

# Contract Documents

For

## Heritage Pond Outfall

~2018~



City of Beaufort

Beaufort County, South Carolina



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**CITY OF BEAUFORT  
HERMITAGE POND OUTFALL**

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# PROJECT SCOPE

The City maintains an outfall pipe out of a pond at the end of North Hermitage Road that outfalls from a nearby pond directly to Battery Creek. The pond and outfall pipe are on private property but receives stormwater from the basin along Hermitage Lane. Portions of the pipe have separated and the pipe is need of repair/replacement. The project is to repair/replace approximately 180 lf of pipe as well as the associated headwalls. Two options have been identified for the project: remove existing CMP and replace with equivalent RCP or slip line the existing pipe. The contractor has the opportunity provide a price for each alternative or simply for only one option. The two options are further described below.

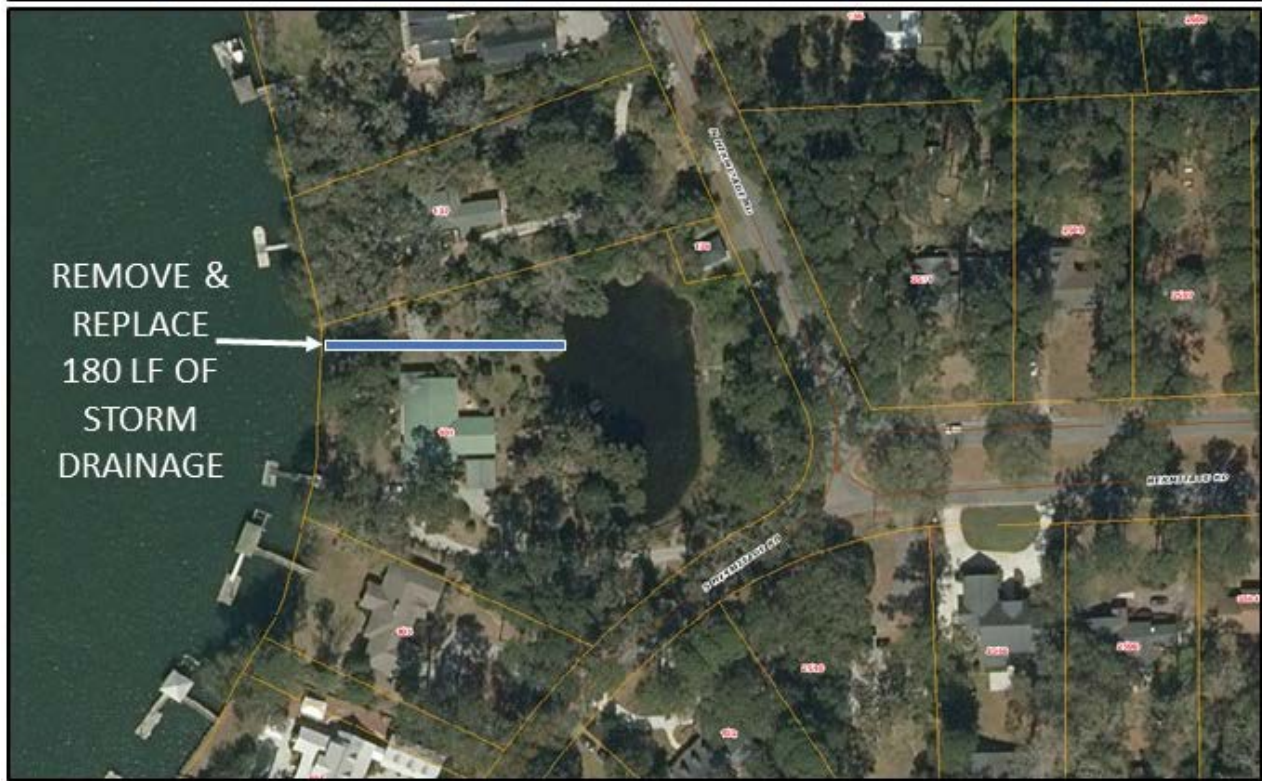
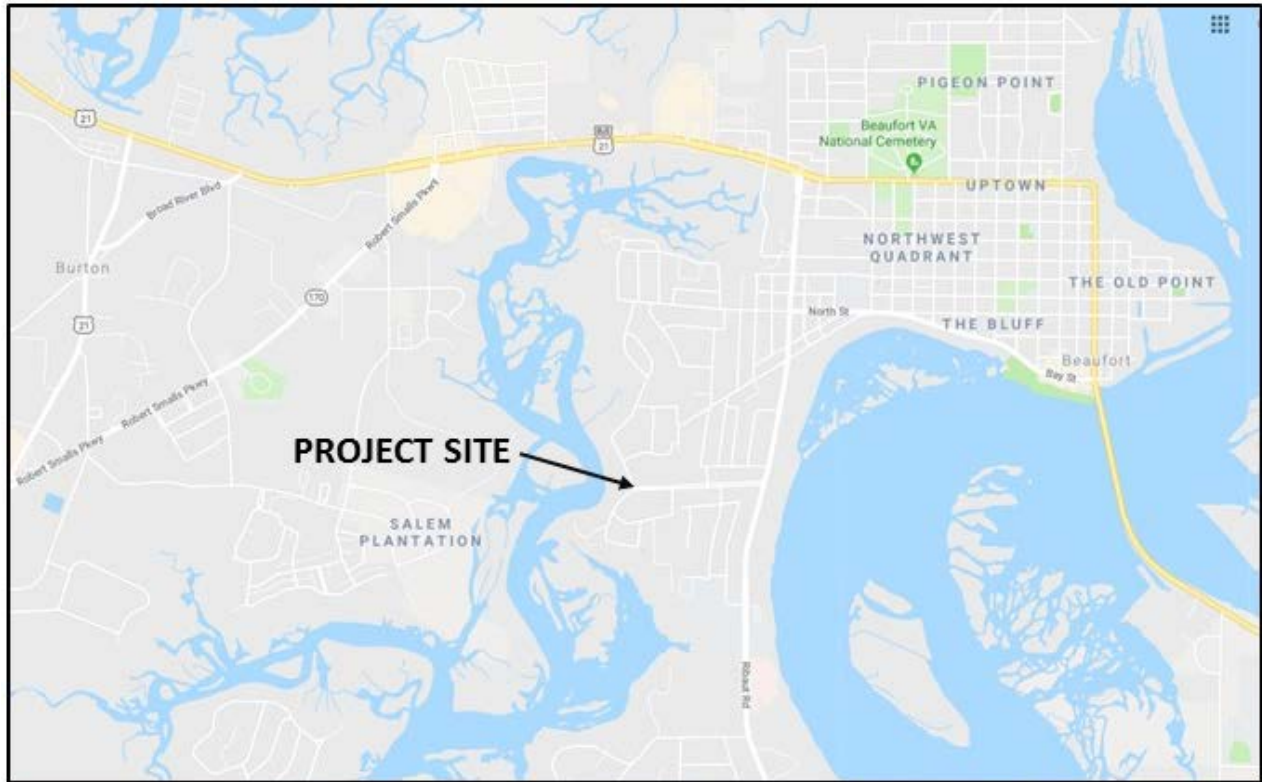
## **OPTION #1 – REMOVE AND REPLACE PIPE**

The contractor shall remove the existing 18” CMP and replace with 18” RCP. Contractor to replace concrete headwall at the pond and install new headwall on the outfall end of the pipe with a rip rap apron into the marsh. New pipe is to be placed at the same elevations and slopes as the existing run of pipe. Due to the close proximity of the residential structure and depth of the pipe, the contractor will be responsible for any/all shoring required to safely conduct the work and not damage the nearby residential structure. Any excess material will be responsibility of the contractor to haul off and remove. Once complete, all disturbed acreage to be dressed and seeded with permanent vegetation. The cost for all work of the defined scope, to include mobilization, bonds, staking and grading, etc., should be included and provided in a lump sum total cost.

## **OPTION #2 – SLIP LINE EXISTING PIPE**

The contractor shall provide a collar to extend the existing pipe with a like kind material to the original outfall location. Contractor to construct a new headwall on the outfall end of the pipe with a rip rap apron into the marsh. Once section of pipe is installed, contractor to slip line pipe with approved material. Slip line material to be submitted and approved by the City of Beaufort prior to installation. Contractor to ensure all voids in the material above the pipe are filled or stabilized as part of the slip line work. Contractor to clean existing pipe prior to placing the lining material. Additionally, contractor is required to video inspection of the pipe before and after the pipe to ensure proper installation. Due to the close proximity of the residential structure and depth of the pipe, the contractor will be responsible for any/all shoring required to safely conduct the work and not damage the nearby residential structure. Any excess material will be responsibility of the contractor to haul off and remove. Once complete, all disturbed acreage to be dressed and seeded with permanent vegetation. The cost for all work of the defined scope, to include mobilization, bonds, staking and grading, etc., should be included and provided in a lump sum total cost.

## PROJECT LOCATION



## SPECIAL PROVISIONS

PROJECT NAME

CITY / COUNTY

HERMITAGE POND OUTFALL

BEAUFORT

This project is to be constructed under the South Carolina Department of Transportation's Specifications for Highway Construction Edition of 2007, the South Carolina Department of Transportation's 2004 Construction Manual, and the Supplemental Technical Specifications in effect at the time of the letting, and the following Special Provisions.

**DEFINITION AND TERMS**

Delete Paragraph 101.3.27, (the) Engineer, of the 2007 Version of the Standard Specifications for Highway Construction in its entirety and replace with the following:

*City of Beaufort, acting directly or through his duly authorized representative, such representative acting within the scope of particular assigned duties or authority. On this Project the firm of Infrastructure Consulting & Engineering, PLLC (ICE) shall function as the Engineer's duly authorized representative with authority as described in Section 105, "CONTROL OF WORK", of the Standard Specifications for Highway Construction, latest Edition.*

***The project Owner is CITY OF BEAUFORT. In the specifications where the terms "SCDOT" or "Department" or other like terms are used to describe the facility Owner, it shall be interpreted as meaning City of Beaufort, as appropriate.***

Add "Notice-to-Proceed" to Section 101 as follows:

*Notice-to-Proceed. A written notice to the Contractor fixing the date on which the Contract Time will commence to run and on which the Contractor may start to perform obligations under the Contract Documents.*

*It is the intentions of the owner to have the Contractor begin work on this project as soon as practical. The owner anticipates that an award and contract will be issued within two weeks after bids are received. The owner will require that the completed contract, bonds, insurance and other information required by the contract shall be completed within two weeks after bids are received.*

**ERRATA TO 2007 STANDARD SPECIFICATIONS FOR HIGHWAY CONSTRUCTION**

See attached Supplemental Specification dated **May 4, 2009**.

**SUBSTANTIAL COMPLETION OF WORK**

Substantial Completion of Work is the point in the project when work has been constructed to the typical section in the Plans over the entire length of the project including tie-ins, all pay items have been installed in reasonable conformance with the plans and specifications over the entire length of the project and all lanes of traffic are open to the public in their final configuration with the only remaining work to be performed being punch list items.

Contractor shall have the work substantially complete within **30 Days** of the issuance of the notice to proceed.

## **AWARD OF CONTRACT**

Subsection 103.2 of the Standard Specifications is amended to allow sixty (60) days for the award of a contract after the opening of proposals.

## **CONSTRUCTION STAKES, LINES AND GRADES**

Stakes, Lines, and Grades shall be provided by the Contractor as necessary.

## **QUALIFIED PRODUCT LISTINGS**

All references to "Approval Sheet" or "Approval Policy" are to be replaced with "Qualified Products Listings (QPL)" and "Qualified Products Policies (QPP)" respectively. This change includes all references in the SCDOT Standard Drawings, SCDOT Standard Specifications, SCDOT Supplemental Specifications, SCDOT Special Provisions, SCDOT Supplemental Technical Specifications, SCDOT Internet and Intranet websites, and all other documents produced by SCDOT.

## **CONSTRUCTION QUALITY CONTROL AND ASSURANCE TESTING**

The contractor shall provide construction quality control and quality assurance testing for this project, except for MANUFACTURERS MATERIALS CERTIFICATIONS AND CERTIFIED TEST REPORTS as required by the provision included below.

## **RETAINAGE**

The City shall retain ten (10) percent of the amount of each payment until final completion and acceptance of all work covered by the Contract Documents. Upon substantial completion of the work, any amount retained may be paid to the Contractor. When the Work has been substantially completed except for Work which cannot be completed because of weather conditions, lack of materials or other reasons which in the judgment of the City are valid reasons for non- completion, the City may make additional payments, retaining at all times an amount sufficient to cover the estimated cost of the Work still to be completed.

## **REQUIRED MEDIA NOTIFICATION FOR CONSTRUCTION PROJECTS**

Contractors are encouraged to co-operate with the news media since all projects are constructed with public funds. Because the scope of this project will cause disruption of normal traffic flow, the Contractor is required to notify the public, in a timely manner, of disruptive activities such as lane closures.

The Contractor is required to utilize area media to accomplish public notification of traffic disruptions.

The Contractor is required to deal directly with the news media and all reasonable efforts should be made to co-operate with the media. However, the safety, security and construction schedule on site should not be disrupted in order to accomplish this. The Contractor may coordinate these activities with and receive guidance from the Engineer.

## **FAILURE TO COMPLETE THE WORK ON TIME**

Delete Section 108.9 in its entirety and substitute the following in its place:

Owner and Contractor recognize that time is of the essence and that the Owner will suffer financial loss if the work is not substantially complete in accordance with the time(s) specified herein. They also

recognize the delays, expenses and difficulties involved in proving in a legal or arbitration preceding the actual loss suffered by the Owner if the work is not completed on time.

Accordingly, instead of requiring such proof, the Owner and the Contractor agree that as liquidated damages for delay (but not as a penalty) the Contractor shall pay the Owner **\$100.00 per day** for each calendar day past the contract specified interim and final completion dates.

### **CONSTRUCTION SCHEDULE**

The successful Bidder shall, prior to commencement of work, submit to the City a schedule showing the order in which he proposes to carry on the Work. The City reserves the right to determine priority of schedule items, but unless modified by the parties, in writing, the successful Bidder shall have sole Responsibility for following and coordinating its schedule.

### **SURPLUS MATERIAL**

The contract bid price for other items of work shall be full payment for excavating, hauling, disposing of and seeding any surplus material.

### **LUMP SUM BID**

This contract is a lump sum bid. All associated project costs are to be included in the overall lump sum bid.

### **WARRANTY**

The Contractor agrees to a one-year warranty against defects, failures etc. caused by materials and workmanship, beginning on the date of final acceptance of punch list.



## SPECIFICATIONS

## REINFORCED CONCRETE PIPE (RCP) PIPE CULVERTS

### 714.1 Description

This section contains specifications for the materials, construction, measurement, and payment for furnishing reinforced concrete pipe culverts (RCP) of the size, shape, type, and dimensions indicated on the plans and installing them to provide drainage structures at places designated on the plans or by the RCE in accordance with these specifications and true to the lines and grades shown on the plans or otherwise given by the RCE. This work includes the furnishing and installing of necessary tee, wye, elbow, and bend joints, and making connections to existing and/or new structures, including drilling and chipping as is necessary to complete the work.

### 714.2 Materials

Use only materials specified herein for the several items that constitute the finished pipe culverts.

#### 714.2.1 RCP Materials

Use only RCP from a qualified manufacturer as indicated on SCDOT Qualified Product List 69. Use only joint sealant specified on SCDOT Qualified Product List 69 with the pipe supplied.

On occasion, the OMR may accept RCP that is not stamped, provided certified tests results are submitted for review for each class and size of RCP to include but is not limited to the results from the three edge bearing test for hairline crack (0.01 inch) and the ultimate strength of RCP. All testing will be in accordance to the latest applicable SCDOT and AASHTO specifications.

Use circular RCP conforming to the applicable requirements of AASHTO M 170, for the specified diameters, shapes, types, and strength classes except for the modifications stated herein and on SCDOT Standard Drawings. Provide the RCE with certification that pipe meets the requirements of AASHTO M 170. When a strength class is not specified in the plans, use minimum Class III pipe. Furnish pipe in manufactured lengths from 4 to 12 feet.

Make certain circular pipe meet or exceed the reinforcement requirements of AASHTO M 170. Install standard AASHTO M 170 reinforced pipe within minimum and maximum fill heights shown on SCDOT Standard Drawings.

Ensure that Portland cement conforms to the requirements of SCDOT Standard Specifications Subsection 701.2.1.

The manufacturer may use fly ash and water-granulated blast-furnace slag in accordance with the following requirements:

1. Fly ash meets AASHTO M 295 for Type F or C with a maximum  $\text{Na}_2\text{O}$  of 1.5%. Water-granulated blast-furnace slag meets the requirements of AASHTO M 302, Grade 100 or better.
2. Cement may be replaced by fly ash or water-granulated blast-furnace slag in accordance with AASHTO M 170.
3. Fly ash is allowed only from sources listed on the latest edition of SCDOT Qualified Product List 3. Slag is allowed only from sources listed on the latest edition of SCDOT Qualified Product List

6. Certified mill test reports are furnished with each shipment to verify compliance requirements.
4. The manufacturer provides a qualified OMR mix design in advance of batching. The submittal indicates the amount of cement removed and the material replacing it.
5. Storage bins, conveying devices and weighing equipment and procedures to ensure accurate batching provided for each material (fly ash or slag) used.

Use only circular reinforcement as listed in AASHTO M 170 for standard pipe. Make certain that steel reinforcement conforms to the requirements of AASHTO M 32, AASHTO M 55, AASHTO M 221, or AASHTO M 225 for wire reinforcement as applicable. Use only steel that conforms with the parameters used in the pipe structural calculations supplied for SCDOT Standard Drawings. For custom pipe requiring deformed billet steel, use circular reinforcement that conforms to ASTM A 706 Grade 60. Ensure that steel conforming to ASTM A 706 comes from a source listed on SCDOT Qualified Product List 60.

Ensure that Rubber Gasket Joint Material meets the requirements of AASHTO M 315. Ensure that Preformed Flexible Joint Sealant meets the requirements of AASHTO M 198. Use only gasket sources that appear on SCDOT Qualified Product List 69 with the supplied pipe. Obtain qualification by furnishing the OMR a certified affidavit with test results made in a recognized laboratory confirming that the material meets AASHTO M 198 for preformed flexible joint sealant and AASHTO M 315 for rubber gaskets, along with complete instructions for installation of the material.

Make certain water meets the requirements of SCDOT Standard Specifications Subsection 701.2.11.

When lift holes or lugs are required in pipe, follow OSHA guidelines for handling pipe, and manufacturer guidelines for plugging lift holes after installation.

For custom pipe, when noncircular (elliptical, shear stirrups, etc.) reinforcement is used,

1. Stabilize reinforcement by satisfactory means to ensure that it does not shift or rotate during the manufacturing process
2. Provide a stencil on the inside and outside shell indicating "CUSTOM PIPE NON CIRCULAR REINFORCEMENT TOP OF PIPE" and a mark "X" indicating exact top of pipe.
3. Provide a stencil on the inside and outside shell indicating designed fill height.
4. Provide to RCE and follow manufacturer guidelines for proper handling and installation instructions. Use installation procedure and materials that meet or exceed the limitations of this specification.

#### 714.2.4 Special Materials and Connections

If special designed pipe is required (beyond the fill height limits of the SCDOT Standard Drawings), have the manufacturer submit to the OMR and the appropriate Structures Engineer a design that meets or exceeds the loading criteria specified on SCDOT Instructional Bulletin 2007-04 for the design cover height for the project and the pipe material chosen.

Use tees, wyes, elbows, bends, reducers, and increasers with strength matching or exceeding the strength of the strongest pipe being connected and with the same joint profile of the connecting pipe. Use tees, wyes, elbows, bends, reducers, and increasers with joint profiles that match connected pipe.

When geotextile for drainage filtration is required, follow SCDOT Standard Specifications subsection 804.2.11 and SCDOT Standard Drawings.

#### 714.2.5 Referenced Documents

##### SCDOT Standard Specifications for Highway Construction

##### SCDOT Test Procedure:

- SC-T-29

##### SCDOT Qualified Product Lists:

- Qualified Product List 1
- Qualified Product List 2
- Qualified Product List 3
- Qualified Product List 30
- Qualified Product List 60
- Qualified Product List 68
- Qualified Product List 69

##### SCDOT Instructional Bulletins:

- SCDOT Instructional Bulletin 2007-4
- SCDOT Instructional Bulletin 2009-2

##### AASHTO Standard Specifications for Transportation Materials & Methods of Sampling and Testing:

- AASHTO M 32
- AASHTO M 55
- AASHTO T 96
- AASHTO T 104
- AASHTO M 145
- AASHTO M 170
- AASHTO M 196
- AASHTO M 197
- AASHTO M 198
- AASHTO M 207
- AASHTO M 221
- AASHTO M 225
- AASHTO M 294
- AASHTO M 295
- AASHTO M 302
- AASHTO M 315

##### ASTM Standard Specifications:

- ASTM A 307
- ASTM A 706

- ASTM B 666
- ASTM C 443
- ASTM C 1479
- ASTM D 1149
- ASTM D 2321
- ASTM D 1056
- ASTM D 3212
- ASTM F 477

Websites:

[www.osha.gov](http://www.osha.gov)

[www.llr.state.sc.us/labor/osha/](http://www.llr.state.sc.us/labor/osha/)

[www.concrete-pipe.org](http://www.concrete-pipe.org)

[www.precast.org](http://www.precast.org)

[www.llr.state.sc.us/labor/osha/](http://www.llr.state.sc.us/labor/osha/)

[www.plasticpipe.org](http://www.plasticpipe.org)

[www.ntpep.org](http://www.ntpep.org)

### 714.3 Construction Requirements

#### 714.3.1 Handling and Storage

Inspect pipe before it is installed. Check pipe for proper markings and for signs of damage due to fabrication or shipment. Pipe may be rejected due to improper marking, incorrect pipe class, gage, corrugation type, size, or strength. Pipe may also be rejected due to damage which may include, but is not limited to fractures or cracks passing through the wall or extending the entire length of the pipe, spalling, chips, breaks, honey-combing, cuts, gouges, de-laminations, bulges, flat areas, bubbles, dents, tears, breaks, gaps, missing or malformed corrugations, or deformations that would adversely affect the strength or function of the pipe. Damage to the end of the pipe including broken tongues or grooves, open seams (particularly at rerolled ends) or end damage to bell or spigot, or ends that are not normal to the walls or centerline of the pipe that prevent satisfactory joint installation may also be cause for rejection. Defective or damaged joint sealant or gaskets may require replacement, but are not cause for rejection of pipe that meets the above requirements.

Handle and store pipe such that no damage occurs to the pipe. Unload the pipe at a site that is relatively flat and level, free of debris, and away from construction traffic. Stack belled RCP pipes using blocking to avoid excess loading on the bells.

For RCP pipe marked “NON CIRCULAR REINFORCEMENT TOP OF PIPE” follow manufacturer requirements for proper handling of pipe.

#### 714.3.2 Trench for Pipe

Lay the pipe in a trench where possible. Excavate trenches to the required grade and to a width sufficient to allow for proper jointing of the pipe and for thorough compaction of the structural backfill material under and around the pipe. Excavate the trench to a width which is the greatest of:

1.  $1.5 \times \text{Pipe OD} + 12''$

2. Pipe OD + 24"
3. 3 x Pipe OD (only in sections where foundation improvement is required in the plans or by the RCE)
4. The width required to safely fit compaction equipment and personnel between the pipe and the trench walls.

When using controlled low strength material (CLSM) backfill, excavate the trench to a minimum width of the outside diameter of the pipe plus 12 inches. Make certain that the trench bottom gives full support to the pipe throughout its length.

Where pipe culverts will be placed in new embankments, first construct the embankments to a height of approximately 1/2 the diameter of the pipe above the top of the designated pipe or to such height as directed by the RCE. Construct the embankment for a distance of not less than 5 times the diameter of the pipe on each side of the pipe location, after which excavate the trench in the embankment as described in this section above.

When excavating for pipe culverts, if rock, hard pan, or other unyielding foundation material is encountered, excavate the hard unyielding material below the elevation of the bottom of the pipe to accommodate the required bedding thickness.

Follow OSHA's excavation regulations found in Subpart P of 29 CFR 1926 for safety requirements of trench excavations and protection systems. The Contractor shall employ an onsite Competent Person (as defined by SC OSHA as follows: one who is capable of identifying existing and predictable hazards in the surroundings, or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them. In order to be a competent person for the purpose of this standard one must have had specific training in, and be knowledgeable about, soils analysis, the use of protective systems, and the requirements of this standard) during all trenching operations. Provide the RCE with the name and contact information of the responsible Competent Person for each installation. If trench widths or wall slopes are changed due to safety requirements, backfill the trench outside of the vertical trench dimensions with materials meeting the minimum requirements of the embankment (or pipe structural backfill for shallow installations) as described in Subsection 1.3.6. Ensure that the support of the pipe and its embedment are maintained throughout the installation.

If trench boxes (shields, etc.) are required, follow 29 CFR 1926.652, trench box manufacturer, and industry standards for trench installations not exceeding 20 feet. When trench boxes are required for trenches exceeding 20 feet deep, the Contractor shall submit to the RCE designs, plans and supporting calculations for protective systems and shoring equipment sealed by a Professional Engineer who is licensed in South Carolina unless provided in the plans. When trench boxes are moved, the previously placed pipe and structural backfill shall not be disturbed. Move trench box in increments during the installation process to permit placement and compaction of structural backfill material for the full width of the trench while continuing to follow Subpart P of 29 CFR 1926 OSHA Standards. Voids that are created by movement of the trench box shall be filled and compacted with structural backfill described in Subsection 3.3.6. If necessary to prevent movement, restrain the pipe using methods that do not damage the pipe.

If temporary shoring (sheet pile, timber shoring, mechanically stabilized earth, etc.) is required, the Contractor shall submit to the RCE designs, plans and supporting calculations for protective systems and shoring equipment sealed by a Professional Engineer who is licensed in South Carolina unless provided in the plans. If temporary shoring is to be removed, it shall be pulled out in vertical increments during the installation process to permit placement and compaction of fill material for the full width of the trench while continuing to follow Subpart P of 29 CFR 1926 OSHA Standards. If temporary shoring is to be left in place, provide the resident with location and description of all buried systems for inclusion in as-built plans.

Provide for temporary diversion of water or pumping as may be necessary in order to permit dry installation of the culvert. Keep trenches free from water until any joint sealant material has hardened sufficiently.

#### 714.3.3 Foundation for Pipe

Unless noted otherwise in the plans or by the RCE, support pipe using foundation material that meets the minimum requirements of the roadway embankment.

Use the soil boring Standard Penetration Test SPT "N" values and recommendations of SCDOT Standard Drawings to determine if additional work is required to prepare an improved foundation. When an improved foundation is required, remove unstable material at least 1 diameter on each side of the pipe. Excavate deep enough to install nonwoven geotextile for drainage filtration and pipe foundation material as indicated on SCDOT Standard Drawings. If Type P1 biaxial geogrid is used with the foundation material and geotextile for drainage filtration, the additional foundation undercut may be reduced as indicated on SCDOT Standard Drawings. When pipe foundation material is indicated, use the same material that is used for the bedding and pipe structural backfill. Compact the pipe foundation material in accordance with methods used for pipe structural backfill. Provide trench suitable to accommodate site conditions and obstructions.

If poor material is encountered that was not indicated in the plans, contact the Preconstruction Regional Production Group Design Manager for instructions on foundation preparation.

#### 714.3.4 Bed for Pipe

For bedding material, use either:

1. Well graded A-1 (AASHTO M 145) soils
2. Screenings meeting A-1 (AASHTO M 145)
3. Macadam or Marine Limestone Graded aggregate base from Qualified Product List 2
4. Materials meeting AASHTO soil classifications A2-4 or A2-5.
5. Uniformly graded, coarse grained A-3 (AASHTO M 145) soils
6. Uniformly graded angular stone as large as #5 stone (Class 2 wrapped, vibrated)

The same material must be used for bedding and structural backfill unless CLSM is used for structural backfill.

The materials marked as (wrapped) require geotextile wrap to control migration of fines into open voids. Other materials should be wrapped if there is a significant grain or particle size difference between the in-situ or embankment material and the bedding and structural backfill material as determined by the RCE. When wrapping is used, provide a geotextile that prevents the transmission of the smallest soil particles present in both the in-situ soil and the soil used for bedding and structural backfill. Wrap the entire bedding and backfill envelope and provide a minimum overlap of 2 feet at all geotextile splices. For shallow installations, provide a cover of 6 inches of soil between geotextile and hot mix asphalt.

A sample of the pipe bedding material will be taken at the beginning of pipe laying operations to verify the classification of materials used for bedding and pipe structural backfill. After the initial sample is taken, the sampling frequency will be for each 1,000 foot production lot or until the source or classification of the bedding/backfill material changes. These are minimum requirements that may be increased at the RCE's discretion.

Ensure that trenches are free of water when placing bedding.

Support the pipe by placing uncompacted bedding material above the stable foundation material. Use the larger of 6 inches or 10.0% of the nominal pipe outside diameter for the bedding thickness. Prepare bedding material at pipe bells and projected hubs (if present) to prevent excess loading and to provide uniform support in these areas.

Compact bedding material that is outside of the middle third pipe diameter in order to ensure proper support of the pipe. Ensure that bedding material outside the middle third of pipe is compacted to a minimum of 95.0% of the maximum dry density when measured in accordance to SC-T-29. Ensure that compaction of bedding material does not cause the pipe to move.

Vibrate angular stone in place using a minimum of 2 passes with a vibratory plate tamp in lifts not to exceed 12 inches.

Do not use controlled low strength material (CLSM), flowable fills or concrete for pipe bedding.

#### 714.3.5 Laying Pipe

Begin pipe laying at the downstream end of the culvert with the bell or groove ends and outside laps upstream.

Make certain each section of pipe has a full firm bearing throughout its length, true to line and grade given. Make certain that all supports are uniform (without point loading from irregular backfill) and joints and bells have been properly accommodated. Remove pipe that settles before final acceptance or which is not in alignment and re-lay without extra compensation.

When custom RCP pipe with noncircular reinforcement is used, install the pipe in such a position that the manufacturer's marks designating the top of the pipe is not more than 5 degrees from the vertical plane through the longitudinal axis of the pipe or manufacturers guidelines, whichever is most vertical.

Prior to being lowered into the trench, closely examine corrugated metal pipe sections and fit so that they will form a true line of pipe when in place. Do not use sections that do not fit together properly.



Place distorted circular metal pipes with the major axis vertical. If rods, struts, or other means are used to maintain pipe distortion, do not remove them before the completion of the embankment unless otherwise permitted by the RCE.

Before laying the pipe or during the pipe laying operations, construct adequate outfall ditches and inlets free of obstructions in order that proper drainage is provided.

When pipes are connected to drainage structures, install or cut pipe flush with inside face of drainage structure. When pipes are connected to end treatments such as slabs or headwalls, install or cut pipe flush with exposed face of end treatment. When pipe culverts are installed connecting to pipe of different material or of connection details, use a standard drainage structure or designed interface as directed by the RCE. Where pipe culverts are constructed in conjunction with existing structures, make connections to the satisfaction of the RCE.

### 714.3.6 Joints

#### 714.3.6.1 Reinforced Concrete Pipe (RCP) Joints

For RCP, use a joint material supplied with the pipe and made by a manufacturer listed on SCDOT Qualified Product List 69 that corresponds with the type of joint specified in the plans or provided by the pipe manufacturer. Submit joint material manufacturer installation recommendations to RCE before installation of pipe. Follow joint material manufacturer's recommendations for installation procedure. Follow pipe manufacturer's recommendations for maximum joint opening to meet tightness requirements specified in the plans or contract documents. Order pipe and appropriate joint material from pipe manufacturer. Install pipe using AASHTO M 198 joints unless specified in the plans, contract documents, or pay items.

##### 1. AASHTO M 198 Preformed Flexible Joint Sealant

Use a combination of pipe and joint material that meets performance requirements of the AASHTO M 198, including the laboratory 10 psi pressure test. The laboratory test (which may be performed using vertical joints as indicated in AASHTO) is not intended to indicate field performance of the joint, but rather to indicate the proper sealant size to joint detail configuration as well as performance of the joint under ideal laboratory conditions. Carefully clean all dirt and foreign substances from the jointing surface of the groove end already laid and tongue end of the pipe being added. Allow jointing surfaces to dry completely before application of the joint material. If required by site conditions or manufacturer recommendations, apply an adhesive primer specified by the flexible sealant manufacturer. During cold weather, warm flexible sealant as directed by the manufacturer before application. Apply material in a single strip as specified by pipe manufacturer (typically from within 1 inch of the tongue end to approximately the middle of the tongue on pipe) for up to 48 inch diameter pipe. For pipe larger than 48 inch diameter, place half of the sealant on the top side of the tongue end and the other half on the bottom side of the groove end of the two pipes being joined. Provide between 1" and 3" overlap of the installed joint sealant by laying the edges of the sealant side by side. Do not twist ends of sealant around each other or stack one end on top of the other. Leave protective paper on outside of flexible sealant to protect during pipe alignment. Apply enough flexible sealant to fill the annular joint space. Align the tongue and groove or bell and spigot ends of the pipes before joining (closing) the joint. Remove any remaining protective paper from outside surface of flexible sealant. Make sure that the flexible sealant is in contact with the entry taper around the entire circumference of the pipe. Confirm that the pipe is aligned properly. Seat the pipe completely before installing next pipe section.

## 2. AASHTO M 315 Rubber Gasket Joint Material

When specified in the plans, use a combination of pipe and joint material that meets performance requirements of the AASHTO M 315 (ASTM C 443), including the laboratory 13 psi pressure test. The laboratory test is not intended to indicate field performance of the joint, but rather to indicate the proper gasket size to joint detail configuration as well as performance of the joint under ideal laboratory conditions. Carefully clean all dirt and foreign substances from the jointing surface of the groove end already laid and tongue end of the pipe being added. Follow pipe manufacturer's recommendations for lubrication of joint and/or gasket. Fit the gasket on the tongue recess. Equalize the rubber gasket by running a smooth round object (such as a screwdriver shaft) between the gasket and the pipe. Complete this equalization procedure at least 3 times around the entire length of each gasket (see detail on standard drawing for reinforced concrete pipe). Ensure proper seating of the gasket before proceeding with installation. Align the tongue and groove ends of the pipes before homing (closing) the joint. Make sure that the gasket is in contact with the entry taper around the entire circumference and that the pipe is aligned properly. Seat pipe completely before installing next pipe section.

### 714.3.7 Pipe Structural Backfill

Advise the RCE of the time Pipe Structural Backfill operations are expected to begin. If not properly advised, the RCE may require the excavation and reinstallation of the structural backfill material.

For structural backfill, use the same material as the pipe bedding (Subsection 3.3.3) unless controlled low strength material is used as described below. When materials are used that require geotextile wrap, cover the entire bedding and structural backfill envelope as described in subsection 714.3.3.

Controlled low strength material (CLSM) and controlled density fill are flowable fills that may be used for structural backfill in the haunch area and above. Select a flowable fill mix design that can be excavated. When using CLSM backfill excavate the trench to a width that is a minimum of the outside pipe diameter plus 12 inches but no wider than the outside pipe diameter plus 20 inches. Do not use CLSM when placing perforated pipe. When using CLSM ensure that the pipe is not displaced and does not float while using methods that do not damage the pipe.

Ensure that trenches are free of water when placing and compacting structural backfill.

Thoroughly compact the structural backfill material in layers not exceeding 6 inches of compacted material. The first lift must be sufficiently below the spring line such that the material can be worked into the haunch zone of the pipe. Perform compaction by the use of mechanical tampers with the assistance of hand tamps when necessary. Thoroughly compact the structural backfill under the haunches of the pipe and ensure that the backfill soil is in continuous uniform contact with the side and joints of the pipe. Exercise sufficient care to prevent damaging or misaligning the pipe with the compaction equipment.

Install and compact structural backfill on both sides of pipe before adding the next lift of backfill material. Evenly distribute structural backfill on both sides of the pipe for its full length. Ensure that Pipe Structural Backfill process does not cause joint separation or displacement of the installed pipe.

Ensure that the compaction of structural backfill is a minimum of 95.0% of the maximum dry density when measured in accordance with SC-T-29.

The RCE will establish a compaction pattern for the contractor to follow during pipe backfill operations. The pattern will be in effect for production lots of 500 feet of pipe, until the source or classification of backfill material changes, site weather conditions change such as rain, or the compactive efforts being applied change. The compaction pattern will be established by allowing the contractor to apply a 6 inch lift in a 50 foot section until the material has been compacted to 95.0% of the maximum dry density for the structural backfill when measured in accordance with SC-T-29. The number of passes and the watering efforts applied to the material will be recorded and this pattern will be considered the compaction pattern.

For pipe smaller than 36 inches in diameter, the RCE will run a minimum of one verification compaction test at the springline of the pipe for each run of pipe between drainage structures or pipe ends. For pipe 36 inches in diameter and larger, a minimum of one test for each 18 inches of the pipe embedment zone height (including one at the pipe springline) for each run of pipe between drainage structures or pipe ends will be performed. This is a minimum frequency and should be increased at the RCE's discretion.

For all tests, insert the nuclear gauge probe to its full depth or within 2 to 3 inches of the bottom of the layer being tested, whichever is less. In the event of a non-conforming compaction measurement, the RCE will check the compaction of the previous lift by removing enough material to perform the verification test. If the second test passes, the contractor will continue the compaction efforts of the current layer until the verification test passes. In the event of 2 failing compaction tests within a single run of pipe (between drainage structures or pipe ends), remove the pipe structural backfill, clean trench and set a new compaction pattern at the RCE's discretion.

For driveway pipes and runs of pipe up to 16 feet in length the frequency of compaction testing will be at the discretion of the RCE.

Vibrate angular stone backfills in place using methods that properly lock the angular stone in place around the pipe and do not damage the pipe, typically 2 passes with a vibratory plate tamp for each 12 inch lift.

Complete structural backfill installation up to the minimum cover elevation above the pipe for typical installations. When installing pipe under pavement and within 3 feet of the subgrade, complete structural backfill installation up to the top of the subgrade. Confirm that structural backfill material in pipe trench meets or exceeds the embankment compaction requirements before applying pavement structure.

#### 714.3.8 Cover Height

Ensure that the minimum and maximum cover is in accordance with the height of cover tables in the SCDOT Standard Drawings.

#### 714.3.9 Construction Loads

Fill height requirements may dictate that more fill is required during construction than for final design. In all cases, install backfill to the minimum construction fill height specified in the SCDOT Standard Drawings before driving heavy equipment over pipe. Maintain this minimum cover until heavy

equipment usage is discontinued so that damage does not occur to the pipe. Install and remove backfill required due to the construction loading on the pipe at no expense to SCDOT. Repair all damage or displacement at no expense to SCDOT.

#### 714.3.10 Structures and End Treatments

Unless shown otherwise in the plans, use a minimum end treatment of a straight pipe end with Class B or C riprap and geotextile for erosion control

When specified in the plans, use end treatments such as pipe beveled end, concrete slab, straight headwall for pipe, pipe end structure, or pipe wingwall and apron system in accordance with SCDOT Standard Drawings or plan structure details.

#### 714.3.11 Installation Inspection

##### Construction Inspection:

Visually inspect 100% of pipe for fractures, cracks, spalling, chips, and breaks during all phases of the installation process. Inspect joints, including tongues and grooves. Chipped pipe ends that prevent the full bond between joint sealant/gasket and both pipes may only be installed in drainage structures at the ends of pipe runs where they will be grouted over. Inspect installed joints for missing, damaged, or improperly installed joint sealant or gasket. Verify line and grade in accordance with the frequencies detailed in the Construction Manual. All inspections must be performed by a SCDOT certified Earthwork, Drainage and Base Technician.

When improper installation or damage is noted during the construction installation inspection of the pipe, repairs must be made to the satisfaction of the RCE. Additional inspections may be performed until confidence is restored that the installation has been performed in accordance with these specifications.

##### Post Construction Inspection:

The RCE will collect survey data for 100% of installed pipe. Survey data will be collected electronically to establish a pipe inventory. Survey data will include county, route information, mile point, latitude and longitude for inlet end of pipe. Survey data collected will also include at a minimum pipe diameter, pipe material, fill height, and shape and description of drainage structures and end treatments. This inventory data will be submitted to the Director of Maintenance office upon acceptance of the project

Post Installation Inspection for acceptance purposes shall be performed by the Department or its Consultant at the discretion of the RCE. The timing, frequency, location, and the method of post construction inspection will be determined by the RCE. 100% of pipe installed on the project may be inspected. The Department or its Consultant will provide any necessary Traffic Control to support the inspection operation. The Contractor shall cooperated fully with the post installation inspection and in no way interfere with the post installation inspection.

These inspections will be performed and submitted by a SCDOT certified Earthwork, Drainage, & Base Technician. Inspections of completed pipe installations will be performed after the embankment is in place and all non-asphalt bases and/or subgrades have been completed for at least 30 days. In cases where the Contractor's accepted schedule indicates that paving operations will be conducted in less

than 30 days, an early inspection may be performed for acceptance. The Contractor will be provided with a copy of the post installation inspection report if deficiencies are discovered.

When improper installation or damage is noted in any prior inspection (visual, compaction, installation, etc.) of the pipe, repair the pipe installation to the satisfaction of the RCE. The RCE may perform additional inspections until confidence is restored that the remaining pipe has been installed in accordance with these specifications and is performing satisfactorily.

For concrete pipe, when signs of distress, such as differential movement, efflorescence, spalling, rust stains or cracks wider than 0.01 inch are present in the pipe, **the Contractor shall** prepare a **remedial action plan** for submittal to the RCE. This **remedial action plan** must address: structural integrity, environmental conditions, design service life of the pipe, and recommended remediation. The RCE must approve both the remediation report and **proposed** repair procedure. At a minimum, seal cracks having widths equal to or greater than 0.01 inch in accordance with manufacturer's instructions. Replace pipes having cracks greater than 0.1 inch determined to be beyond satisfactory structural repair. Repair or replace pipes having displacement across the crack. Repair or replace pipes exhibiting spalls or delaminations. The RCE may perform additional inspections until confidence is restored that the remaining pipe has been installed in accordance with these specifications and is performing satisfactorily.

#### 714.3.12 Installing Pipe Culvert Under Existing Pavement

On projects where the original approach pavement structure is being retained, lay the pipe culvert as herein specified. Repair the portion of the pavement structure removed due to the excavation of the trench using the same type of materials used in the original construction. The RCE may accept the use of other materials as deemed appropriate. Perform the work to the satisfaction of the RCE. Include the cost of the materials and the labor involved in the unit bid price for the pipe culvert.

#### 714.3.13 Placing Pipe Under Railroads and Other Transportation Facilities

When the plans include the installation of pipe under railroads or other transportation facilities not under the jurisdiction of the Department, unless otherwise provided, install the pipe using such methods, materials, and procedures required by the owner. There is no extra compensation for this change in methods, materials, and procedures.

#### 714.3.14 Cleaning Out Pipe

Thoroughly clean out the entire length of newly installed pipe culverts. No additional payment will be made for the cleaning out of newly installed pipe culverts. Pipes must be clean and accessible for inspection and acceptance.

#### 714.3.15 Trench Backfill for Expedited Construction

At the RCE's discretion or where otherwise noted, controlled low strength material (CLSM) may be used as structural backfill and to complete trench backfill for pipe installations in order to expedite the re-opening of the roadway to traffic. The decision should be based on traffic volume, safety and public inconvenience.

CLSM, also known as flowable fill, can be placed to a height not to exceed the subgrade elevation. The remaining pavement structure must be installed according to the pavement typical section. Measurements for payment will be made based on the neat line at a trench width (pipe outside

diameter + 12") for the pipe type being installed. Any material used beyond these dimensions is considered incidental to the pipe installation. CLSM shall be installed in accordance with manufacturer's recommendations to prevent pipe displacement and uplift during CLSM placement.

When CLSM is specified in the plans or special provisions for completion of the trench backfill, CLSM in the pipe embedment zone will be included in the cost of the pipe, and CLSM above the pipe embedment zone will be paid for at the contract unit price for Controlled Low Strength Material.

When CLSM is specified by the RCE during construction, all CLSM used in the trench above the pipe springline will be paid for at the contract unit price for Controlled Low Strength Material.

#### 714.3.16 Cleaning Out of Existing Pipe (All Existing Pipe)

Maintain retained pipe culverts that are clean in the same condition as they existed before beginning work. When specified in the plans, thoroughly clean out the entire length of existing pipe culverts. Remove all debris and settlement that affects the hydraulic performance of the entire pipe, including all debris within two pipe diameters of each end of the pipe.

#### 714.3.17 Removing of Existing Pipe (All Existing Pipe)

Remove existing pipe in accordance with the provisions of SCDOT Standard Specifications Subsection 202.4.3. Backfill and compact fill material to the same grade and slope of the area before the pipe was removed.

#### 714.3.18 Abandoning Pipe (All Existing Pipe)

At locations on the plans where existing pipe culvert is to be abandoned, plug the existing pipe using brick and mortar or use the Taylor Made Plastics, Inc. "Pipe Plug" or equal. Fill the entire abandoned pipe with CLSM that meets the strength requirements of the embankment and can be excavated. Place CLSM using a method that produces the smallest air pockets or voids within the abandoned pipe, such as pumping from a single location until the both ends of the pipe are full.

#### 714.4 Measurement

The quantity for the items pipe culvert, of the size, kind, class, thickness or type specified, or Smooth or Corrugated Wall Pipe Culvert of the size specified is measured in linear feet of the net length of pipe culvert complete in place and accepted.

Pipe quantities will be the linear measurement from end to end of the pipe through tees, wyes, elbows, bends, reducers, increasers, elbows, and beveled ends, excluding all drainage structures. The length is obtained by adding the centerline length of each run of pipe between Drainage Structures and to the completed end of pipe at End Treatments. Do not include the length of end treatment beyond the pipe in the measurement of the pipe.

If the plans require bevels at the pipe ends, include the length of the beveled end section in the measured length of pipe.

The quantity for the items beveling of smooth wall pipe culvert, beveling of corrugated wall pipe culvert, pipe culvert tees, wyes, elbows, bends, reducers, and increasers of the size and kind specified is measured by each item.

Measure the quantity for riprap placed around pipe end or end treatment in tons based on the quantity required to complete installation in accordance with the SCDOT Standard Drawing and Instructional Bulletin 2009-2 for the pipe end treatment used.

Measure the quantity for geotextile for erosion control under riprap in square yards based on the quantity required to complete installation in accordance with the SCDOT Standard Drawing for the pipe end treatment used.

The quantity for the items pipe culvert flared end section, straight headwalls, concrete slabs, pipe end structures, wingwall and apron system, and drainage structures is measured by each unit, complete in place and accepted.

The quantity of pipe additional foundation work is measured in linear feet along the centerline of the pipe as shown in the SCDOT Standard Drawings. Dispose of any unstable material in the manner outlined in SCDOT Standard Specifications Subsection 203.2.1.5.

For typical and maximum cover installations shown on SCDOT Standard Drawings, no measurement will be made for backfill material shown within the pipe embedment zone, and payment for this material will be included in the cost of the pipe. For shallow and minimum cover installations shown on SCDOT Standard Drawings, no measurement will be made for backfill within the pipe trench, and payment for this material will be included in the cost of the pipe.

For installations in cut sections where pipe is deeper than shallow installation, embankment material overfill above the pipe embedment zone will be measured as the volume between the standard trench walls from the top of the pipe embedment zone to the top of the subgrade as shown on the SCDOT Standard Drawings.

No measurement will be made for the removal of existing pipe culverts that will be replaced by new culverts. No measurement will be made for pipe inspection.

The quantity for the cleaning of existing pipe culverts is measured in linear feet for the entire length of the pipe to be cleaned plus four pipe diameters.

The quantity for the excavation necessary for the removal of existing pipe culverts that are not to be replaced by new culverts is measured in cubic yards as set forth in SCDOT Standard Specifications Subsection 202.5.

Measurement for pipe abandoning will be paid for as CLSM in accordance with SCDOT Standard Specifications Subsection 210.5.

#### 714.5 Payment

Pipe culvert and end treatments, measured as provided in Subsection 3.4, are paid for at the contract unit price for the respective items, which price and payment is compensation for furnishing all material, labor, equipment, tools including hauling and placing all pipe sections and materials, excavation of the entire standard trench, bedding, and pipe structural backfill as described in the measurement section (both structural and embankment backfill in this region), removal of existing pipe to be replaced, constructing pipe joints, removal of old end treatments, cleaning out pipe, disposal of surplus materials, all visual inspection, traffic control for all inspections, and all incidentals necessary to complete the work.

The Contractor may choose to dispose of the material excavated from the pipe trench on the project site if the RCE determines that the material is suitable, or the Contractor may dispose of the material

off the site of the project in accordance with the disposal requirements of Section 203.2.1.5 of the Standard Specifications entitled "Surplus Material." The Contractor is not entitled to any additional payment for the disposal of the material excavated from the pipe trench regardless of which method of disposal is utilized.

All traffic control necessary to perform the installation and post construction inspections will be provided by the Prime Contractor. No separate payment will be made for this traffic control.

Beveling of the pipe ends will be included in the unit cost of beveling of pipe culvert as specified in the plans.

Payment for riprap and geotextile for erosion control under riprap as measured in Subsection 714.4 includes all direct and indirect costs and expenses necessary to complete the work.

The quantities for the items pipe culvert tees, wyes, elbows, bends, reducers, and increasers measured as provided in Subsection 714.4, are paid for as each.

The quantity of pipe additional foundation work, measured as provided for in Subsection 714.4, is paid for at the contract unit price, which price and payment is compensation for furnishing all material (foundation, extra bedding, extra structural backfill, extra geotextile, etc.), labor (additional trench excavation, compaction, etc.), equipment, tools, hauling, and disposal (of poor material) to complete construction of the pipe foundation, and wider trench as specified in the SCDOT Standard Drawings, the plans, or by the RCE.

Embankment material overfill in cut sections as described in the measurement section will be paid for as borrow.

All work associated with the excavation, removal and disposal of existing pipe culverts that will be replaced by a new structure will be paid for in the pay item of the new structure.

The excavation for the removal of existing pipe is paid for at the contract unit price for Unclassified Excavation as specified in SCDOT Standard Specifications Subsection 202.6, which price and payment is full compensation for all work and costs of removal, transporting, and storing or disposing of existing pipe that is not to be replaced by a new structure and re-installation and compaction of fill material to restore embankment to original grade.

Cleaning of existing pipe is paid for at the contract unit price for Cleaning Existing Pipe, which price and payment is full compensation for all work and costs of cleaning, debris removal, transporting, disposing of all obstructions within the pipe that is to be cleaned and within two pipe diameters of each pipe end.

Payment for pipe abandoning will be in accordance with SCDOT Standard Specifications Subsection 210.6, which price and payment is full compensation for all work and costs of materials, labor, and construction costs to abandon the pipe. No additional pay items will be made for this work regardless of the method chosen.

Payment for each item includes all direct and indirect costs and expenses necessary to complete the work.

Pay items under this Supplemental Technical Specification include the following:



Item No.	Pay Item	Unit
714XXXX	<i>(size)</i> Smooth Wall Pipe Culvert	LF
714XXXX	<i>(size)</i> Corrugated Wall Pipe Culvert	LF
714XXXX	<i>(size)</i> RC Pipe Culvert (RCP) - <i>(class)</i>	LF
714XXXX	<i>(size)</i> RC Pipe Culvert (RCP) - <i>(class)</i> AASHTO M315	LF
714XXXX	<i>(size)</i> Corr. Alum. Alloy Pipe Culvert (CAAP) - <i>(gage)</i>	LF
714XXXX	<i>(size)</i> Spiral Rib. Alum. Pipe Culvert (SRAP) - <i>(gage)</i>	LF
714XXXX	<i>(size)</i> Corr. Polyethylene Pipe Culvert (HDPE) – Type S	LF
714XXXX	<i>(size)</i> <i>(kind)</i> Pipe Culvert Flared End Section <i>(class or thickness)</i>	EA
714XXXX	<i>(size)</i> <i>(kind)</i> Pipe Culvert Tee	EA
714XXXX	<i>(size)</i> <i>(kind)</i> Pipe Culvert Wye	EA
714XXXX	<i>(size)</i> <i>(kind)</i> Pipe Culvert <i>(degree)</i> Bend	EA
714XXXX	<i>(size)</i> <i>(kind)</i> Increaser <i>(size)</i> to <i>(size)</i> Diameter	EA
7149999	Cleaning Existing Pipe	LF

## **CURED-IN-PLACE PIPE SYSTEMS**

### *1.00 INTENTION*

#### **1.01 INTENTION:**

The intent of this CIPP lining process is to line pipes which are subject to partial structural deterioration, partial distortion, interior corrosion, settling, misalignment, cracking, ex-filtration and infiltration. The liner will withstand long-term external hydrostatic loading.

### *2.00 SITE WORK AND PREPARATIONS*

#### **2.01 TELEVISION INSPECTION PRIOR TO INSTALLATION:**

The contractor is advised that a video tape inspection was made of the pipeline to be reconstructed and that this tape is available for review prior to bid opening. All prospective bidders are urged to view the tapes. The contractor will also be required to perform another television inspection and video tape recording of the pipeline a maximum of seven (7) days prior to the setting up of the liner insertion equipment at the job site. This inspection will be performed utilizing a radial eye camera, to determine the latest condition of the pipeline and to accurately identify the location of the active service connections. Should the result of this television inspection show a condition different than previously noted, the contractor shall immediately notify the Engineer.

#### **2.02 CLEANING:**

The contractor shall furnish all labor, materials and equipment and shall do all necessary work to remove and dispose of all debris, silt, protruding service connections and roots in the existing pipeline and manholes.

#### **2.03 FLOW BYPASSING:**

The contractor shall provide for the diversion of flow at an existing upstream manhole (if available) and pump the flow into an existing downstream manhole. The pump and bypass lines shall be of adequate capacity and size to handle the flow. The proposed bypassing system shall be submitted to the engineer for approval and no work shall commence until such approval is granted.

#### **2.04 OBSTRUCTION REMOVAL:**

A high speed rotation hydraulic cutter will be used to cut protruding service laterals, offset joints, roots, barnacles, concrete or other obstructions in V.C.P. (vitrified clay pipe), concrete pipe and C.I.P. (cast iron pipe). The cut will be made flush with the wall of the pipe to be restored, and the debris will be pushed down the pipe to the downstream manhole. If an obstruction cannot be removed by conventional methods or by remotely controlled mechanical equipment, then the contractor shall remove or repair the obstructions by excavation. Such excavation shall be considered as a separate pay time and must be approved prior to start up.

#### **2.05 PRIOR TO COMMENCING WORK:**

The contractor will provide submittals on all lining materials and resins and shall furnish manufacturer certification that the liner material complies with the requirements of the customer. The contractor will provide pre-sizing calculations that demonstrate that the liner has been properly downsized to avoid the creation of wrinkles or folds.

## 2.06 SAFETY:

The Contractor shall conform to all work safety requirements of pertinent regulatory agencies, and shall secure the site for the working condition in compliance with the same. The contractor shall erect such signs and other devices as are necessary for the safety of the work site.

The contractor shall also perform all of the work in accordance with applicable OSHA standards. Emphasis is placed upon the requirements for entering confined spaces and working with steam.

## 2.07 EXTENSION OF TIME:

If the contractor is delayed in the course of the work by act or neglect of the client, municipality, or by unexpected problem beyond his control, or by any cause which the engineer shall decide justifies the delay, then the time of completion shall be extended for a reasonable time as agreed upon by the engineer and contractor.

## 3.00 LINER AND COMPONENT MATERIALS:

### 3.01 TUBING:

The liner tube will consist of one or more layers of flexible needled felt or an equivalent woven or non-woven material.

### 3.02 GEO MEMBRANE:

The needled felt will have a Geo membrane coated on either one or both *sides width* of a minimum thickness of 12 mils.

### 3.03 RESIN:

A premium corrosion resistant isophthalic, thixotropic unsaturated polyester resin. The resin will be specifically formulated for the use in the manufacture of needled felt liners for insertion into sewer and drain lines needing repair.

### 3.04 CATALYST:

The catalyst shall be compatible with the resin and the other materials used in the manufacturing of the CIPP. The non-promotes resin shall be catalyzed by the addition of a sufficient catalyst to produce the required physical properties of the cured in place pipe.

## 4.00 TECHNICAL SPECIFICATIONS:

### 4.01 FINISHED AND CURED LINER PROPERTIES:

The material will be capable of carrying resin, be able to withstand installation pressure and curing temperatures, and the compatible with the resin system used.

The resin system used will be compatible with the application and pipeline environment and shall be able to cure in the presence or absence of water.

The fully cured-in-place liner will meet or exceed the minimum structural standards of the industry.

#### 4.02 INDUSTRY SPECIFICATIONS

The CIPP shall conform to the minimal standards as follows:

- ASTM 1216-93 Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin-Impregnated Tube.
- ASTM F1743-96 Rehabilitation of Existing Pipelines and Conduits by Pulled-in-Place Installation of Cured-in-Place Thermosetting Resin Pipe(CIPP)
- D-5813 Standard Specifications for Cured-In-Place Thermosetting Resin Sewer Pipe
- C-581 Standard Practice for Determining Chemical Resistance of Thermosetting Resins
- D-2990 Standard Test Methods for Tensile, Compressive, Flexural Creep, and Creep Rupture of Plastics.
- D-638 Test Method for Tensile Properties of Plastic.
- D-790 Test Method for Tensile Properties for Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
- D-256 Impact Test.
- D-638 Barcol Hardness Test.

#### 5.00 LINER DESIGN AND SELECTION

The contractor shall furnish, prior to the use of the lining materials, satisfactory written guarantee of his compliance with standards for all materials and techniques being used in the lining process.

After the liner has been cured, the contractor will trim any excess liner in the manholes. He will then proceed to reconnect the existing active service connections. This is done without excavation by the use of an internal, remote controlled cutting devise through the newly installed liner.

#### 5.01 RESIN AND TUBE ACCEPTANCE:

At the time of resin impregnation, the entire tube shall be inspected for defects. The resin shall not contain fillers, except those required for viscosity control, fire retardant, or extension of pot life. Thixotropic agents that do not interfere with visual inspection may be added for viscosity control. Resins may contain pigments, dyes, or colors, which do not interfere with visual inspection of the CIPP or its required properties. Additives may be incorporated that enhance the physical and/or chemical resistance.

The impregnated liner bag shall be transported to and stored at the site in such a manner that it will not be damaged, exposed to direct sunlight, or result in any danger to public safety.

#### 5.02 INSPECTION:

The contractor shall arrange a freely accessible place and means so that the pipe and all equipment to be used during the installation, including injection manifolds, gauge stations, steam equipment, winches, etc., can be inspected by the client. The contractor shall prepare and inspect all necessary equipment for the installation prior to going to the job site. The contractor shall also provide all necessary tools and spare parts as may be required for the most frequently damaged equipment, and shall make sure that said tools and spare parts are available at the site.

The supporting equipment such as pumps and generators must be provided at the site in the event there is a fluid surge and pumping is required on an emergency basis. The contractor shall also prepare and make operable all necessary communication equipment for his field crew.

#### 5.03 INSPECTION OF LINER:

The contractor shall designate a location where the un-cured resin in the original containers and the un-impregnated liner will be impregnated prior to installation. The contractor shall allow the engineer and/or his representative to inspect the materials and chemical impregnation procedure. The quantities of the liquid thermal-setting materials shall be as per manufacturer's standards to provide the lining thickness specified.

The impregnated liner material shall be inserted through the existing manhole by means of a winch assembly. If the surface is sufficiently rough to cause damage to the impregnated liner material a protector shield may be used to cover the manhole opening and the invert throughout the section to be lined. Next, the impregnated liner shall be inserted into the existing sewer by a cable attached to the liner to be pulled by a winch.

#### *6.00 INSTALLATION, PULL IN PLACE, WATER INVERSION AND AIR INVERSION:*

##### 6.01 PULL IN PLACE:

The liner may be drawn into the existing sewer by means of winch cable. With the ends of the liner sealed, the liner will be expanded by compressed air or water. The pulling tension shall not exceed more than half of the tensile strength of the liner.

##### 6.02 AIR INFLATION:

Initially, compressed air is introduced, inflating and forming the liner material against the inner walls of the pipe to be lined.

##### 6.03 STEAM AND AIR CURING:

After the inflation steps are completed, the contractor shall begin the curing process by utilizing the approved heat source. The equipment will be capable of delivering steam to the far end of the liner to uniformly raise the temperature required to effectively cure the resin.

The temperature maintained during the curing period shall be that recommended by the resin manufacturer and approved by the engineer.

During the curing process the heat source shall be fitted with pressure gauges and thermocouples to continuously monitoring the temperature of the incoming and outgoing heat medium supply. The water, steam or air temperature during the cure period shall meet the resin manufacturer's requirements as measured at the heat source inflow and outflow return lines.

At the engineer's direction, the contractor shall provide standby equipment to maintain the heat source supply throughout the curing process, and the contractor shall maintain static head (internal pressure) in the liner greater than the maximum design external water pressure.

The initial cure shall be deemed complete when inspection shows that the exposed liner portions appear hard and sound and the remote temperature sensors indicate that an exothermic reaction has occurred. The cure period shall be of duration recommended by the resin manufacturer as modified to account for length, thickness and diameter of the liner.

The hardened liner has to be cooled to a temperature below 100 degrees F. After reaching the appropriate temperature, the static head in the lined pipe is relieved. This cool-down period shall occur prior to opening the downstream stopper, reconnecting of services and returning normal flow back into the system.

If the cured pipe does not fit tightly against the host pipe at its termination point(s), the voids shall be sealed, by filling them with a resin mixture compatible with the CIPP.

All internal (dry or non-bonded) inflation tubes that are not bonded to the resin impregnated tube prior to installation of the liner tube shall be completely removed from the finished cured-in place liner pipe.

Wrinkles in the finished liner pipe that cause a backwater, reduce the pipe's hydraulic capacity or structural stability or that create voids between the liner and pipe wall will be unacceptable.

All unacceptable sections shall be removed or repaired by a method approved by the engineer at the contractor's expense. Repair methods shall be proposed by the contractor and submitted to the engineer for approval.

#### 6.04 WATER INVERSION:

The wet-out tube shall be inserted through an existing manhole or other approved access by means of an inversion process using water with a hydrostatic head sufficient to fully extend it to the next designated manhole or termination point. The tube shall be inserted in the vertical inversion standpipe so that a leak proof seal is created. The inversion head shall be adjusted to sufficient height to cause the impregnated tube to invert from point of termination and hold the tube tight to the pipe wall, producing dimples at side connections. Care shall be taken during the inversion so as not to over-stress the felt fiber.

#### 6.05 HEATED WATER CURING:

If heated water is used to cure the liner, provide a suitable head source, and water recirculation equipment capable of delivering hot water to the far end of the liner to quickly and uniformly raise the water temperature in the entire inverted liner to the temperature to commence the exothermic reaction of the resin as determined by the catalyst system employed. The heat source shall be fitted with suitable monitors to gauge the temperatures of the incoming and outgoing water supply to determine when uniform temperature is achieved throughout the length of the liner. Water in the liner shall be raised to a temperature recommended by the resin manufacturer. Initial cure is deemed to be complete when the uniform temperature recommended by the resin

manufacturer is achieved throughout the length of the liner. Water temperature monitors at the heat source shall determine this uniform temperature. The post cured period shall then commence with the heat source shut down with recirculation of the water continued to maintain uniform temperature in the liner. Hot water may be bled out of the system and replaced by clean water at ambient water main temperature to control post cure water complete cure. Time required to cure is a function of the pipeline section diameter and length, and shall be determined by the lining manufacturer's instructions. The curing process should be sufficient to hold the liner tight to the pipe wall and produce dimples at side connections. After curing, open and drain the line in a manner so a vacuum will not be developed which may damage the installed liner.

#### 6.06 AIR INVERSION:

Insert the wet-out tube through an existing manhole or other approved access by means of an inversion process using an application of air pressure sufficient to fully extend it to the next designated manhole or termination point. The tube shall be connected by an attachment at the upper end of the guide chute so that a leakproof seal is created with the impermeable plastic membranes side facing out. As the tube enters the guide chute, the tube shall be turned inside out. The inversion air pressure shall be adjusted so that sufficient pressure is provided to cause the impregnated tube to invert from point of termination and hold the tube tight to the pipe wall, producing dimples at side connections. Care shall be taken during the inversion so as not to over stress the woven and non-woven materials.

#### 6.07 HOT AIR:

If hot air is used to cure the liner, provide suitable heat source and recirculation equipment to uniformly distribute the heat. The temperature and pressure in the line during the cure period shall be that recommended by the resin manufacturer. Hot air generating equipment shall be equipment with a suitable monitor to gauge the temperature of the outgoing steam. The temperature of the resin being cured shall be monitored by placing gauges between the impregnated tube and the existing pipe at both ends during cure.

Initial cure shall begin during temperature heat-up and shall be deemed complete when exposed portions of the new liner appear to be hard and sound and the remote temperature sensor indicate that the temperature is of a magnitude to create an exotherm or cure in the resin. After initial cure is reached, the temperature shall be raised to the post cure temperature recommended by the resin manufacturer. Post cure temperature shall be held for a period as recommended by the resin manufacturer. During the post cure time the distribution and control of hot air shall continue to maintain required temperature. The curing process should be sufficient to hold the liner tight to the wall and produce dimples at side connections. Curing of the liner pipe shall take into account the existing pipe material and size, the resin system and ground conditions, which includes temperature, moisture level and thermal conductivity of soil.

#### 6.08 SERVICE CONNECTIONS:

After the curing is complete and the pipe system is placed into service, all active house connection sewers shall be reinstated without delay. This is to be done without excavation by use of an internal, remote-controlled cutting device through either the lateral pipe or through the newly installed liner.

#### 6.09 TELEVISION INSPECTION AFTER INSTALLATION:

A television inspection and video tape recording of the newly lined pipe including the restored service connections shall be performed immediately after work is completed. Should the results of this inspection reveal

any defects as defined above, the contractor will be required to repair or replace these defects as ordered by the engineer at the sole cost of the contractor.

The contractor shall furnish and maintain in good condition, all equipment necessary for the proper execution and inspection of the work.

#### 7.00 PAYMENT:

Payment of rehabilitation work will be based on the unit price listed in the bid schedule. This payment shall include full compensation for all labor, material, tools, and incidentals for lining of the existing pipeline

Payment for reinstallations of house connection shall be in accordance with bid item.

Payment for obstruction removal by a point repair shall be in accordance with bid item.

#### 7.01 MEASUREMENTS FOR PAYMENT:

All measurements shall be as specified or made by conventional means with accuracy consistent with field conditions and common practice. Should a discrepancy in measurement exist which is greater than 10%, the item in question shall be re-measured by both the contractor and the owner's representative for verification.

#### 7.02 MEASUREMENT FOR PAYMENT SHALL BE BASED ON THE FOLLOWING SCHEDULE:

PIPELINE CLEANING shall be paid for at the unit price bid per linear foot of each size pipe. Measurement of the actual number of feet cleaned shall be made from the center of the manholes.

TELEVISION INSPECTION of the sewer lines shall be paid for at the unit price bid per linear foot of each size pipe. Measurements of the actual number of feet inspected shall be made from the center of the manholes.

PUMPING AND BYPASSING of sewer flows shall be paid for at the unit price bid per setup.

REMOVAL OF INTRUDING PIPES shall be paid for at the unit price bid per removal.

INSTALLATION OF LINER shall be paid for at the unit price bid per foot of liner installed for each size pipe.

REINSTATEMENT OF SERVICE CONNECTIONS shall be paid for at the unit price bid per reinstatement.

FINAL TV INSPECTION shall be paid for at the unit price bid per linear foot of each size pipe. Measurement of the actual number of feet inspected shall be made from the center of the manholes.

#### 7.03 CLEANUP:

After the liner installation has been completed and accepted, the contractor shall clean up the entire project area. The contractor, in accordance with local laws and regulations shall dispose of all excess materials and debris, not incorporated into the permanent installation.



*8.00 WARRANTY.*

**8.01 WARRANTY:**

The contractor shall warrant the liner installation for a period of one year. During the warranty period, any defects that affect the integrity or strength of the pipe shall be repaired at the contractor's expense in a manner mutually agreed upon by the owner and the contractor.

# BID FORM