with mechanical tamping required. Where underdrain pipes of other than round sections are connected to circular outlet pipes and at the ends of trunk lines, wye, tee, or ell laterals, the openings shall be plugged with especially prepared vitrified clay plugs mortared in place. The joints of clay and concrete pipe outlets shall be cemented with mortar, and corrugated metal pipe sections of outlets shall be joined with standard connecting bands.

An acceptable alternate to mortared joints for clay pipe underdrain shall be the use of complementary asphaltic rings precast around the spigot and inside of the bell of the pipe which by tapered design and wedging action when joined will seal the joint. Before joining the sections, a solvent recommended by the manufacturer of the pipe shall be brush applied to the asphaltic rings in the bell and on the spigot. No pipe shall be used when the

jointing material has been deformed or when there is adhering foreign material which will prevent a close and totally sealed joint.

D. Installation

After completion of the excavation, the trench shall be lined with filter fabric and a 4 to 6-inch deep layer of aggregate installed on top of the fabric. The pipe shall then be installed as previously specified, aggregate backfill installed to the depth indicated in the Contract Documents, and the filter fabric lapped across the top of the aggregate for a minimum width of 12 inches. In the longitudinal direction filter fabric shall be overlapped at least 18 inches.

E. Backfill

In addition to the requirements of Section 02250, the following shall apply: Trenches shall be backfilled to the dimensions and grade indicated on the Plans. The aggregate backfills shall be screeded or raked to proper thickness and grade, but they shall not be tamped. The placing of the embankment material over the sand will depend upon conditions, depths and position with respect to the road. In general, this portion of the backfill shall meet the requirements for embankments. The embankment material portion of the backfills shall be tamped.

02510.04 METHOD OF MEASUREMENT

RESERVED FOR FUTURE USE

02510.05 BASIS OF PAYMENT**A. General**

RESERVED FOR FUTURE USE

B. Underdrains and Outlets

RESERVED FOR FUTURE USE

SECTION 02511
SPRING CONTROL

02511.01 GENERAL

A. Description

Spring control installation shall include, but not necessarily be limited to; furnishing and installing pipe, filter fabric, and granular filter material, underdrain pipe outlets, and blind drains using granular material in accordance with the Contract Documents.

B. Related Work Included Elsewhere

1. Protection of the environment; Section 01500.
2. Trench excavation, backfill, and compaction; Section 02250.
3. Underdrain installation; Section 02510.

C. Quality Assurance

1. Materials
 - a. The County Engineer will inspect all materials before and/or after installation to ensure compliance with the Contract Documents. When specific materials tests are called for in the referenced standards and specifications, the County Engineer will have the option of requiring that any or all of these tests be performed for materials furnished for a specific project. When testing is required, it will be specified herein or in the "Special Provisions."
 - b. Quality assurance for pipe materials for spring control shall be as specified in Section 02510.01.
2. Field Tests

Field tests shall be as specified in Section 02510.01.

D. Submittals

Shop drawing and certificate of compliance requirements shall be as specified in Section 02510.01.

02511.02 MATERIALS

A. Materials Furnished by the County

SPRING CONTROL

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The County will not furnish any materials for spring control.

B. Contractor's Options

None.

C. Detailed Material Requirements

Detailed material requirements shall be as specified in Section 02510.02.

02511.03 EXECUTION

The installation of pipe, aggregate filter material, filter fabric, pipe outlets, and blind drains shall be as specified in Section 02510.03.

02511.04 METHOD OF MEASUREMENT

RESERVED FOR FUTURE USE

02511.05 BASIS OF PAYMENT

A. General

RESERVED FOR FUTURE USE

B. Spring Control

RESERVED FOR FUTURE USE

SECTION 02512

DEWATERING

02512.01 GENERAL

A. Description

1. Dewatering shall include, but not necessarily be limited to, designing, furnishing, installing, maintaining, operating, and removing temporary dewatering systems as required to lower and control water levels and hydrostatic pressures during construction; and disposing of pumped water in accordance with the Contract Documents.
2. Dewatering includes lowering the water table and intersecting seepage which would otherwise emerge from the slopes, trench sidewalls, or bottom of the trench or excavation; increasing the stability of excavated slopes; preventing loss of material from beneath the slopes or bottom of the excavation; reducing lateral loads on sheeting and bracing; improving the excavating and hauling characteristics of sandy soil; and preventing rupture or heaving of the bottom of an excavation.
3. The geotechnical data in the Contract Documents is provided for the Contractor's information only. The County does not warrant or guarantee the accuracy or completeness of the data. The Contractor should note the date and method(s) of data collection. The interpretation of the data and its applicability to the project is the responsibility of the Contractor and the Contractor is responsible for satisfying Contractor as to the actual conditions and/or confirming the data provided prior to submitting the Contractor's bid.

B. Related Work Included Elsewhere

1. Protection of the environment; Section 01500.
2. Excavation; Sections 02210, 02220, 02230, 02240, and 02250.

C. Quality Assurance

1. It shall be the Contractor's responsibility to select materials, methods, and equipment, and design a dewatering system which will:
 - a. Effectively reduce the hydrostatic pressure and lower the groundwater levels below the excavation;
 - b. Develop a substantially dry and stable subgrade for the prosecution of subsequent operations;
 - c. Not result in damage to adjacent properties, buildings, structures, utilities,

private and public water wells, and other work;

- d. Assure that after 12 hours of initial pumping, no soil particles will be present in the discharge.
2. Methods may include sump pumping, single or multiple stage well point systems, eductor and ejector type systems, deep wells, and combinations thereof.
3. Locate dewatering facilities only where they will not interfere with utilities and construction work to be done by others. If observation wells are used, they shall be placed both perpendicularly and longitudinally along the excavation to demonstrate the effectiveness of the dewatering system and its impact on the surrounding unexcavated areas.
4. Modify dewatering procedures which cause, or threaten to cause, damage to new or existing facilities, so as to prevent further damage. The Contractor is responsible for determining the modifications to be made, which shall be implemented at no additional cost to the County.

D. Submittals

The Contractor shall, at the preconstruction meeting or a minimum of fourteen days prior to installation of the dewatering system, submit to the County Engineer a letter report, including working drawings and/or design data that is required to detail any or all of the following:

1. The proposed type of dewatering system, including relief of hydrostatic head and maintenance of the excavation in a dewatered and in a hydrostatically relieved condition;
2. Arrangement, location, and depths of the components of the system;
3. A complete description of equipment to be used, with installation, operation, and maintenance procedures;
4. Standby equipment and power supply;
5. Location and size of berms, dikes, sumps, and discharge lines, including the relation to water disposal ditches;
6. Types and sizes of filters;
7. Design calculations demonstrating adequacy of the selected system and equipment.

02512.02 MATERIALS

Not used.

02512.03 EXECUTION**A. General**

It shall be the Contractor's responsibility to adequately control both surface drainage and drainage of excavated areas as follows:

1. Surface Drainage: Intercept and divert precipitation, surface water, and groundwater away from excavation through the use of dikes, curb walls, ditches, pipes, sumps, or other means.
2. Drainage of Excavated Areas: Provide and maintain ditches of adequate size to collect surface and seepage water which may enter the excavations. Divert the water into sumps and drain or pump into drainage channels or storm drains. The discharge of flushing or ground water into existing sanitary sewers is strictly prohibited. Discharge all water to a settling basin or other sediment control device with approval of the Charles County Soil Conservation District to reduce the amount of fine particles which may be carried into the drain. If a storm drain becomes blocked or its capacity restricted due to dewatering operations, the Contractor shall clean the drain at no additional cost to the County.

B. Dewatering

1. Organize dewatering operations to lower the groundwater level in excavations as required for prosecution of the work, and to provide a stable, dry subgrade for the prosecution of subsequent operations.
2. Maintain the water level at such lowered elevations until no danger to the structure or facility can occur because of buildup of excessive hydrostatic pressure, and in any event maintain the water level a minimum of 2 feet below the subgrade, unless otherwise permitted by the County Engineer.
3. If approved by the County Engineer, the extent of dewatering may be reduced, for structures designed to withstand uplift pressure, to maintain the water level a minimum of 5 feet below the prevailing level of backfill as it is being placed, provided such water level does not result in uplift pressures in excess of 80% of the downward pressure produced by the weight of the structure and backfill in place.

02512.04 METHOD OF MEASUREMENT

RESERVED FOR FUTURE USE

02512.05 BASIS OF PAYMENT

RESERVED FOR FUTURE USE

SECTION 02520

PIPE, STRUCTURAL PLATE PIPE AND PIPE ARCH, AND BOX CULVERTS

02520.01 GENERAL

A. Description

Pipe culvert and storm drain installation shall include, but not necessarily be limited to, furnishing and installing gravity pipe, fittings, and appurtenances of the size and type shown on the Plans, installed on firm foundation true to line and grade in accordance with the Contract Documents.

B. Related Work Included Elsewhere

1. Protection of the environment; Section 01500.
2. Trench excavation, backfill, and compaction; Section 02250.
3. Storm drainage structure installation; Section 02530.

C. Quality Assurance

1. Materials
 - a. The County Engineer will inspect all materials before and/or after installation to ensure compliance with the Contract Documents. When specific materials test are called for in the referenced standards and specifications, the County Engineer will have the option of requiring that any or all of these tests be performed for materials furnished for a specific project. When testing is required, it will be specified in the "Special Provisions."
 - b. Corrugated polyethylene drainage tubing, pipe, and fittings shall be homogeneous throughout and free from foreign inclusions, cracks, creases, or uneven pigmentation.
 - c. Class PS 50 polyvinyl chloride (PVC) pipe and fittings shall be homogeneous throughout and free from foreign inclusions, cracks, creases, flaws, or other injurious defects. Pipe and fittings shall be as uniform as commercially practical in color, opacity, and other physical properties.
 - d. Precast reinforced concrete box sections shall be free from fractures or cracks passing through the wall, except for a single end crack that does not exceed the depth of the joint; surface defects indicating honeycombed or open texture; defects that indicate imperfect proportioning, mixing, and molding; or damaged or cracked ends where such damage would prevent making a satisfactory joint.

- e. Reinforced concrete culvert and storm drain pipe and fittings and arch and elliptical pipe shall be free from fractures or cracks that extend through the wall of the pipe or fitting; surface defects indicating honeycombed or open texture; defects that indicate imperfect proportioning, mixing, and molding; damaged or cracked ends where such damage would prevent making a satisfactory joint; or any continuous crack having a surface width of 0.01 inch or more and extending for a length of 12 inches or more.

Materials and finished product testing shall be in accordance with AASHTO M 170, M 206, or M 207 as detailed in AASHTO T 33, and as specified herein. Acceptability of pipe through 54-inch diameter, or with a maximum 54-inch rise, and classes produced in accordance with design tables found in AASHTO M 170, M 206, or M 207, or the modified and special designs permitted therein, shall be determined by results of a three-edge bearing test for a load to produce a 0.01-inch crack. If the load exceeds the requirements before the 0.01-inch crack is reached, the load may be relieved and the pipe accepted for use. For pipe 60-inch diameter, or with a 58-inch rise, and larger, acceptance will be based on materials tests specified in AASHTO M 170, M 206, or M 207.

- f. Corrugated metal culverts, pipe, and pipe arches shall be free from defects due to uneven laps; elliptical shaping; variation from a straight center line; ragged or diagonal sheared edge; loose, unevenly lined or spaced rivets or spot welds; poorly formed rivet heads or lack seams; unfinished ends; illegible brand; lack of rigidity; bruised, scaled, or broken metallic coating; or dents or bends in the metal itself.
- g. Cast iron soil pipe and fittings shall be sound and without defects that might impair its service. Repair of defects by welding or other methods will not be allowed if such repairs adversely affect the serviceability of the pipe or fitting.
- h. With the exception of entrance culverts under residential driveway entrances only concrete, reinforced concrete or HDPE pipe shall be used for all storm drains and culverts within public right-of-ways and public drainage easements. Concrete, reinforced concrete and HDPE pipe must meet material and installation specifications as established in these specifications.

2. Field Tests

a. General

No testing will be conducted on pipe, structural plate pipe or pipe arch, or box culverts installed in accordance with this Section; however, the work will be visually inspected.

After installation, storm drains and culverts will be inspected by the County Engineer for compliance with these Specifications. Inspections will be conducted at least 15 days after the section of pipeline being inspected has been backfilled in accordance with Section 02250.03.

b. Visual Inspection

All equipment necessary for the inspection will be furnished by the County, however, the Contractor shall provide assistance as may be required to enable the County to perform the inspection.

The County Engineer will inspect all pipe and culverts for alignment, grade, and condition. The inspection may be conducted by crawling or walking through the pipeline, or using mirrors to reflect light through the pipeline.

- 1) If a mirror test is used, the pipe alignment will be acceptable if it is sufficiently true and straight to allow passage of the reflected light with an image of a "full moon."
- 2) The pipeline shall be installed on a continuous grade so it does not pond or trap water anywhere along the line.
- 3) The pipeline shall not contain excessive amounts of debris, silt, earth, gravel, rock, or other foreign material.
- 4) Any pipe not properly installed shall be taken up and relayed without additional compensation.

D. Submittals

1. Shop Drawings

Shop drawings shall be submitted as specified in the "General Provisions" for the various types of pipe and culverts specified in Section 02520.02. The shop drawings shall include: product information, material strength "type" or "class," joint type, and storage, handling, and installation recommendations or erection diagrams for structural plate pipes and pipe arches.

2. Certificates of Compliance

Certificates of compliance shall be submitted in accordance with the "General Provisions" for pipe, culverts, and bituminous sealer for concrete pipe specified in Section 02520.02. The certificate shall state that the item furnished has been manufactured in accordance with, and meets the requirements of, the standard referenced.

02520.02 MATERIALS**A. Materials Furnished by the County**

The County will not furnish any materials for drain pipe, structural plate pipe or pipe arch, or box culvert installation.

B. Contractor's Options

None.

C. Detailed Material Requirements

1. Pipe, structural plate pipe, and pipe arch and box culverts shall meet the requirements of the referenced standards or specifications:
 - a. Corrugated polyethylene drainage tubing, type PS 28 - AASHTO M 252
 - b. Corrugated polyethylene pipe, 12 to 24-inch diameter - AASHTO Section 18
 - c. Class PS 50 polyvinyl chloride (PVC) pipe - AASHTO M 278
 - d. Precast reinforced concrete box sections for culverts, storm drains, and sewers with less than 2 feet of cover subject to highway loadings - AASHTO M 273
 - e. Precast reinforced concrete box sections for culverts, storm drains, and sewers - AASHTO M 273
 - f. Reinforced concrete culvert, storm drain and sewer pipe - AASHTO M 170
 - g. Reinforced concrete arch culvert, storm drain, and sewer pipe - AASHTO M 206
 - h. Reinforced concrete elliptical culvert, storm drain, and sewer pipe - AASHTO M 207
 - i. Metallic (zinc or aluminum-zinc alloy) coated corrugated steel culverts and underdrains - AASHTO M 36
 - j. Bituminous coated corrugated metal culvert pipe and pipe arches - AASHTO M 190
 - k. Corrugated aluminum alloy culverts and underdrains - AASHTO M 196
 - l. Structural plate for pipe, pipe arches, and arches - AASHTO M 167
 - m. Aluminum alloy structural plate for field bolted conduits - AASHTO M 219
 - n. Cast iron soil pipe and fittings - ASTM A 74
 - o. High-Density Polyethylene (HDPE) Corrugated Pipe with Smooth Interior:
 - 1) HDPE Corrugated Pipe with smooth interior shall conform to AASHTO M-294 Type "S". The material specification and minimum cell class as described in ASTM D3350 shall conform to the latest edition of AASHTO, Section 18 (Design Specifications). The HDPE pipe shall be permanently marked with the applicable AASHTO specifications.
 - 2) Pipe shall be installed per 2520.02-C.1)q. of these specifications.
 - 3) Select backfill must be placed according to section 2520.02-C.1)r. of

these specifications.

- 4) Joints shall be made using soil tight couplers or silt tight couplers or rubber gasketed bell and spigot or rubber gasketed bell and bell couplers..
 - 5) Backfill materials shall be compacted to the requirements found in section 2520.02-C.1)s. of these specifications.
 6. A Manning's roughness coefficient of "n" = 0.012" shall be used for design purposes.
- p. All flexible pipe (excluding concrete pipe and pipes through stormwater management embankments) shall be installed using select backfill. Select backfill shall consist of washed gravel or stone ranging from No. 8 to No. 57 for a depth of not less than the spring line of the pipe. The backfill requirements for the remainder of the fill above, around (not below) and over the pipe shall be the more stringent of the manufacturer's recommendations and/or these specifications. All backfill requirements shall be clearly spelled out and/or shown on the plans.
- q. Select backfill for flexible pipe (excluding concrete pipe and pipes through stormwater management embankments) must be placed six (6) inches under the pipe and the more stringent of one (1) foot outside of the pipe, per the manufacturer's recommendations but not less than what is required for proper placement as determined by the County Engineer. The minimum cover shall be measured from the outside diameter of the pipe to the bottom of the pavement section. The maximum cover height shall be per the manufactures recommendations. All backfill requirements shall be clearly spelled out and/or shown on the plans.
- r. All select backfill placed for flexible pipe shall be compacted with a minimum of one pass of a vibratory compactor as per directed by the County Engineer. The compaction requirements for the remainder of the fill beside and over the pipe shall be those as found in these specifications. The compaction requirements shall be clearly spelled out and/or shown on the plans.

Class to be specified in the "Special Provisions" or on the Plans, and the material requirements based on the diameter of the pipe. Where no class of pipe is specified, Class III pipe shall be furnished.

2. Concrete pipe for culverts and storm drains shall be made with tongue and groove jointing and in not less than four-foot lengths. Other types of joints will be considered by the County Engineer for use in the work provided the Contractor furnishes evidence satisfactory to the County Engineer that the joints are equal or better than those specified.
3. Portland cement concrete shall be the Mix Number specified herein, indicated on the Plans, and/or Standard Details, and meet the requirements specified in Section 03310.

4. Mortar for pipe joints shall be as specified in Section 04100.02.
5. Bituminous sealer for concrete pipe joints shall be a homogeneous mixture of asphalt, mineral filler and petroleum solvents. When applied by a cold trowel, the sealer shall have adhesive and cohesive properties. Each container shall be legibly marked with a description of the contents, the manufacturer's name and the place of manufacture.

The supplier shall furnish a certified copy of the test results showing that the bituminous sealer meets the following requirements:

<u>Test and Method</u>	<u>Specification Limits</u>
Residue by evaporation nonvolatile matter, ASTM D2939 % min	70
Inorganic filler on ignition, ash content, ASTM D2939 %	15-45

6. Preformed joint for concrete circular sewer and culvert pipe shall be rubber type gaskets meeting the requirements of AASHTO M198.
7. The end section of corrugated metal pipe shall have annular corrugations measuring 2-²/₃ inches by 1/2 inch.

02520.03 EXECUTION

A. General

1. Trench excavation, backfill, and compaction, and pipe bedding and haunching shall be as specified in Section 02250.
2. Pipe shall not be installed by the Contractor until the length called for at each station has been approved by the County Engineer.
3. When a pipe, structural plate pipe, or pipe arch is to be laid projecting above existing ground on or in fill, the embankment shall be constructed to a height of at least 9 inches above but not more than 3 feet above the top of pipe and then a trench excavated to receive the pipe.
4. No pipe shall be laid upon a foundation into which frost has penetrated, nor at any time when there is danger of ice formation or frost penetration at the bottom of the excavation. In freezing weather, open trench length shall be kept to a minimum and the excavation promptly backfilled after the pipe has been installed.
5. Each pipe shall be bedded on a solid foundation acceptable to the County Engineer. Bell holes shall be dug sufficiently large to insure that joints are properly made and the pipe is firmly bedded for the full length of the barrel.
6. All pipe shall be installed in accordance with the recommendations of the pipe manufacturer and as specified herein. These recommendations shall include maximum trench width, if more restrictive than that shown in the Standard Details;

bedding requirements; backfill material and compaction, where applicable.

B. Corrugated and Non-corrugated Plastic Pipe and Tubing

1. All corrugated polyethylene drainage tubing and pipe shall be installed with coupled joints. Only couplings and fittings supplied or recommended by the tubing or pipe manufacturer shall be used.
2. Class PS50 PVC pipe shall be installed with one or more of the following joint systems as specified or shown on the Plans:
 - a. Elastomeric gasket joints meeting ASTM D 3212
 - b. Belled ends
 - c. Sleeve-type couplings
 - d. Stop-type couplings
 - e. Solvent cement-type joints

C. Cast Iron and Reinforced Concrete Pipe

1. All cast iron and reinforced concrete pipe shall be installed with cemented joints. The pipe shall be installed carefully, hubs up grade, spigot ends fully entered into the adjacent hub and true to lines and grades given. Before succeeding sections of pipe are installed, the lower half of the hub of the preceding section shall be plastered on the inside with the cement mortar of sufficient thickness to bring the inner surfaces of the abutting pipes flush and even. At the same time, the upper half of the spigot of the succeeding pipe shall be similarly plastered with mortar. After the pipe is installed, the remainder of the joints shall be filled with similar material; and sufficient additional material shall be used to form a bead around the joint. The inside of the joint shall be wiped and finished smooth. The mortar on the outside shall be protected from the air and sun for two (2) days or until the back fill is made around the pipe. The use of 8-foot lengths of pipe handled with a single support through a lay hole through the shell of the pipe will be permitted with an approved lifting device. After installation, the lay hole shall be filled in its entirety with mortar.
2. Where indicated on the Plans or directed by the County Engineer, pipe shall be encased in a 6-inch jacket of Mix No. 1 Concrete. When required, the Contractor shall furnish cold weather protection for mortar joints and concrete encasement by maintaining a temperature of not less than 40°F for a period of 3 days, or backfill immediately and maintain a temperature of 40°F inside the pipe for a period of 3 days.
3.
 - a. As an alternate to mortared joints for concrete culvert, storm drain, and sewer pipe, bituminous sealer, rubber type gaskets, or resilient type material may be used under the prescribed conditions. Care shall be exercised to insure the proper application of sealer on the underside of all joints.

- b. Bituminous sealer shall not be applied when the air temperature is less than 35°F unless provision is made to preheat it before use, such as storage at normal room temperature or immersion of the containers in a warm water bath prior to use. Care shall be exercised to insure the proper application of sealer on the underside of all joints.
4. Joints between sections shall be caulked with one or more rings of oakum, jute or hemp. The jointing material shall then be firmly applied into the joint space until flush with the outer rim of the bell or barrel of tongue-and-groove section, after which additional sealer shall be applied to form a bead around the joint.

D. Corrugated Metal Pipe

1. When any type of corrugated metal pipe sections are connected on the work, the ends shall be butted together and the sections joined with a standard band which shall be bolted firmly in place. Pipe sections or fittings shall not be cut with a torch.
2. Spiral corrugated metal pipe sections shall be butted together and joined with an approved metal band.

E. Pipe Connections

Where shown on the Plans, pipe connections shall be constructed. These connections shall be for any pipe size, type or alignment and shall be of two basic types.

1. Prefabricated Pipe Connection. This type connection shall be prefabricated by the pipe manufacturer and delivered to the project for installation. It shall include reinforced concrete pipe, corrugated metal pipe, structural plate pipe, pipe arches, and box culverts.
2. Field Pipe Connection. This type shall be fabricated at the site during the installation of the pertinent pipe culverts. It shall include connections of new pipe culverts to existing pipe culverts when specified. A field connection shall include cutting a hole in one pipe, inserting and trimming the connecting pipe and pouring a concrete collar at the connection. In the case of corrugated metal pipes, a welded connection may be substituted for the concrete collar. Backfill may be placed immediately after installing pipe, provided the mortar joints are protected with building paper or other approved material.

F. End Treatments

The following requirements apply to all types of pipe culverts except structural plate pipes and structural plate pipes arches:

1. The ends of pipe culverts placed askew shall be cut off flush with the end wall.
2. Endwalls on the inlet ends of pipe, when built to grade and visible from the roadway, shall be constructed parallel to the roadway; askew pipe shall protrude through the endwall.
3. Endwalls on the inlet ends of pipes, when not built to grade and not visible from the

roadway, shall be constructed normal to the center line of the pipe. Embankment slope faces, in case of askew pipes, will not be warped. The area between endwall and normal slope will be filled to 3 inches below top of endwall and the area sloped to drain.

4. Endwalls on the outlet end of pipes, when used, shall be constructed as noted above.

G. Structural Plate Pipes and Pipe Arches

This paragraph is intended to describe structural plate pipes and pipe arches, which structures differ from pipe culverts hereinbefore mentioned, in that they are usually of greater size and are composed of curved plates usually bolted together in the field. The plates must be shop fabricated to required dimensions and having all required holes and be shipped complete with proper markings and including all necessary connection devices, such as bolts, nuts, washers, etc. Culvert structures with beveled or skewed ends shall be detailed by the producer and the detailed drawings submitted to the County Engineer. An erection diagram shall be submitted to the County Engineer for all structural plate pipes and pipe arches. No fabrication shall be performed until shop drawings are reviewed and approved by the County Engineer.

1. Plates

Plates shall consist of structural units of galvanized corrugated metal. Single plates shall be furnished in standard sizes to permit structure length increments of 2 feet. (Plates have approximately a 2-inch lip beyond each end crest, which results in the actual length of a given structure being approximately 4 inches longer than the nominal length, except when skewed or beveled).

2. Gages

The gages for plates will be specified in the Contract Documents for each location. The plate configurations shall have radii and curvature in accordance with AASHTO requirements. When bottom plates are specified to be thicker than top and side plates, the thicker plates for circular pipes shall cover at least 25% of periphery of the circle. For pipe arches, the thicker plates shall include corner plates as well as bottom plates.

3. Erection

The plates at longitudinal and circumferential seams shall be connected by bolts. Joints shall be staggered so that not more than three plates come together at any one point. Each plate shall be curved to one or more circular arcs.

- a. Plates shall be formed to provide lap joints. The bolt holes shall be punched so that all plates having like dimensions, curvature, and the same number of bolts per foot of seam shall be interchangeable. Each plate shall be curved to the proper radius so that the cross sectional dimensions of the finished structure shall be as indicated on the Plans or as specified.
- b. Unless otherwise specified, bolt holes along those edges of the plates that will form longitudinal seams in the finished structure shall be staggered in

rows 2 inches apart, with one row in the valley and one in the crest of the corrugations. Bolt holes along those edges of the plates that will form circumferential seams in the finished structure shall provide for a bolt spacing of not more than 12 inches. The minimum distance from center of hole to edge of the plate shall be not less than one and three quarter times the diameter of the bolt. The diameter of the bolt holes in the longitudinal seams shall not exceed the diameter of the bolt by more than 1/8 inch.

- c. Plates for forming skewed or sloped ends shall be cut so as to give the angle of skew or slope specified. Burned edges shall be free from oxide and burrs, shall present a workmanlike finish. Legible identification numerals shall be placed on each plate to designate its proper position in the finished structure.
- d. The method of erection will vary with the size of the structure. The structural plates shall be assembled in accordance with the recommendations of the manufacturer and/or reviewed and accepted detailed shop drawings. The structures may be partially assembled and then placed on the prepared foundations. If the structures are to be preassembled other than at the job site, the materials and construction procedure shall be in strict accordance with the specification requirements contained herein. Whenever two or more sections of the structure are to be assembled at the job site, care shall be exercised to insure proper matching and aligning of joints. Where such procedure is allowed, the length of the assembly shall not exceed that which permits lifting, moving, and depositing of the section without any bending or distortion or stress being induced therein.

4. Foundation Preparation

- a. Excavation and bedding shall be in accordance with Section 02520.03, Article A. It is very important that templates be set at convenient intervals and the foundation screened to be coincidental with the exact shape of the bottom plates. Screeding shall be done immediately prior to erection.
- b. In some cases, the prepared foundation must be cambered to allow for possible settlement of underlying strata supporting the foundation because the part of the structure under the deepest fill will deflect greater than under the slopes. Therefore, before preparing any foundation, the Contractor is responsible for conferring with a Geotechnical Engineer with the concurrence of the County Engineer to ascertain anticipated need for camber, as well as the amount thereof.

5. Bolting

All bolting and tightening of nuts shall be done with impact wrenches. Each nut and bolt shall be tightened to a minimum of 100 foot pounds and not to exceed a maximum of 200 foot pounds of torque. The impact wrenches shall be equipped with a device to assure that the number of foot pounds of torque applied is between these minimum and maximum limits.

- a. The plates composing the bottom of the structures may be bolted together

in positions outside of permanent one. In this case, the bottom sections may be bolted in lengths as limited above and placed on the prepared foundation. Plates composing sides and tops shall then be erected and bolted. In any event, all plates (bottom, etc.) must be in their proper positions. Bolts shall be placed in all holes, unless otherwise specified.

- b. Where washers are specified or required, they shall be placed under the nuts. In preliminary assembly, the bolts shall first be scattered or disturbed over the section being assembled and holes made to align by shifting the places; and the nuts shall not be drawn tight until the section is assembled and ready for placing. For bottom plates, the nuts may be inside the structure, if necessary. After placing and before backfilling or coating, all nuts shall be finally tightened and tested to assure compliance with torque requirements.

6. Backfilling

- a. Backfilling shall be as specified in Section 02250.03 with additional precaution that backfills are elevated uniformly along each side of the structure. For structures without headwalls, backfill shall be commenced in the center of the structure. If the structure includes headwalls or spandrel walls, backfilling operation may commence at one wall and extend toward the opposite side, care being taken in all cases to bring embankment or sections thereof up evenly on each side to a height of not less than 18 inches above top of the structural plate pipe structure.
- b. No trucks or construction equipment shall be allowed to pass over any part of a structural plate pipe structure until the backfill has been completed and tamped up to a height of not less than 18 inches above the structure. In all cases, the fill material shall be thoroughly but not excessively tamped.

7. Strutting

Where specified, structural plate pipe structures shall be strutted with timber posts. In such cases, the table for strutting will be shown on the Plans. If no strutting table is shown, it shall be the Contractor's responsibility to prepare a suggested table of strutting sizes and spacings which is subject to approval by the County Engineer before strutting begins. The strutting shall be done in combination with the use of approved jacks so the structure's rise is changed by the proper amount. When strutting is specified, it shall be uniform from end to end. Struts shall be left in place until backfills are completed, unless their removal is otherwise permitted by the County Engineer. All removal of struts shall be done by the contractor, and the Contractor shall receive and dispose of all removed materials.

8. Concreting

When specified on the Plans or in the "Special Provisions," the invert of structural plate pipe or pipe arch shall be paved using Mix No. 2 concrete. The dimensions of the invert paving will be detailed on the Plans.

The concrete shall be cured in accordance with the requirements of Section 03300.03 using burlap. Cold weather protection shall be performed in accordance

with the requirements of Section 03300.03.

9. Multi-cell Installations

Where batteries or multi-cell installations of structural plate pipe structures are specified, the aforementioned provisions shall be used with extra requirements as follows:

- a. In backfilling, backfills between cells shall be elevated equally on each side of each cell.
- b. Individual cells may be erected for their full length before beginning another cell, or the entire structure may be erected in sections so that the total length of the total structure is completed at approximately the same time.
- c. Structural plate pipe structures shall have at their termini cutoff walls, endwalls, headwalls, or slope protection. The details and type of end protection shall be as shown on the Plans, and construction shall be in accordance with the pertinent item.

10. End Treatment

- a. Ends of structural plate pipe arches shall be shop fabricated on a bevel to fit and be flush with the slope and alignment of the surface through which they protrude, except that where an endwall or masonry slope protection is specified the ends of the structural plates shall then be shop fabricated to fit that construction. Beveled ends shall not be used on skews of 70° or less angle (between center line of stream and center line of road). The ends of all structural plate pipes and pipe arches which require an end treatment (endwall or slope protection) shall contain hook bolts for anchorage into the concrete.
- b. Endwalls for structural plate pipes and pipe arches, unless otherwise specified, shall be constructed parallel to the alignment of the edge of the adjacent road shoulder.

H. Box Culverts

1. The precast reinforced concrete box sections shall be produced with male and female ends. The ends shall be of such design and the ends of the box sections so formed that when the sections are laid together they will make a continuous line of box sections with a smooth interior free of appreciable irregularities in the flow line.
2. Box section shall be installed with mortared joints, bituminous sealer, rubber type gaskets, or resilient type material. The inner surfaces of the abutting sections shall be flush and even. Mortared joints shall be protected from the air, sun, and freezing, and bituminous sealer protected from cold temperatures as specified in Section 02520.03, Article B.

I. Connections to Existing Structures

1. Holes for installing new pipes in existing structures shall be carefully cored, drilled, or cut in such a manner to minimize damage to the structure. Any damage to the

PIPE, STRUCTURAL PLATE PIPE AND PIPE ARCH, AND BOX CULVERTS

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existing structure shall be promptly repaired to the satisfaction of the County Engineer or the structure replaced. Reinforcing steel in precast manholes and inlets shall be cut only to the extent necessary to accommodate the new pipe.

2. The new pipe shall be roughly centered in the hole and the pipe end set flush with the inside wall. The entire space between the pipe and the wall shall be filled with brick and mortar so as to make it watertight.

02520.04 METHOD OF MEASUREMENT

A. Pipe and Box Culverts

RESERVED FOR FUTURE USE

B. Structural Plate Pipe Structures

RESERVED FOR FUTURE USE

C. Portland Cement Concrete

RESERVED FOR FUTURE USE

02520.05 BASIS OF PAYMENT

A. General

RESERVED FOR FUTURE USE

B. Pipe, Structural Plate Pipe and Pipe Arch, and Box Culverts

RESERVED FOR FUTURE USE

SECTION 02530

STORM DRAINAGE STRUCTURES

02530.01 GENERAL

A. Description

Storm drainage structure construction shall include, but not necessarily be limited to, furnishing and installing or constructing in place: pipe endwalls, inlets, catch basins, manholes, spring boxes, junction boxes, steps, barriers, and miscellaneous structures of concrete or brick masonry built to the shapes and dimensions shown in accordance with the Contract Documents.

B. Related Work Included Elsewhere

1. Trench excavation, backfill, and compaction; Section 02250.
2. Riprap installation; Section 02291.
3. Cast-in-place concrete; Section 03300.
4. Precast concrete structure installation; Section 03400.
5. Brickwork, unit masonry; Section 04200.

C. Quality Assurance

1. Materials

The County Engineer will inspect all materials before and/or after installation to ensure compliance with the Contract Documents.

2. Field Tests

No testing will be conducted on storm drainage structures installed in accordance with this Section; however, the work will be visually inspected by the County Engineer.

D. Submittals

1. Shop Drawings

Shop drawings shall be submitted as specified in the "General Provisions" for all materials listed in Section 02530.02 when indicated in the Section where the materials are specified.

2. Certification of Compliance

Certificates of compliance shall be submitted as specified in the "General Provisions" for materials listed in Section 02530.02 when indicated in the Section where the materials are specified.

02530.02 MATERIALS**A. Materials Furnished by the County**

The County will not furnish any materials for storm drainage structures.

B. Contractor's Options

1. The Contractor may furnish aluminum or plastic-coated steel manhole steps.
2. The Contractor may furnish precast, cast-in-place, or masonry construction for miscellaneous storm drainage structures, unless otherwise noted.

C. Detailed Material Requirements

1. Riprap shall be the size specified in the Contract Documents and shall meet the material requirements specified in Section 02291.02.
2. Granular bedding for storm drain structure foundations and for porous backfill adjacent to headwalls shall meet the requirements of AASHTO M 43, size number 57, as specified in Section 02621.02.
3. Portland cement concrete for cast-in-place structures shall be Mix No. 3 as specified in Section 03310, unless otherwise noted.
4. Precast manhole bases, joints, risers, cone sections, grade rings, and other precast structures shall be as specified in Section 03400.
5. Quick-setting non-shrink grout and mortar shall be as specified in Section 03600.
6. Mortar for brickwork shall be as specified in Section 04100.02.
7. Brick for manhole inverts and miscellaneous structures shall be sewer brick as specified in Section 04200.02.
8. Frames, covers, gratings, ladders, and steps shall be as specified in Section 05500. Covers shall be labeled in accordance with the Standard Details. Frames, covers, and grates shall be factory coated with a coal tar paint meeting the requirements of Federal Military Specification MIL-C-18480A. Steps and ladders shall be as dimensioned in the Standard Details.
9. Waterproofing for exterior of manholes and miscellaneous structures shall be as specified in Section 07100.02.

02530.03 EXECUTION**A. General**

1. Excavation, foundation preparation, backfill, and compaction shall be as specified in Section 02250.
2. Manholes, pipe endwalls, inlets, catch basins, junction chambers, and other structures shall be constructed or installed in accordance with the Standard Details and as specified herein.
3. Miscellaneous structures shall be constructed where shown and as indicated on the Plans or as directed by the County Engineer.
 - a. Cast-in-place concrete construction shall be as specified in Section 03300.03.
 - b. Brick construction shall be as specified in Section 04200.03.
4. Pipelines connected to manholes and other structures shall have a pipe joint not more than 2 feet from the exterior wall of the structure.

B. Construction Sequence

Underground drainage structures, including earthwork and backfilling incidental thereto, shall be completed before the adjacent roadway surfacing is placed. Manholes, catch basins, and inlets shall not be completed to final grade until after the grading has been finished and all necessary arrangements have been made to insure suitable connections and tie-ins at proper grade and alignment with pavements, gutters, curbs, etc.

C. Castings

Grates and/or frames for grates and covers for inlets and manholes shall be set in full beds of mortar or be otherwise properly secured as indicated on the Plans or Standard Details so as to be held rigidly in place to proper grade and alignment.

D. Pipe Connections

Inlet and outlet pipes at inlets, bend structures, wye branches and manholes shall be set or cut flush with the inside face of the walls of such structures and shall extend a sufficient distance beyond the outside face of the walls to provide ample room for making proper connections. The joint around the pipe in the structure wall shall be completely and neatly closed with mortar or other material, as may be specified, so as to make it watertight.

E. Inverts

Inlets containing two or more pipes which require directional flow shall have channeled inverts. The details of the channeled invert shall be as shown on the Standard Details.

F. Underdrain Stubs

When directed by the County Engineer, inlets and manholes shall be constructed with two

underdrain stubs for future connection of underdrain or for erosion control. The inlets or manholes shall be backfilled with AASHTO M 43 No. 57 aggregate for a width of 1.5 feet outside of the neat line from the top of footing to subgrade elevation.

G. Constructing New Structures Over Existing Pipelines

1. The area around the existing pipeline shall be carefully excavated in a manner to prevent disturbing or damaging the portion of the existing pipeline to remain after the new structure is installed.
2. Any soft or yielding material shall be removed and replaced with gravel or crushed stone, thoroughly compacted, to prevent the settlement of the new structure.
3. The existing pipe shall be cut, trimmed, or reinstalled as necessary to accommodate the new structure. When the existing pipe is to be cut, the Contractor shall use methods which will neither damage the structural integrity of the pipe nor leave any sharp or rough edges.

02530.04 METHOD OF MEASUREMENT**A. Inlets and Manholes**

RESERVED FOR FUTURE USE

B. Standard Endwalls

RESERVED FOR FUTURE USE

C. Nonstandard Endwalls and Miscellaneous Structures

RESERVED FOR FUTURE USE

02530.05 BASIS OF PAYMENT**A. General**

RESERVED FOR FUTURE USE

B. Inlets and Manholes

RESERVED FOR FUTURE USE

C. Standard Endwalls

RESERVED FOR FUTURE USE

D. Nonstandard Endwalls and Miscellaneous Structures

RESERVED FOR FUTURE USE

SECTION 02540

STORM DRAIN REHABILITATION

02540.01 GENERAL

A. Description

Storm drain rehabilitation shall include, but not necessarily be limited to, pipe joint sealing, inlet and manhole rehabilitation, pipe and fitting replacement, and inlet and manhole replacement in accordance with the Contract Documents.

B. Related Work Included Elsewhere

1. Protection of environment; Section 01500.
2. Trench excavation, backfill, and compaction; Section 02250.
3. Storm drainage pipe and culvert installation; Section 02520.
4. Storm drainage structure installation; Section 02530.

C. Quality Assurance

1. Materials
 - a. The County Engineer will inspect all materials before and/or after installation to ensure compliance with the Contract Documents.
 - b. Special grouts, sealers, and coating systems shall be delivered to the site in the manufacturer's sealed, labeled, and dated containers. Storing and handling materials shall be in strict accordance with the manufacturer's instructions. Failure to properly store and handle material will result in rejection of material for use. Materials beyond the expiration date indicating the manufacturer's recommended shelf life will not be permitted to be used.
2. Field Testing
 - a. General
 - 1) After the item in question has been rehabilitated or replaced, it will be inspected by the County Engineer for compliance with these Specifications.
 - 2) If the item in question fails the inspection, the Contractor shall, at the Contractor's own expense repair or replace any defective component and have the County Engineer reinspect the item until all

requirements are met.

D. Submittals**1. Shop Drawings**

- a. Shop drawings shall be submitted as specified in the "General Provisions" for all materials listed in Section 02540.02. The Contractor shall submit product information and detailed manufacturer's recommendations and instruction on the storage, handling, mixing (where appropriate), and installation of all materials intended to be used for rehabilitation.
- b. For those materials which rely on chemical reactions and/or heat (energy) sources to obtain a "cure" of the materials, detailed instructions shall be submitted indicating "pot life" after mixing; curing time; temperature limitations during transportation, application, and installation; and special handling requirements.

2. Certificates of Compliance

Certificates of compliance shall be submitted as specified in the "General Provisions" for materials listed in Section 02540.02 when indicated in the paragraph where the materials are specified.

02540.02 MATERIALS**A. Materials Furnished by the County**

The County will not furnish any materials for storm drain rehabilitation.

B. Detailed Material Requirements

1. Portland cement concrete for pipe encasement shall be Mix No. 1 as specified in Section 03310.
2. Quick-setting, non-shrink grout shall be as specified in Section 03600.
3. Storm drain structure rehabilitation;
 - a. Frame, cover, grate, ladder, and step materials shall be as specified in Section 05500.02. Covers shall be labeled in accordance with the Standard Details.
 - b. Brick for structures and inverts shall be sewer brick as specified in Section 04200.02.
 - c. Structural wall rehabilitation compounds shall be Drycon as supplied by I.P.A. Systems, Inc., Brush-Bond as supplied by Preco Manufacturing, or equal.
4. Pipe and culvert replacement

Pipe and culverts shall be as specified in Section 02520.02.

5. Storm drain structure replacement
 - a. Cast-in-place concrete shall be as specified in Section 03300, Mix Number as indicated on the Standard Details or the Plans.
 - b. Precast concrete shall be as specified in Section 03400.
 - c. Brick shall be sewer brick as specified in Section 04200.02.
 - d. Frame, cover, grate, ladder, and step materials shall be as specified in Section 05500.02. Covers shall be labeled in accordance with the Standard Details.
 - e. Waterproofing for storm drain structure exterior shall be as specified in Section 07130.02.

02540.03 EXECUTION**A. Pipe Joint Sealing**

1. General
 - a. The intent of pipe joint sealing is to seal damaged or defective joints to prevent the surrounding soil from washing into the storm drain causing surface subsidence.
 - b. Pipe joint sealing may be accomplished from either inside or outside the pipe as specified in the Contract Documents.
2. Inside Joint Repair
 - a. The inside of joints to be sealed shall be carefully cleaned, and where determined by the County Engineer, notched to provide a suitable anchorage for the repair patch.
 - b. Once the joint has been prepared, it shall be sealed by firmly packing with a quick-setting, non-shrink grout.
3. Outside Joint Repair
 - a. The area over the joint shall be excavated in accordance with Section 02250.03.
 - b. The damaged joint shall be carefully cleaned and packed with a stiff mortar mix.

B. Storm Drain Structure Rehabilitation

1. General

- a. The intent of storm drain structure rehabilitation work is to provide materials and equipment appropriate for each structure scheduled for rehabilitation.
- b. Storm drain structure rehabilitation includes the following:
 - 1) Replacement or resetting of manhole frames and/or covers.
 - 2) Replacement or resetting of inlet frames and/or grates.
 - 3) Replacement of steps or ladders.
 - 4) Repair of inverts and benches.
 - 5) Structural rehabilitation of walls, inverts and benches with coatings.

2. Structure Identification

Structures requiring rehabilitation work will be indicated in the Contract Documents which will identify and locate structures to be rehabilitated and the type of rehabilitation required for each structure.

3. Structural Rehabilitation of Walls

Rehabilitation shall be accomplished by applying high-strength compounds to the walls as follows:

- a. Surface preparation shall consist of cleaning all foreign materials and matter from the interior of the structure. Cleaning may be accomplished by waterblasting, sandblasting, or applying a 10% solution of muriatic acid or hydrochloric acid over all surfaces. If an acid solution is used, it shall be washed off and the wall allowed to dry before any coating application. Mixing, application, and removal of acid shall be done in strict accordance with the manufacturer's recommendations.
- b. After surface preparation and before application of coating materials, infiltration shall either be stopped by sealing in accordance with Section 02565 .03, Article F, or channeled to the drain through "bleed" pipes installed at the bottom of the structure.
- c. Application of the coating materials shall be by spray gun, Guniting gun, roller, brush, or hand trowel at the option of the Contractor in accordance with the material manufacturer's recommendations. The material shall be applied to all surfaces from the base to the manhole ring.
- d. After proper curing of surface coating materials, the "bleed" pipes shall be removed and the structure sealed in accordance with Section 02565.03, Article F.

4. Frame, Cover, and Grate Resetting or Replacement

Storm drain structure frames, covers and grates shall be removed and reset or replaced as follows:

- a. Excavation for Frames, Covers, and Grates in Pavement
 - 1) The removal of manhole or inlet frames or grates shall be accomplished by making a rectangular cut in the pavement of sufficient size and depth to fully expose the frame or grate.
- b. Excavation for Frames, Covers, and Grates in Unpaved Areas
 - 1) Only sufficient excavation of materials from around the manhole or inlet shall be done to expose the frame or grate.
 - 2) Excavated material shall be used for backfill and shall be compacted to prevent settlement and to restore the setting. Backfill shall not cover the manhole or inlet.
 - 3) Private property which is disturbed for access to the manhole shall be restored by the Contractor to its original condition.
- c. Replacement frames, covers, and grates shall be installed where indicated on the Plans or as directed by the County Engineer, and as specified in Section 02530.03.
- d. Installation of new or resetting of existing frames, covers, and grates shall be accomplished as follows and as shown on the Standard Details:
 - 1) Existing frames, covers, and/or grates designated on the Plans or by the County Engineer as defective or unacceptable shall become the property of the Contractor and removed from the site of the work.
 - 2) The Contractor shall install a new frame and cover or frame and grate as indicated or directed, or reinstall the existing frame and cover or frame and grate.
 - 3) The frame shall be carefully set flush with the existing surface or to new elevations shown on the Plans or as directed by the County Engineer.
 - a) Where a manhole is located in a paved area, the frame and cover shall be carefully set flush with the paved surface to conform to both longitudinal and transverse slopes.
 - b) Where manholes are located in sump areas, and/or where indicated on the Plans, the manhole frames shall be fitted with grating-type covers.
 - 4) The frames shall be set in a full bed of mortar and encased in concrete in accordance with the requirements of Section 02680.03.
 - 5) Where manhole frames are to be raised, the grade adjustment shall be accomplished by adding a sufficient number of precast concrete grade rings set in a full bed of mortar to obtain the desired elevation.

- 6) The Contractor, at no additional cost to the County, shall replace any portion of concrete or brick and mortar ring of the existing manhole or inlet which is damaged when the existing frame is removed or replaced or a new frame is installed.
5. Step or Ladder Replacement
 - a. Existing steps or ladders shall be removed or cut off flush with the inside of the wall. Any damage to the wall as a result of this activity shall be repaired by the Contractor at no additional cost to the County.
 - b. Location of holes for new steps shall be in accordance with the Plans or Standard Details and carefully measured and marked on the wall.
 - c. Holes shall be drilled to the diameter and depth, and the steps installed as recommended by the step manufacturer.
 - d. Ladders shall be installed with materials furnished by and in accordance with the manufacturer's recommendations at the locations indicated on the Plans or Standard Details.
 6. Invert and Bench Repair
 - a. Sections to be repaired shall be carefully cleaned as described in Paragraph 3 of this Article, and all loose brick and mortar removed to sound material.
 - b. After the section to be repaired has been acceptably cleaned, new brick and quick-setting non-shrink grout shall be used to rebuild the invert and bench as shown on the Plans, indicated on the Standard Details, and/or as directed by the County Engineer.

C. Pipe and Fitting Replacement

1. General

When a portion of the pipeline in question has collapsed, cannot be cleaned by the methods previously described, or is structurally damaged where it cannot be lined, those sections of the pipeline shall be uncovered, removed, and replaced with new pipe as directed by the County Engineer.
2. Installation Procedures
 - a. The area over the pipe shall be excavated in accordance with Section 02250.03 to fully expose the damaged section.
 - b. The damaged pipe shall be cut and removed to limits indicated or directed and a new section or sections installed in its place. Particular care shall be given to insure the slope and invert of the new pipe matches the existing line.
 - c. The new pipe shall be connected to the existing pipe with a full circle clamp or other acceptable means.

- d. The line shall be secured in place and backfilled in accordance with Section 02250.03.
- e. Structurally damaged fittings shall be removed from the drain system and replaced with new fittings.

D. Storm Drain Structure Replacement

1. General

When an existing storm drain structure cannot be repaired by one of the previously described methods, or is structurally damaged or deficient, it shall be removed and replaced by a new structure.

2. Installation procedures shall be as follows for removal of the existing structure and installation of the new structure:

- a. The area around the existing structure shall be carefully excavated in a manner to prevent disturbing or damaging the existing pipes in accordance with Section 02250.03.
- b. The existing structure shall be removed to the crown of the existing pipe, or as directed by the County Engineer. Any irregularities in the remaining wall shall be repaired and the base leveled with quick-setting non-shrink, grout.
- c. After the base has been repaired to the satisfaction of the County Engineer, a layer of quick-setting non-shrink, grout shall be placed on the base and the new riser section set in place, or new walls constructed.
- d. After the grout has set, the remaining sections and frame and cover or grate shall be installed in accordance with Section 02530.03 and the Standard Details.

02540.04 METHOD OF MEASUREMENT

A. Pipe Joint Sealing

RESERVED FOR FUTURE USE

B. Storm Drain Structure Rehabilitation

RESERVED FOR FUTURE USE

C. Pipe and Fitting Replacement

RESERVED FOR FUTURE USE

D. Storm Drain Structure Replacement

RESERVED FOR FUTURE USE

STORM DRAIN REHABILITATION

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E. Excavation, Backfill and Compaction

RESERVED FOR FUTURE USE

02540.05 BASIS OF PAYMENT

A. General

RESERVED FOR FUTURE USE

B. Pipe Joint Sealing

RESERVED FOR FUTURE USE

C. Storm Drain Structure Rehabilitation

RESERVED FOR FUTURE USE

D. Pipe and Fitting Replacement

RESERVED FOR FUTURE USE

E. Storm Drain Structure Replacement

RESERVED FOR FUTURE USE

F. Excavation, Backfill and Compaction

RESERVED FOR FUTURE USE