

SPECIAL PROVISIONS FOR



**Pima County Regional
Wastewater Reclamation
Department**

PANTANO SEWER INTERCEPTOR AT HARRISON ROAD AND PANTANO WASH

**Pima County Regional Wastewater
Reclamation Department Project Number
G-2007-053**

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SPECIFICATIONS AND DETAILS

The work embraced herein shall be performed in accordance with the requirements of the following separate documents:

City of Tucson/Pima County, Standard Specifications for Public Improvement, 2003 Edition;

City of Tucson/Pima County, Standard Details for Public Improvements, 2003 Edition and current additions, except as modified on the plans;

City of Tucson, Pavement Marking Design Manual, Second Edition, August 2008;

City of Tucson Signing Manual May 2002;

U.S. Department of Transportation, Federal Highway Administration, Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD), 2009 Edition, and amendments, including Revisions I & II;

State of Arizona, Department of Transportation Division of Highways, Part 1 – Construction Standard Drawings, May 2007;

State of Arizona, Department of Transportation Division of Highways, Part 2 – Structures Section Standard Drawings, June 1992, with current edition Structural Detail Drawings series;

State of Arizona, Department of Transportation Division of Highways, Part 3 – Traffic Signals and Lighting Standard Drawings, April, 2010;

State of Arizona, Department of Transportation Division of Highways, Part 4 – Signing and Marking Standard Drawings, January 2002 with updates through December 2008;

City of Tucson, Tucson Water Standard Specifications and Details, 2001 Edition;

Pima County Wastewater Management Department Standard Specifications and Details, 2003 Edition;

PROPOSED WORK

The proposed work is located within Section 35 of Township 14 South, Range 15 East, Gila and Salt River Meridian, Pima County, Arizona. This project upsizes the gravity sewer pipe from 12-inch to 18-inch between Millmar Road and Escalante Road, and consists of polyvinyl chloride and welded steel pipe. The project also consists of driven piles to prevent damage to the gravity system if current grade control systems were to fail.

The work is permitted per the approved mitigation landscape plan and native plant preservation plan (NPPO). However it is anticipated that the Harrison Road Divided Urban Pathway project will precede this pipeline work and will have met the requirements of the NPPO.

The contractor shall perform all work within the public right-of-way, legally obtained easements and property legally acquired by the Agency. The contractor shall assume all responsibility and liability for any encroachment upon private property. The use of private property for construction yards will be allowed only if zoning requirements allows its use for this purpose – see Section 106 of these Special Provisions for further details regarding temporary construction yards. The cost of the construction yard is considered incidental to the project.

Driver and pedestrian/access shall be maintained during the construction of improvements. Temporary paved access shall be provided at all times. The contractor is advised that an approved construction sequencing scheme meeting the intent of the project objectives will need to be followed.

The contractor shall verify all pipe lengths shown on the project plans and submit the information to the Engineer for approval before ordering the pipe.

GENERAL PROVISIONS

1. Project Objectives

The objective of this contract is to complete construction as quickly as possible while minimizing the impact to the Stakeholders. The Stakeholders are, but not limited to, the adjacent businesses, commuters, buses, emergency services, pedestrians, bicyclists, and adjoining neighborhoods. As such, this work will be done in an orderly manner as defined herein.

The contract for the road construction shall be 120 calendar days. Time allotted for plant establishment shall be unspecified, as plantings are to have been accomplished by the Harrison Road Divided Urban Pathway project.

All decisions regarding construction sequencing and work restrictions shall be made based upon meeting these objectives. The contractor(s) shall take into account these objectives when scheduling and executing the work.

The contractor shall be responsible for all construction zone traffic control and shall provide a traffic control plan in accordance with Section 701 of the Standard Specifications and these Special Provisions and shall be approved by the Engineer.

The contractor shall ensure that two-way traffic is maintained on an asphaltic concrete paved surface continuously during all phases of construction. For sewer manhole modification in the intersection of Harrison Road and Escalante road, and for bypass pumping operations, exceptions may be granted if an approved traffic control scheme is presented to the Engineer.

Residential and commercial access shall be continuously maintained, with temporary closures not to exceed two (2) hours, and twenty-four (24) hour prior notice of any such closure given to the property owner. When short-term lane closures are approved by the Engineer, traffic will be delayed in one direction while vehicles traveling in the other direction use the open lane. When this occurs, work will be accomplished during daylight hours and will utilize a pilot vehicle and/or flagmen.

The contractor shall provide a clear and safe pedestrian access travel way at all times during construction. Safe pedestrian access through the construction site shall be provided during and after regular work hours.

The contractor shall ensure that emergency vehicles have two-way access at all times.

(106MATERIAL, 5/17/12)

SECTION 106 - CONTROL OF MATERIAL of the Standard Specifications is revised to read:

106-1 SOURCE OF SUPPLY AND QUALITY REQUIREMENTS

The contractor shall furnish all materials required to complete the work, except materials that are designated in the Special Provisions to be furnished by the Agency as set forth in Subsection 106-12.

Only materials conforming to the requirements of the contract documents shall be incorporated into the work. Materials shall be new except as may be provided elsewhere in the contract documents. The materials shall be manufactured, handled and used in a workmanlike manner to insure completed work in accordance with the requirements of the contract documents.

In order to expedite the inspection and testing of materials, the contractor shall notify the Engineer of the proposed sources of materials prior to delivery. At the option of the Engineer, materials may be approved at the source of supply before delivery is started. If it is found after trial that sources of supply for previously approved materials do not produce specified products, the contractor shall furnish materials from other sources.

Whenever water is required on a project, as part of either a process or a product, it shall be free of contaminants which, in the judgment of the Engineer, constitute a health hazard to those individuals employed on the project and to the general public. Untreated effluent shall not be utilized in any aspect of the work.

The contractor shall, at no additional cost to the Agency, obtain all permits required for utilizing treated effluent. When treated effluent is used on the project, the contractor shall notify the Engineer and all workers of this use.

106-2 ITEMS OF SPECIAL MANUFACTURE

The contractor shall furnish the Engineer a list of all items of special manufacture or items which are, or may be, in short supply and which will be incorporated into the work either at the time of the preconstruction conference, or at a time agreed to by the Engineer. Items of special manufacture shall include, but shall not be limited to, materials and equipment for traffic signal and lighting systems, steel bridge members, precast, prestressed concrete bridge members, or other structural components, and materials of special manufacture.

The items of special manufacture which have been agreed upon by the Engineer and the contractor shall be ordered by the contractor promptly so that they will be available as required and will not delay the work.

The contractor shall advise the Engineer regarding the dates of the orders and the dates that the items are expected to be received.

If there is any delay in the prosecution of the work because of a delay in the delivery of items of special manufacture, an extension of the contract time shall only be granted in accordance with Subsection 108-8 if the Engineer is completely satisfied that the contractor has made every effort to obtain the items in a timely manner.

106-3 LOCAL MATERIALS SOURCES

Sources of local borrow, base, or surfacing materials or other similarly extracted materials shall be furnished by the contractor. When the contractor obtains material from other than a commercial source, it shall determine for itself the amount of equipment and work required to produce a material meeting the specifications.

When a non-commercial source is used, the contractor shall acquire the necessary rights to take materials from the source and shall pay all costs related thereto, including any which may result from an increase in length of haul. All costs of exploring and developing sources shall be borne by the contractor. The use of material from other than commercial sources shall not be permitted until tests on preliminary samples indicate general acceptability of the material. Additional samples may be required of the contractor for inspection and testing by the Engineer prior to approval of and authorization to use the source.

The use of material sources situated in the 100-year floodplain of any stream or watercourse shall be governed by the governmental entity or entities having jurisdiction over the floodplain.

The location of any new material source or existing non-commercial material source proposed for use on the project shall be reviewed by the appropriate agency having floodplain management jurisdiction for the area in which the proposed source is located. The contractor shall obtain a letter from the floodplain management agency certifying that the location of the proposed source conforms to the requirements of their regulations.

Contractors seeking a floodplain material source are cautioned that Section 404 of the Federal Clean Water Act may prevent use of the source unless an appropriate permit is first obtained from the U.S. Army Corps of Engineers.

If a floodplain source is being considered for use, the contractor is advised to ensure that the source will be obtainable within the required time frame.

106-4 TESTS AND ACCEPTANCE OF MATERIALS

All materials shall be inspected, tested and approved by the Engineer prior to incorporation in the work. Any work in which materials not previously approved are used shall be performed at the contractor's risk and may be considered as unauthorized and unacceptable and not subject to the payment provisions of the contract. Failure of the Engineer to inspect or test any material shall not relieve the contractor from its obligations under the contract and any liability for injury or

damage. Acceptance by the Engineer shall not relieve the contractor of its responsibility for conformance with the requirements of the contract documents.

Materials shall be sampled and tested for acceptance by a qualified representative of the Agency and at the expense of the Agency unless otherwise specified in the contract documents. Copies of all test results shall be furnished to the contractor's representative.

The contractor shall submit a request for materials testing a minimum of 24 hours in advance.

In the case where a density test fails to achieve the minimum requirement, one additional test will be conducted at that location after the contractor has reworked the area. Should this test also yield unacceptable results, additional retesting, after reworking by the contractor, will be conducted at the expense of the contractor. The unit charges for retests are available from the Engineer.

Whenever a reference is made in the specifications to an Arizona Test Method, it shall mean the test method of the Arizona Department of Transportation as found in their Materials Testing Manual that is in effect on the day the advertisement inviting bids for the work is dated.

Whenever a reference is made in the specifications to a Federal Specification, or to a specification or test designation of the American Association of State Highway and Transportation Officials (AASHTO), the American Society for Testing and Materials (ASTM), or any other recognized national organization, it shall mean the year of adoption or latest revision of the specification or test designation in effect on the day the advertisement inviting bids for the work is dated.

The contractor shall be solely responsible for quality control of all materials incorporated into the work.

106-5 CERTIFICATES

106-5.01 General. The contractor shall submit to the Engineer an original and two copies of either a Certificate of Compliance or a Certificate of Analysis, as required, prior to the use of any materials or manufactured assemblies for which these specifications or the Special Provisions require that such a certificate be furnished.

The Engineer may permit the use of certain materials or manufactured assemblies prior to, or without, sampling and testing if accompanied by a Certificate of Compliance or a Certificate of Analysis, as herein specified. Materials or manufactured assemblies for which a certificate is furnished may be sampled and tested at any time, and, if found to be not in conformance with the requirements of the plans and the specifications, will be subject to rejection, whether in place or not.

Certificates shall comply with the requirements specified herein and as contained in the ADOT Materials Testing Manual.

106-5.02 Certificate of Compliance

The Certificate of Compliance shall contain the following information:

- (1) A description of material supplied.
- (2) Quantity of material represented, by the certificate.
- (3) Means of material identification, such as label, lot number, marking.
- (4) Statement that the material complies in all respects with the specific requirements of the cited specifications, including the test method or the specification section or Special Provision. Certificates may cite both the test method and the specification/Special Provision section, if applicable.
- (5) The name, address, and telephone number of the manufacturer or supplier together with the signature and title of a person having legal authority to bind the manufacturer or supplier of the material. The signature shall be dated. A copy or facsimile reproduction is acceptable. However, the original certificate bearing the original signature shall be made available upon request.

The person signing the certificate shall be one of the following:

- An officer of a corporation.
- A partner in a business partnership or an owner.
- A general manager.
- Any person having been given the authority by one of the above.

The delegation of authority shall accompany the Certificate of Compliance in writing. The delegation of authority will be kept on file should subsequent certificates be received for that material on that project.

Each of the first four numbered items specified above, shall be provided by the firm or organization that is certifying the material prior to the signing as defined in item five, and all of the first four shall be in one type style or handwriting. No certificate shall be accepted that has been altered, added to, or changed in any way after the authorized original signature of the person that has legal authority to bind the firm or organization has been affixed to the original certificate. Materials or assemblies shall not be incorporated into the project without a valid certificate of compliance or proper testing.

The Agency reserves the right to refuse to permit the use of material on the basis of a Certificate of Compliance.

106-5.03 Certificate of Analysis. The Certificate of Analysis shall include all the information required in a Certificate of Compliance and, in addition, shall include the results of all tests required by the specifications.

106-6 INSPECTION OF THE PLANT

The Engineer may undertake the inspection of materials and material production facilities at their source. The Engineer shall have full entry, during the hours of operation, to such parts of the material production facilities involved in the manufacture or production of the materials being

furnished to the project. The Engineer shall have the appropriate training and certifications required for entry onto the materials production site. The Engineer shall have the full cooperation and assistance of the contractor and the contractor's material producer in conducting all inspections including any required safety orientation required by Federal and/or State regulations. Adequate safety measures shall be provided and maintained at the production facility in conformance with applicable occupational and safety regulations.

The Agency reserves the right to retest all materials which have been tested and accepted at the source of supply after the same have been delivered and prior to incorporation into the work and to reject all materials which, when retested, do not meet the requirements of the specifications.

106-7 SAMPLING DEVICE

All material extraction and processing equipment used in producing materials for the project shall be equipped with an appropriate sampling device or devices that can be operated, at all times and under all conditions, in a safe manner.

These devices shall be constructed and operated so that they will provide a representative sample which meets the sampling requirements for the material.

The sampling devices shall be equipped with necessary attachments so that they can be safely and conveniently collected and conveyed for testing.

The sampling devices shall be approved by the Engineer and shall be maintained in a satisfactory working condition so that samples may be taken at any time, as required by the Engineer.

106-8 PROPRIETARY PRODUCTS, TRADE NAMES AND SUBSTITUTIONS

The contract documents may contain references to equipment, materials or patented processes by manufacturer, trade name, make or catalog number. Such references shall be regarded as establishing a standard of quality, finish, appearance or performance or as indicating a selection based upon compatibility with existing equipment or materials and shall not be construed as limiting selection to a specific item or source.

The use of an alternative or substitute article of equipment, material or process which, for the purpose intended, is of equal quality, finish, appearance, or performance and which is compatible with existing equipment and materials, when required, may be considered at the sole discretion of the Agency.

Consideration of a contractor request for substitution shall not be processed prior to contract award, except as addressed herein.

Requests for substitution of materials, including other manufacturers than those listed in the contract documents shall be submitted in conformance with the requirements of Arizona Revised Statute 34-104.

After the award has been made, and within a time frame that will allow consideration and approval without delaying the work, the contractor may submit a written request for substitution. The request for substitution shall include all information necessary in order to ascertain the equality and suitability of the proposed substitution, including samples for testing, if required. Direct submittals from subcontractors, material vendors, or manufacturers shall not be accepted. Requests for Value Engineering substitutions shall meet the requirements of Subsection 104-9. Acceptance of substitutions shall not relieve the contractor from responsibility for complying with all other requirements of the advertisement inviting bids documents and coordinating substitution(s) with adjacent materials and/or other affected equipment.

The Contractor may be required to provide laboratory test data performed by a nationally recognized independent testing laboratory with experience in testing the material(s) being proposed. Laboratory tests shall include the material types used in the substitute item or system, including thickness and strength, with a direct comparison to the associated item or system specified, for capacities, capabilities, coatings, functions, life cycle usage, and operations.

The Agency shall evaluate the information submitted, perform tests when necessary and make comparisons. The Engineer shall then make the final decision as to the acceptability of the proposed substitution. The Agency shall not be liable for any delay in acting upon any request for substitution nor for any failure to accept any request pursuant to this substitution. If acceptance of a substitution requires modifications to foundations, structures, piping, electrical or other related designs or existing facilities, these costs shall be borne by the contractor.

106-9 STORAGE OF MATERIALS

Materials shall be so stored as to insure the preservation of their quality and fitness for the work. Stored materials, even though approved before storage, may again be inspected prior to their use in the work. Stored materials shall be located so as to facilitate their prompt inspection.

Approved portions of the right-of-way may be used for storage purposes and for the placing of the contractor's plant and equipment, but any additional space required for this purpose shall be provided by the contractor at the contractor's expense.

Private property shall not be used for storage purposes without the following:

- written permission of the owner or lessee;
- all permits and approvals required by Federal, State and local laws and regulations;
- compliance with zoning, including a Temporary Use Permit if required, and;
- if requested by the Engineer, copies of such written permission and approvals

The contractor shall be solely responsible for all costs and compliance with all laws and regulations pertaining to storage of materials on private property.

All storage sites shall be restored to their condition agreed to by the owner and the contractor at no additional cost to the Agency.

106-10 HANDLING MATERIALS

All materials shall be handled in such a manner as to preserve their quality and fitness for the work.

Aggregates shall be transported from the storage site to the work in tight vehicles so constructed as to prevent loss or segregation of materials after loading and measuring in order that there may be no inconsistencies in the quantities of materials as loaded and intended for incorporation into the work and the quantities of materials as actually received at the place where they are to be incorporated into the work.

106-11 UNACCEPTABLE MATERIALS

Unless otherwise directed by the Engineer, materials not conforming to the requirements of the specifications, whether in place or not, shall be rejected and shall be promptly removed from the site of the work at no additional cost to the Agency. No rejected material, the defects of which have been corrected, shall be returned to the work site until such time as approval for its use has been given by the Engineer.

106-12 AGENCY FURNISHED MATERIAL

The contractor shall furnish all materials required to complete the work, except those specified to be furnished by the Agency.

Material furnished by the Agency shall be delivered or made available to the contractor as specified in the Special Provisions.

The contractor shall receive, inventory, store, inspect, protect, distribute, and install Agency furnished material unless otherwise specified in the Special Provisions.

The cost of handling and placing all materials after they are delivered to the contractor shall be considered as included in the contract price for the item in connection with which they are used.

The contractor shall be held responsible for all material delivered to the contractor. Deductions shall be made from any monies due the contractor to make good any shortages or deficiencies, from any cause whatsoever and for any damage which may occur after such delivery, and for any late delivery charges.

106-13 WARRANTIES AND GUARANTEES

The contractor shall warrant and guarantee all the work against defective workmanship or materials for a period of one year commencing on the date of final acceptance of the work under the contract, ordinary wear and tear and unusual abuse or neglect excepted. In the case of a latent defect, the warranty shall commence on the date the defect is discovered, except that this warranty period shall not extend beyond the period allowed by law.

Any omission on the part of the Engineer to condemn defective work or materials at the time of construction shall not be deemed an acceptance. Payment shall not be conclusive evidence of the

completion of the work, either in whole or in part, or be construed as an acceptance of defective work or improper materials, or relieve the contractor from making good such defects. The contractor shall be required to correct defective work or materials at any time before full acceptance and within the warranty and guarantee period.

Should any defects develop within the warranty and guarantee period due to faults in workmanship or materials, the contractor shall, within 14 calendar days of receipt of written notice from the Engineer, begin making the necessary repairs. Such work shall include the repair or replacement of other work or materials damaged or affected by making the above repairs or corrective work, all to the satisfaction of the Engineer and at no additional cost to the Agency.

The contractor shall obtain such manufacturer's or producer's warranties or guaranties on all items, materials, electrical, or mechanical equipment consistent with those provided as customary trade practice. The form in which such warranties or guaranties are delivered to the contractor shall include the provision that they are subject to transfer to the maintaining agency as named by the Agency, and shall be accompanied by proper validation of such fact. Transfer of warranties or guaranties shall occur at the time of final acceptance of the work or equipment by the Agency.

In addition, a contractor warranty or guarantee shall be furnished providing for satisfactory in-service operation of the mechanical and electrical equipment and related components for a period of 12 months following project acceptance.

Should any defect develop during this 12 month period, the malfunction or defect shall be corrected by and at the expense of the contractor, including all labor, material, and associated costs.

The warranties and guarantees provided herein shall be in addition to and not in limitation of any other warranties, guarantees, or remedies required by law.

If the contractor fails to make any repair, adjustment, or other work that may be made necessary by a defect, the Agency may cause the work to be properly done, in accordance with the provisions of the Contract documents, and to pursue whatever recourse it deems necessary to recover, from the contractor, any additional expense or cost it may have incurred. The performance bond shall remain in full force and effect through the warranty and guarantee period.

106-14 APPROVED PRODUCTS LIST

The Approved Products List (APL) is a list of products which have been shown to meet the requirements of these Standard Specifications. The Approved Products List is compiled and maintained by the Arizona Department of Transportation and is deemed acceptable for use by contractors on Agency projects subject to the following:

Compliance with the provisions of Subsection 106-5 is required regardless of a product's listing on the Arizona Department of Transportation's Approved Products List.

The APL only provides documentation that the listed product(s) have been tested, evaluated, or examined under Arizona Department of Transportation standards and, as such, may be acceptable for use on Agency projects.

Trade or manufacturer's names which appear on the APL are cited only because the Arizona Department of Transportation considers them essential to the objectives of their APL. Neither the U. S. Government, the State of Arizona nor the Agency endorse products or manufacturer's so noted.

The APL is updated at regular intervals. Copies of the most current version are available on the internet at the Arizona Department of Transportation's web site, under their Product Evaluation Program.

The contractor shall verify that any products chosen for use from the Approved Products List are selected from the version which was most current at the time of the bid opening. Unless otherwise specified in the Special Provisions, products not appearing on the Approved Products List at the time of the bid opening may be used if they meet the requirements of the project plans and specifications, and are submitted for approval as specified in Subsection 106-8.

The Agency will neither be liable for any delay in acting upon any request for approval of a new product nor for any failure to accept any request pursuant to this Subsection.

When the Special Provisions limit product selection to only those listed on the Approved Products List, other products will not be evaluated or approved.

SECTION 508 – SANITARY SEWER PIPE of the Standard Specifications is revised to include:

508-03.03(G) Steel Pipe. Steel pipe shall be 18-inch, 0.375-inch wall thickness and conform to ASTM 500, Grade B, $f_y = 42,000$.

Coating, lining, and testing of steel pipe shall be per Section 509.

Ductile Iron Pipe (DIP)

All materials, manufacture and testing for DIP shall be in accordance with ASTM A746 and the latest revision of ANSI/AWWA C151/A21.51. Each pipe shall be subjected to a hydrostatic pressure test of at least 500 psi at the point of manufacture. DIP shall be manufactured in nominal 18 or 20-foot laying lengths.

DIP shall have standard asphaltic coating on the exterior (see Section 509), unless otherwise specified in the Sewer Plans. DIP shall have an Approved interior lining installed by the pipe manufacturer or a third-party lining applicator. Refer to the Department’s List of Approved Products for the recommended DIP interior lining materials. The party responsible for applying the interior lining shall provide a certification statement as described in the following:

ALL DIP AND FITTINGS HAVE AN INTERNAL LINING COMPRISED OF CIPP lining with a minimum thickness of 6 mm.

The following information shall be clearly marked on the exterior surface of each piece of DIP:

- Name or trademark of pipe manufacturer;
- Pipe material “DI” or “Ductile”;
- Pressure class or thickness class;
- Date and country of pipe casting;
- Lot or Serial number;
- Name of lining applicator;
- Name of lining product;
- Date of lining application.

All pipe shall be furnished with push-on type joints, such as Tyton® or Fastite®. Joints shall conform to the latest revision of ANSI/AWWA C111/A21.11, and shall be furnished complete with all required accessories. EPDM gasket material shall be used for all DIP, unless otherwise specified in the Sewer Plans. Fittings shall be ductile iron and shall conform to the latest revision of either ANSI/AWWA C110/A21.10 or ANSI/AWWA C153/A21.53. Fittings and accessories shall be furnished with either push-on or mechanical type joints in accordance with to the latest revision of ANSI/AWWA C111/A21.11.

Polyethylene wrap in tube or sheet form in 12-inch widths minimum for piping encasement shall be manufactured from virgin polyethylene material and marked in accordance with the requirements of ANSI A21.5, ASTM D4976 and AWWA C105. The minimum thickness shall be 8 mils.

SECTION - 509 POLYURETHANE LINING AND COATING ON PIPE - WASTEWATER

The following substitution shall be made to **509-2.09 COATINGS** for steel pipe interior and exterior linings and coatings. These instructions relate to the polyurethane coating applied to steel pipe.

PART 1 -- GENERAL

1.1 THE REQUIREMENT

- A. The CONTRACTOR shall provide pipe coating, complete and in place, in accordance with the Contract Documents.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

AWWA C216 Heat-shrinkable Cross-linked Polyolefin Coatings for the Exterior of Special Sections, Connections, and Fittings for Steel Water Pipelines.

AWWA C222 Polyurethane Coatings for Interior and Exterior of Steel Water Pipe and Fittings.

NACE RP-0188 Discontinuity (Holiday) Testing of Protective Coatings.

SSPC-SP-1 Solvent Cleaning Surface Preparation

SSPC-SP-2 Hand Tool Cleaning Surface Preparation

SSPC-SP-3 Power Tool Cleaning Surface Preparation

SSPC-SP-5 White metal Abrasive Blast Surface Preparation

SSPC-SP-10 Near White Metal Abrasive Blast Surface Preparation

SSPC-SP-11 Power Tool Cleaning to Bare Metal

ASTM D16 Standard Terminology Relating to Paint, Varnish, Lacquer, and Related Products

1.3 CONTRACTOR SUBMITTALS

- A. General: Submittals shall be furnished in accordance with this specification, unless indicated otherwise below.
- B. Submittals shall include the following information and be submitted at least 30 days prior to coating the pipe.

1. Manufacturer's data sheet for each product proposed, including Statements on the suitability of the material for the intended use.
2. Technical and performance information that demonstrates compliance with the system performance and material requirements.
3. Manufacturer's instructions and recommendations on surface preparation and application.
4. Colors available for each product (where applicable).
5. Compatibility of shop and field applied coatings (where applicable).
6. Material Safety Data Sheet for each product.

1.4 QUALITY ASSURANCE

- A. Coating Applicator's Experience and Certification
1. Coating application personnel, whom have direct spray application responsibility, shall be certified by the manufacturer of the selected product.

1.5 DEFINITIONS

- A. DFT: Minimum Dry Film Thickness, without any negative tolerance.

1.6 ABBREVIATIONS

MDFT	Minimum Dry Film Thickness
Mil	Thousandths of an Inch

PART 2 -- PRODUCTS

2.1 GENERAL

- A. Coating materials shall be standard products produced by recognized manufacturers who are regularly engaged in production of such materials for essentially identical service conditions. Products must have five (5) years of case histories on similar steel pipe coating projects.
- B. Pipeline coating materials shall be the products of a single manufacturer, unless otherwise noted in this specification. Product substitutions during the project will not be considered or permitted.

- C. Coating applicator shall provide a monitoring system approved by the coating manufacturer that constantly records pipe and coating conditions during coating application. Recorded monitoring parameters shall include pipe temperature, line speed, surface preparation, holiday test and other parameters applicable to the type of coating.
- D. Substitute or "Or-Equal" Products for Coating Systems
 - 1. The CONTRACTOR shall furnish satisfactory documentation from the manufacturer of the proposed substitute or "or-equal" product that the material meets AWWA C222 and the property requirements listed in Section 2.2.D.6.c.
 - 2. If a proposed substitution requires changes in the WORK, the CONTRACTOR shall bear all such costs involved, as part of the WORK.

2.2 POLYURETHANE SYSTEM

- A. General: Pipe, fittings, and specials shall be lined and coated with polyurethane complying with AWWA C222 - Polyurethane Coatings for the Interior and Exterior of Steel Water Pipe and Fittings. Surfaces in contact with potable water shall receive a coating, which is certified under NSF Standard 61.
- B. Material: The coating material shall be a two-component, fast set, Type V polyurethane according to ASTM D 16 - Standard Terminology Relating to Paint, Varnish, Lacquer, and Related Products. Solids content shall be no less than 100 percent by volume.
 - 1. Surface Preparation: SSPC-SP10, White Metal blast, 3.0-mil angular profile, minimum, or as required by the manufacturer, whichever is greater.
- C. Product acceptance is contingent upon:
 - 1. Submission of an independent testing report documenting conformance to the coating performance criteria specified herein.
 - 2. Verification that no significant change in product formulation has occurred since independent test was performed.
- D. Coating Performance Testing and Report
 - 1. Coating manufacturer shall submit to the Engineer for approval, test reports documenting conformance to the specified performance criteria using prepared samples and coating materials conforming to the following general requirements:

- a. Polyurethane coating material tested shall have been manufactured within 30 days of test sample preparation.
 - b. Coating material to have a minimum of five years prior pipeline coating application history.
 - c. Extended polyurethane coatings will not be acceptable.
2. Submission of incomplete reports, use of test procedures or methods other than those specified, or preparation of samples with coating material other than those listed will result in rejection of the coating.
3. Reports shall be submitted for review and approval not less than 30 days prior to coating application along with current product data sheets and MSDS sheets for Parts A and B.
4. Test Sample Preparation:
- a. Failure to fully conform to the preparation requirements will result in rejection of the submitted coating material.
 - b. Sample preparation completed by the coating manufacturer shall be fully documented and reported to the testing agency by the manufacturer.
 - c. All coating test samples shall be prepared in conformance with the following general requirements.
 - d. Sample Surface preparation:
 - 1) Method: Abrasive blast, steel grit or green diamond, SSPC-SP5, white metal.
 - 2) Profile: 3.00 mils minimum, angular profile measured and recorded using surface profilometer or surface replica tape.
 - e. Coating Application:
 - 1) Method: Spray film in accordance with manufacturer's written shop application requirements. Thickness: 30 mils exterior, 60 mils interior.
 - 2) Cure: Air cure only, oven or other accelerated cures will not be acceptable.

- 3) Form: Sheet, steel panel, or steel pipe as required for the test procedure.
 - f. Sample Quantity: Provide a minimum of three samples for each test performed or as required by the ASTM test standards, whichever is more stringent.
6. Coating Tests and Criteria:
- a. Testing shall be performed by a certified independent laboratory testing agency with a minimum five year’s experience in the performance of ASTM test procedures on coating systems.
 - b. All testing shall be at room temperature, unless specifically required otherwise by the ASTM test procedure.
 - c. Material property test requirements are listed in the table below:

Property	Requirement
Permeance	No more than 0.10 inch-pound using Water Procedure BW (App. X1), when tested according to ASTM E96
Abrasion Resistance	Less than 50 mg weight loss per 1000 revolutions of a CS-17 wheel, 1 kg weight, when tested according to ASTM D4060
Electrochemical Impedance Spectroscopy	Log Z ≥ 10.0; 60 day immersion in 5% NaCl electrolyte solution @ 100°F.

7. Reporting:
- a. As required by the ASTM test method and the following additional information:
 - 1) Sample panel preparation date and identification
 - 2) Surface preparation method and abrasive
 - 3) Surface preparation profile
 - 4) Coating lot and date of manufacture
 - 5) Application spray gun and equipment used

6) Application temperatures of coating materials and material temperature at the gun, ambient temperature, and panel surface temperature.

- b. Show all calculations as required by the ASTM test method.
- c. Submit report in PDF format.

E. Thicknesses

Interior of pipe and fittings-Low Flow	60 mils DFT, minimum
Exterior pipe and fittings	30 mils DFT, minimum
Sealing areas on bells and spigots	8-mils DFT. Thicker coating which does not compromise joint tightness may be accepted.

F. Cutbacks for Field Welds

- 1. If the pipe sections are to be joined together by field welding, a 3-inch minimum band of substrate on the internal and/or the external shall be left uncoated. This band shall receive the same surface preparation as the rest of the pipe.

G. Non Welded Joints

- 1. If mechanical couplings or gaskets are used to connect the pipe sections together, the pipe shall be lined and/or coated to its ends, including sealing area, with no cut back.

H. Manufacturers, or equal

- 1. Coating: LifeLast Inc. DuraShield 210, 310 or equal.
- 2. Lining: LifeLast Inc. DuraShield 210, 310 or equal

2.3 INTERIOR FIELD JOINT COATING

A. Surface preparation shall be per the joint lining manufacturer’s recommendations.

B. Manufacturers, or equal

- 1. Spray Application: LifeLast Inc. DuraShield 210, DuraShield 310
- 2. Hand Application: LifeLast Inc. DuraShield 310 JARS (Joint and Repair)

System).

- C. Field joint coating method and system shall be determined by the engineer based on criteria such as: environmental conditions, project size (length and diameter), access and contractor experience.
- D. Field contractor must provide a letter from the coating system manufacturer stating they have been approved as an applicator.
- E. Coating applicator that does not meet the qualifications requirements may be rejected by Construction Manager.
- F. Contractor shall provide a third party NACE Level III inspector with experience with the applied coating system on steel pipe, to inspect surface preparation and application of the joint lining and document application conditions.

2.4 EXTERIOR FIELD JOINT COATING

- A. Buried: All field joints shall be coated with heat shrink sleeves per AWWA C216.
- B. Above Ground
 - 1. Manufacturers, or equal
 - a. LifeLast Inc. DuraShield 210, DuraShield 310, DuraShield 310 JARS (Joint and Repair System).
 - 2. Field joint coating method and system shall be determined by the engineer based on criteria such as: environmental conditions, project size (length and diameter), access and contractor experience.
 - 3. Field contractor must provide a letter from the coating system manufacturer stating they have been approved as an applicator.
 - 4. Coating applicator that does not meet the qualifications requirements may be rejected by Construction Manager.
 - 5. Contractor shall provide a third party NACE Level III inspector with experience with the applied coating system on steel pipe, to inspect surface preparation and application of the joint lining and document application conditions.

2.5 REPAIR OF COATINGS AND LININGS

A. General

1. Coating or lining repair materials shall be compatible with the shop-applied coating or lining system.

B. Field Repair Coating Materials

1. Polyurethane Coating or Lining
 - a. Polyurethane coating or lining system repair shall be in accordance with the coating manufacturer's recommended procedures.
2. Curing of Field Applied Coatings
 - a. All field-applied coatings shall be completely cured prior to installation.

PART 3 -- EXECUTION

3.1 WORKMANSHIP

- A. Skilled manufacturer, trained craftsmen and experienced supervision shall be used to perform the application. Spray application of the polyurethane, requires certification by the manufacturer, of the individual applicators.

3.2 STORAGE AND MIXING OF MATERIALS

- A. Manufacturer's Recommendations: Unless otherwise indicated, the coating manufacturer's printed recommendations and instructions for thinning, mixing, handling, applying, and protecting its coating materials, for preparation of surfaces for coating, and for all other procedures relative to coating shall be strictly observed.
- B. Materials shall be used within the manufacturer's recommended shelf life.
- C. Storage and Mixing: Materials shall be stored and mixed per the manufacturers recommendations.

3.3 SURFACE PREPARATION

- A. Pipe shall be clean and free of contaminants. If not the pipe surfaces shall be cleaned

in accordance with SSPC-SP1, to remove oil, grease, and other soluble contaminants. No residue shall remain on the pipe. Remove burrs, weld splatter and gouges.

- B. Prepare the metal surface to achieve a metal finish and cleanliness in accordance with SSPC-SP10 to an angular profile of 3.00-mil minimum measured and recorded using surface profilometer or surface replica tape.
- C. Pipe temperatures shall be at least 5 degrees F warmer than the dew point temperature and within the coating manufacturers recommended temperature range per the technical data sheet. Pipe shall be warmed if necessary.
- D. Pipe shall not be allowed to flash rust before coating is applied.

3.4 APPLICATION

- A. Apply the coating in strict conformance to the manufacturer's recommendations.
- B. Recoating shall be performed in strict conformance to the manufacturer's recommendations.

3.5 FACTORY TESTING

- A. All testing shall be per AWWA C222 unless modified herein.
- B. Adhesion Testing
 - 1. Polyurethane coating adhesion to steel substrates shall be tested using Delfesko Positest AT-A automatic pneumatic pull off tester and 14mm dollies.
 - 2. Adhesion testing records shall include pipe identification, surface tested (interior or exterior), surface temperature, coating thickness, tensile force applied, mode of failure, and percentage of substrate failure relative of dolly surface.
 - 3. Dollies for adhesion testing shall be glued to the coating surface and allowed to cure for a minimum of 12 hours. Because of high cohesive strength, polyurethane coatings shall be scored around the dolly prior to conducting the adhesion test. Extreme care shall be taken when scoring around the dollies.
 - 4. Failure shall be by adhesive and cohesive failure only. Adhesion failure is defined as separation of the coating from the steel substrate. Cohesive failure is defined as failure within the coating, resulting in coating remaining both on the steel substrate and dolly.

6. Partial adhesion and glue failures will be retested if the adhesion failure is less than 50 percent relative of the dolly surface area and the applied tension was less than the adhesion criterion. Pipes that have partial adhesion failures greater than 50 percent and less than the required adhesion will be rejected as a substrate adhesion failure.
7. Adhesion tests shall be terminated once 1,500 psi is reached and considered satisfactory.
8. Adhesion tests will be conducted on polyurethane pipe coating and lining independently and will be accepted or rejected independently of the other.

3.6 FIELD INSTALLATION

- A. Pipe shall be handled at all times to minimize damage to the lining and coating. Damaged lining and coating shall be repaired.
- B. Repair of Field Welded Joints and Damaged Areas.
 1. Weld sparks and splatter shall not be allowed to damage existing lining or coating.
 2. After welding, repair the weld holdback areas and defects as recommended by the manufacturer.
 3. Test the pipe after welding for holidays per NACE RP-0188. Mark holidays and repair per the manufacturers recommendations.
 4. Use only material recommended by the manufacturer for repair. This recommendation will take into consideration pipe diameter and quantity of joints.

3.7 REPAIR OF COATING AND LININGS

- A. General
 1. Areas where holidays are detected or coating is visually damaged, such as blisters, bubbles, cuts or other defects shall be repaired.
- B. Polyurethane Coating or Lining Repairs
 1. General
 - a. Complete coating repairs in accordance with the coating manufacturer's written instructions and these Specifications, whichever is stricter.

- END OF SECTION -

**ITEM 5105110 CEMENT-ASBESTOS WATER PIPE REMOVAL AND DISPOSAL
TEN INCH (10”) AND SMALLER**

DESCRIPTION:

The work under this item shall consist of furnishing all labor and equipment required to remove and properly dispose of offsite cement-asbestos (CA) water pipe, ten inches (10”) and smaller, and any CA water related appurtenances in accordance with the requirements of these Special Provisions.

MATERIALS:

None.

CONSTRUCTION REQUIREMENTS:

The Contractor shall be responsible for the proper removal and disposition of water related CA materials from the construction site in accordance with Subsection 510-3.02 (pg. 320) and Standard Detail W-105, note 11, C.

METHOD OF MEASUREMENT:

Cement Asbestos Water Pipe Removal and Disposal, Ten Inch (10”) and Smaller shall be measured by the unit, Linear Foot, (LF) for the actual Linear Feet of CA pipe removed and disposed.

BASIS OF PAYMENT:

The accepted quantities of Cement Asbestos Water Pipe Removal and Disposal, Ten Inch (10”) and Smaller, measured as provided above, shall be paid for at the contract unit price Linear Foot which price shall be full compensation for the work, complete in place.

SECTION 603 – DRIVEN PILE COATING SYSTEM

The following substitution shall be made to **603-3.07** for painting metal piles. These instructions relate to coating that shall be applied to driven steel piles and associated appurtenances.

PART 1 -- GENERAL

1.1 THE REQUIREMENT

- A. The CONTRACTOR shall provide pile coating, complete and in place, in accordance with the Contract Documents. Cost for pile coating shall be considered incidental to Item 6030211 – Driving Steel Piles.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

Per manufacturer specifications as provided in Appendix E of these Special Provisions.

1.3 CONTRACTOR SUBMITTALS

- A. General: Submittals shall be furnished in accordance with this specification, unless indicated otherwise below.
- B. Submittals shall include the following information and be submitted at least 30 days prior to coating the piles.
 - 1. Manufacturer's data sheet for each product proposed, including Statements on the suitability of the material for the intended use.
 - 2. Technical and performance information that demonstrates compliance with the system performance and material requirements.
 - 3. Manufacturer's instructions and recommendations on surface preparation and application.
 - 4. Colors available for each product (where applicable).
 - 5. Compatibility of shop and field applied coatings (where applicable).
 - 6. Material Safety Data Sheet for each product.

1.4 QUALITY ASSURANCE

- A. Coating Applicator's Experience and Certification

1. Coating application personnel, whom have direct brush or spray application responsibility, shall be certified by the manufacturer of the selected product.

1.5 DEFINITIONS

- A. DFT: Minimum Dry Film Thickness, without any negative tolerance.

1.6 ABBREVIATIONS

MDFT	Minimum Dry Film Thickness
Mil	Thousandths of an Inch

PART 2 -- PRODUCTS

2.1 GENERAL

- A. Pile coating material shall be Denso Protal 7200 as described in Appendix E of this document or approved equal. Products must have five (5) years of case histories on similar steel pile coating projects.
- B. Coating applicator shall provide a monitoring system approved by the coating manufacturer that constantly records pile and coating conditions during coating application. Recorded monitoring parameters shall include pile temperature, line speed, surface preparation, holiday test and other parameters applicable to the type of coating.
- C. Substitute or "Or-Equal" Products for Coating Systems
 1. The CONTRACTOR shall furnish satisfactory documentation from the manufacturer of the proposed substitute or "or-equal" product that the material meets or exceeds the technical specifications provided in Appendix E of this document.
 2. If a proposed substitution requires changes in the WORK, the CONTRACTOR shall bear all such costs involved, as part of the WORK.

2.2 PILE COATING SYSTEM

- A. General: Driven piles, pile caps and all appurtenant hardware are to be coated in accordance with this specification.
- B. Surface Preparation: Per manufacturer’s recommendations in Appendix E of this document.
- C. Product acceptance is contingent upon:

1. Submission of an independent testing report documenting conformance to the coating performance criteria specified herein.
2. Verification that no significant change in product formulation has occurred since independent test was performed.

D. Coating Performance Testing and Report

1. Coating manufacturer shall submit to the Engineer for approval, test reports documenting conformance to the specified performance criteria using prepared samples and coating materials conforming to the following general requirements:
 - a. Pile coating material tested shall have been manufactured within 30 days of test sample preparation.
 - b. Coating material to have a minimum of five years prior pipeline coating application history.
2. Submission of incomplete reports, use of test procedures or methods other than those specified, or preparation of samples with coating material other than those listed will result in rejection of the coating.
3. Reports shall be submitted for review and approval not less than 30 days prior to coating application along with current product data sheets and MSDS sheets.
4. Test Sample Preparation:
 - a. Failure to fully conform to the preparation requirements will result in rejection of the submitted coating material.
 - b. Sample preparation completed by the coating manufacturer shall be fully documented and reported to the testing agency by the manufacturer.
 - c. All coating test samples shall be prepared in conformance with the following general requirements.
 - d. Sample Surface preparation:
 - 1) Method: Abrasive blast, steel grit or green diamond, SSPC-SP5, white metal.
 - 2) Profile: 3.00 mils minimum, angular profile measured and recorded using surface profilometer or surface replica tape.

- e. Coating Application:
 - 1) Method: Spray film in accordance with manufacturer’s written shop application requirements. Thickness: 45 mils minimum, 60 mils maximum.
 - 2) Cure: Air cure only, oven or other accelerated cures will not be acceptable.
 - 3) Form: Sheet, steel panel, or steel pipe as required for the test procedure.

- f. Sample Quantity: Provide a minimum of three samples for each test performed or as required by the ASTM test standards, whichever is more stringent.

6. Coating Tests and Criteria:

- a. Testing shall be performed by a certified independent laboratory testing agency with a minimum five year’s experience in the performance of ASTM test procedures on coating systems.
- b. All testing shall be at room temperature, unless specifically required otherwise by the ASTM test procedure.
- c. Material property test requirements are listed in the table below:

Property	Requirement
Hardness	Shore D 85 ±2 when tested according to ASTM D2240-02
Impact Resistance	60.89 in-lbs, when tested according to ASTM G14-88
Adhesion to Steel	3200 psi when tested per ASTM D4521-02

7. Reporting:

- a. As required by the ASTM test method and the following additional information:
 - 1) Sample panel preparation date and identification
 - 2) Surface preparation method
 - 3) Surface preparation profile

- 4) Coating lot and date of manufacture
- 5) Application spray gun and equipment used
- 6) Application temperatures of coating materials and material temperature at the gun, ambient temperature, and panel surface temperature.

b. Show all calculations as required by the ASTM test method.

c. Submit report in PDF format.

E. Thicknesses

Pile Exterior and Associated Appurtenances	45 mils DFT, minimum
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2.5 REPAIR OF COATINGS AND LININGS

A. Field Repair Coating Materials

1. Pile Coating

a. Pile coating system repair shall be in accordance with the coating manufacturer’s recommended procedures.

2. Curing of Field Applied Coatings

a. All field-applied coatings shall be completely cured prior to installation.

PART 3 -- EXECUTION

3.1 WORKMANSHIP

A. Skilled manufacturer, trained craftsmen and experienced supervision shall be used to perform the application. Spray or brush application of the pile coating requires certification by the manufacturer, of the individual applicators.

3.2 STORAGE AND MIXING OF MATERIALS

A. Manufacturer's Recommendations: Unless otherwise indicated, the coating manufacturer's printed recommendations and instructions for thinning, mixing, handling, applying, and protecting its coating materials, for preparation of surfaces for coating, and for all other procedures relative to coating shall be strictly observed.

- B. Materials shall be used within the manufacturer's recommended shelf life.
- C. Storage and Mixing: Materials shall be stored and mixed per the manufacturers recommendations.

3.3 SURFACE PREPARATION

- A. Surface preparation shall be in accordance with manufacturer's recommendations provided in Appendix E of this document.

3.4 APPLICATION

- A. Apply the coating in strict conformance to the manufacturer's recommendations as presented in Appendix E of this document. Coating shall be applied by spray.
- B. Recoating shall be performed in strict conformance to the manufacturer's recommendations.

3.5 FIELD INSTALLATION

- A. Piles and related appurtenances shall be handled at all times to minimize damage to the lining and coating. Damaged lining and coating shall be repaired.
- B. Repair of Field Welded Joints and Damaged Areas.
 - 1. Weld sparks and splatter shall not be allowed to damage existing coating.
 - 2. After welding coated piles, repair the weld holdback areas and defects as recommended by the manufacturer.
 - 4. Use only material recommended by the manufacturer for repair.

3.6 FIELD INSPECTION AND TESTING

- A. Contractor shall provide a third party NACE Level III inspector with experience with the designated coating system on steel piles or pipe to inspect surface preparation, application of coating, document application conditions, and perform the required testing to ensure proper coating thickness and absence of holidays, blisters or other defects.
- B. Inspection shall include visual observation and recording of blisters, bubbles, cuts and other unacceptable defects, as well as holiday testing per NACE RP-0188 at points of connection with pile caps and other appurtenances, spot repairs, or other potentially suspect areas as directed by the Engineer.

- C. Coating thickness shall be measured utilizing industry accepted methodologies at a minimum of every 10 linear feet of pile and recorded with the pile number and distance from the tip. Sections which do not have sufficient thickness shall be recoated per the manufacturer's specifications to achieve the minimum allowable thickness.

3.7 REPAIR OF COATING AND LININGS

- A. General

- 1. Areas where holidays are detected or coating is visually damaged, such as blisters, bubbles, cuts or other defects shall be repaired to the satisfaction of the NACE inspector and documented.

- B. Pile Coating Repairs

- 1. General

- a. Complete coating repairs in accordance with the coating manufacturer's written instructions and these Specifications, whichever is stricter.

- END OF SECTION -

ITEM 6030001 - FURNISHING STEEL PILES

ITEM 6030211 - DRIVING STEEL PILES

Items 6030001 – Furnishing Steel Piles, and 6030211 – Driving Steel Piles are subject to descriptions, terms, and conditions Section 603. The following additions and clarifications are included.

DESCRIPTION:

The work under this item consists of furnishing all equipment, labor and materials required to install steel piles as shown in these specifications and per project plans. Installation of piles will occur in a floodway, which piles will support new 18-inch steel gravity sewer pipe. Piles occur thirty (30) feet on center. Additional piles are provided as integral components of manhole bases. Also see Subsection 603-1.

Work shall also include as-built drawings showing: 1) the final pile location, 2) splicing information, and 3) driving point used for each batter or vertical pile. As-built locations shall be by a registered land surveyor. The bearing capacity of each batter or vertical pile shall be determined and documented per Section 603-3.08 – Determination of Bearing Value. This as-built data and bearing report shall be provided in a legible, easily reproducible fashion. An affidavit shall be provided by the Contractor (Principle thereof) attesting to these reported values.

MATERIALS:

Materials shall be in accordance with these specifications and details shown on the plans and shall conform to the requirements of Section 603 PILING of Standard Specifications. Piles are H sections, sizes as shown on the project plans, ASTM A572 steel, 50 KSI yield strength. Also see Subsection 603-2.

CONSTRUCTION DETAILS:

Construction shall be in accordance with the details shown on the plans and shall conform to the requirements of Section 603-3.04 and the details shown on the plans, where tip maximum elevation and minimum bearing are specified. (Maximum tip elevation is required, even if minimum bearing has been demonstrated per Section 603-3.04.) Batter and vertical piles in tandem are required at locations along the new 18-inch pipe and three (3) piles utilized at manhole bases, as shown on the plans. Pile installation occurs along a new pipeline in an open trench by the Contractor. Contractor shall be responsible for providing detailed shop drawings indicating means and methods used for installation. Also see Subsection 603-3.

Limited geotechnical data, including borings, is attached in the appendix. **Borings do not extend to the required minimum depth of the driven steel piles** and are positioned along the entire pipeline reach. Should the Contractor require supplemental geotechnical data where the new 18-inch pipe crosses the Pantano Wash and flood plain, the Contractor may secure the

services of a Consultant/Subcontractor to provide said data. This investigation will be at no cost to the Owner.

METHOD OF MEASUREMENT:

Measurement will be per Subsection 603-4.

Measurement is understood to include as-built data, determination of bearing value, and Contractor affidavit described above.

BASIS OF PAYMENT:

Payment will be per Subsection 603-5.

SECTION 810 - EROSION CONTROL AND POLLUTION PREVENTION of the Standard Specifications is revised to read:

810-1 DESCRIPTION

810-1.01 General. On projects where an Arizona Pollutant Discharge Elimination System or equivalent National Pollutant Discharge Elimination System (AZPDES/NPDES) permit is required, the contractor shall implement the requirements of the permit for sediment and erosion control due to stormwater runoff during construction, as specified under the AZPDES/NPDES Construction General Permit AZG2008-001. The Agency and the contractor shall prepare and submit separate Notices of Intent (NOI) and Notices of Termination (NOT) forms for the project. The contractor shall copy their AZPDES NOI Application and NOI Certification to the owner of the Municipal Separate Storm Sewer System (MS4) (i.e. Pima County Department of Environmental Quality, City of Tucson Stormwater Management or Town of Marana Environmental Engineering). The contractor shall copy their AZPDES NOT Acknowledgement to the owner of the MS4 upon project stabilization. Copies of all NOI and NOT documentation shall be placed in to the SWPPP.

The Agency has prepared a Stormwater Pollution Prevention Plan (SWPPP), which includes a narrative description of the proposed measures to be implemented, sequence of construction activities, and a site-specific diagram indicating the proposed locations where erosion control devices or measures may be required during construction. This SWPPP is included in the Special Provisions. A list of subcontractors and key field personnel contact numbers shall be placed into the SWPPP. Prior to the start of construction, each contractor and all subcontractors shall be asked to sign a certification that they understand all requirements of the AZPDES/NPDES permit. Signed certifications shall be placed into the SWPPP.

The work under this item shall include furnishing, installing, maintaining, removing and disposing of temporary sediment and erosion control measures such as silt fences, check dams, sediment basins, netting, sediment logs/wattles, and other erosion control devices or methods as shown in the SWPPP and in the Special Provisions.

Permanent erosion control will be constructed under the specific items found in the plans and listed in the Special Provisions and bid schedule.

810-1.01 (a) Stormwater Implementation Plan

Contractor will provide an implementation plan describing the SWPPP activities associated with the construction sequencing of the project and how all requirements of the SWPPP will be accomplished during all phases of construction. All disturbed slopes that will not be stabilized within the SWPPP mandated 14 days must have temporary stabilization installed.

810-1.02 Erosion Control. Erosion controls, both temporary and permanent, shall be installed in accordance with phasing provisions in the approved SWPPP and coordinated with the related construction. Erosion controls must be provided within 14 days of completion of land disturbance. This applies to each location within a project area.

Perimeter control is required before work begins for all down-slope and some side-slope boundaries, unless the project is designed with sediment basins.

Stockpiles must have sediment control, except when actively worked. Sediments controls are required during weekends and evenings. Stockpiles cannot be placed in washes, surface waters, curb and gutter, or streets leading to these conveyances.

All work specified in this subsection will be temporary for use during construction.

The contractor shall be responsible for maintaining all erosion and pollution control devices in proper functioning condition at all times.

When deficiencies in the erosion control devices or other elements of work listed herein are noted by inspection or other observation, specified corrections shall be made by the contractor by the end of the day or work shift, or as directed by the Engineer.

Work specified herein which is lost, destroyed, or deemed unacceptable by the Engineer as a result of the contractor's operations shall be replaced by the contractor at no additional cost to the Agency. Work specified herein which is lost or destroyed as a result of natural events, such as excessive rainfall, shall be replaced by the contractor and be paid for in accordance with the requirements of Subsection 109-3.

In cases of serious or willful disregard for the protection of the waters of the U.S. and/or natural surroundings by the contractor, the Engineer will immediately notify the contractor of such non-compliance. If the contractor fails to remedy the situation within 24 hours after receipt of such notice, the Engineer may immediately place the erosion and/or other pollution control elements in proper condition and deduct the cost thereof from moneys due the contract.

810-1.03 Other Pollutant Controls. The work shall include implementing controls to eliminate the discharge of pollutants, such as fuels, lubricants, bitumens, dust palliatives, raw sewage, wash water, silt laden water, and other harmful materials into storm and other off-site waters. The work shall include the implementation of spill prevention and material management controls and practices to prevent the release of washoff of pollutants. These controls and practices shall be specified in the SWPPP and shall include delivery and storage procedures for chemicals and construction materials, material use, stockpile management, liquid and solid waste management, hazardous waste management, disposal and cleanup procedures, the Contractor's plans for handling of potential pollutants, and other pollution prevention measures as required.

Handling procedures for potential pollutants shall also be included in the contractor's "good housekeeping" practices as specified herein. At the preconstruction conference, the contractor shall specify "good housekeeping" practices and requirements, on-site and off-site tracking control, protection of equipment storage and maintenance areas, sweeping schedule of highways and roadways related to hauling activities, a construction sequence of major activities, Spill Prevention and Response Plan, and a listing of potential pollutants in the SWPPP.

If concrete washout activities occur and there is an AZPDES Construction General Permit (402 Permit) for the site, ADEQ's Aquifer Protection Type 1.12 General Aquifer Protection Permit (APP) shall be followed. If there is no 402 permit and concrete washout activities occur, a separate APP permit shall be obtained by the contractor.

Vehicle/equipment washing is not an allowable discharge covered under the SWPPP. Contractor shall apply for and obtain a type 3.03 General APP if vehicle washing will be done on site. Contractor shall also provide copies of their Type 3.03 General APP Permit for vehicle/equipment wash down areas for placement into the SWPPP as well as any other permits required

Contractor must identify locations of the following on the SWPPP Site Map: Vehicle/equipment wash down area, concrete wash out areas, staging yard/area, chemical storage area, equipment maintenance and repair areas, stockpile areas and equipment and construction material storage areas.

810-1.04 Staging/Storage Yard. If the contractor has entered into a separate agreement with an owner or lessee of private property to obtain property for use as a storage or staging area, the contractor shall assume all responsibilities for compliance with the AZPDES/NPDES regulations for this property. Contractor shall ensure that activities at this location do not affect the AZPDES permit held by the Agency.

The Agency shall state in its SWPPP that this area is under the control of the contractor.

810-2 MATERIALS

810-2.01 Silt Fence. Material requirements for silt fences, including posts, wire support fencing, and fasteners, shall be in accordance with Section 915. Geotextile fabric shall conform to the requirements of Subsections 1014-1 and 1014-8, except that the filter cloth shall be woven polypropylene, and the fabric Apparent Opening Size shall be between numbers 20 and 50 U.S. Standard sieve sizes when tested in accordance with ASTM D 4751.

810-2.03 Riprap and Rock Mulch. Riprap for culvert inlet and outlet protection and cut and fill transitions designated on the plans shall conform to the requirements of Section 913.

Rock mulch for headwall and wingwall treatments and rock check dams designated on the plans shall conform to the requirements of Section 803.

810-2.04 Sand Bags and Gravel Bags. Sand and gravel bags, when filled shall measure approximately 18 inches long by 12 inches wide by 3 inches thick, and weight approximately 33 pounds. Bags shall be manufactured from polypropylene, polyethylene, or polyamide woven fabric with the following characteristics:

Unit Weight, Minimum, oz. Per sq. yd.	4
Mullen Burst Strength, Exceeding, psi.	300
Ultraviolet Stability, Exceeding, %	70

Material used to fill sand bags shall be clean sand or a clean sandy soil free of silt, as approved by the Engineer.

Gravel fill shall be between 0.4 and 0.8 inches in diameter, and shall be clean and free from clay balls, organic matter and other materials.

810-2.05 Erosion Control Sediment Logs. Erosion control sediment logs shall be composed of weed-free, 100 percent virgin aspen wood excelsior or rice straw in a tube of non-biodegradable polyester or high-density polyethylene netting. Netting at each end of the log shall be secured with metal clips or knotted ends to assure fiber containment. The nominal diameter of the logs shall be from 9 to 20 inches as specified on the plans. The length of the rolls shall be from 7 to 25 feet as specified on the plans.

810-2.06 Sediment Wattles. Sediment wattles shall be manufactured rolls composed of weed-free, 100-percent virgin aspen wood excelsior or rice straw, encased in a tube of long-term photodegradable plastic or biodegradable natural fiber netting with a maximum one-inch by one-inch grid. Netting at each end of the log shall be secured with metal clips or knotted ends to assure fiber containment. Sediment wattles shall have nominal diameters of 9, 12, or 18 inches, with lengths from 7 to 25 feet, as specified on the plans. Fibers shall be evenly distributed throughout the wattle.

810-2.07 Curb Inlet Guard. Curb drain inlet guards shall be manufactured systems composed of high density polyethylene (HDPE) support brackets, an HDPE outer jacket and an integrated particle filter. Segments shall be adjusted and overlapped to fit the drain opening.

810-3 CONSTRUCTION REQUIREMENTS

Prior to the start of construction, the Engineer and contractor will jointly review the SWPPP, make any revisions needed, and approve and sign the SWPPP. The contractor shall use the signed SWPPP provided at the pre-construction meeting, and implement the SWPPP as required throughout the construction and establishment periods. The Engineer and contractor will perform a minimum of one routine inspection of disturbed areas that have not been stabilized at least once every 14 calendar days *and* within 24 hours of the end of a 0.5 inch rainfall. Reduced inspection frequency can occur when the site has been temporarily stabilized. The reduced inspection frequency is once every 28 days *and* before predicted rainfall events *and* after 0.5 inch rainfall events.

After each inspection, the contractor shall document the findings and revise the SWPPP as necessary. The Engineer and contractor shall jointly approve and sign each revision to the SWPPP before implementation. The contractor shall complete revisions to the SWPPP within 15 calendar days following notification if ADEQ determines the SWPPP is deficient. The contractor shall

amend the SWPPP, as needed and record inspection results in the SWPPP within 15 business days after an inspection by local, state or federal officials. Changes to the SWPPP must be implemented in the field within 7 calendar days, or before the next rainfall event.

Maintenance of erosion and sediment control devices will follow the schedule outlined in Part IV, I. of the CGP No.AZG2008-001. The contractor shall maintain all related erosion control elements in proper working order.

No condition of local grading ordinances or the SWPPP shall release the contractor from any responsibilities or requirements under other environmental statutes or regulations.

Erosion control and pollution prevention work specified in the contract which is to be accomplished under any of the various contract items will be paid for as specified under those items.

Final stabilization is met when all soil disturbing activities have been completed, temporary Best Management Practices have been removed and disposed of, and either a uniform perennial vegetative cover with a density of 70% of the native background has been established on all unpaved areas, or equivalent permanent stabilization measures are in place. Until final stabilization of the project, the contractor shall have the charge and care thereof and shall take every precaution against injury or damage to any part thereof by the action of the elements, or from the nonexecution of the work. The contractor shall rebuild, repair, restore, and make good all injuries or damages to any portion of the work occasioned by any of the above causes before final stabilization. No reimbursement shall be made for work necessary due to the contractor's failure to comply with the requirements of the SWPPP. The original completed SWPPP shall be returned to the Agency.

Except as specifically provided under Subsection 108-4, in the case of suspension of work from any cause whatsoever the contractor shall be responsible for the project and shall take such precautions as may be necessary to prevent damage to the project, provide for normal drainage and shall erect any necessary temporary structures, signs, or other facilities. During such period of suspension of work, the contractor shall properly and continuously maintain, in an acceptable growing condition, all newly established plantings, seedlings and soddings, furnished under its contract and shall take adequate precautions to protect new tree growth and other important vegetative growth against injury.

Erosion control features shall be temporary or permanent, as designated herein. All temporary erosion control features specified for removal shall become the property of the contractor, and shall be removed and disposed of by the contractor upon final stabilization. During removal, all sediment shall be disposed of, and the area restored to a finished condition as shown on the plans, or as directed by the Engineer.

810-3.01 Silt Fences. Installation and maintenance requirements for silt fences shall be accordance with Section 915, unless otherwise specified.

810-3.03 Riprap and Rock Mulch. Ripraps used in culvert inlet and outlet protection and cut and fill transitions; and rock mulch treatments for headwalls, wingwalls, and rock check dams; shall be installed in accordance with the project plans and details or as directed by the Engineer.

Rock shall be installed so as to conform to and completely cover the treatment area shown on the plans with a uniform, cohesive rock unit. The rock shall not impede flow into the treatment area and shall be feathered at the outflow.

Accumulated debris shall be removed and disposed of by the contractor after each rain storm, or as directed by the Engineer.

Pipe treatments, headwall and wingwall treatments, and cut and fill transitions are permanent project features, which shall remain in continuous service after installation and project completion.

Rock check dams shall remain in service until the seeding work commences or until they are no longer needed, as approved by the Engineer. When use of a rock check dam is discontinued, the materials shall be removed and wasted on site in a manner that will not impede designed drainage flows, as approved by the Engineer.

810-3.04 Sand Bags and Gravel Bags. The work shall include supplying bags and sand or gravel, preparing the filled bags, and installing filled bags where shown on the plans or as approved by the Engineer.

Gravel bags shall be used for drain inlets surrounded by asphaltic concrete or paved surfaces. Bags in the vicinity of curbs and catch basins shall be installed to 2 inches below the height of the adjacent curb to allow drainage into the drainage structure. Flow during a severe storm shall not overtop the curb. When sediment depth behind the bags reaches one-third the height of the bag, the sediment shall be removed and disposed of in accordance with local, state, and federal laws and permit requirements.

810-3.05 Erosion Control Sediment Logs. Erosion control sediment logs shall be installed in channel bottoms, around catch basins, as check dams, or on slopes, in accordance with the project plans and details, or as directed by the Engineer in accordance with the manufacturer's instructions. Stakes shall be located every two feet to secure the logs. Each stake shall be intertwined with the netting on the downstream side of the log and driven approximately two feet into the ground. Soil shall be tamped against the upstream side of the roll to assure that storm water is forced to flow through the log rather than under it. There shall be no gaps between the log and soil.

The ends of adjacent logs shall be abutted tightly together so that water cannot undermine the logs. If the width of the ditch/channel is greater than the length of one log, the ends of adjacent logs shall be overlapped a minimum of 24 inches.

When allowed by the SWPPP, sediment logs installed in drainage channel bottoms shall be perpendicular to the flow of the water, and shall continue up the channel side slope two feet above the high water flow line. Spacing of the logs shall be as specified in the project plans.

When sediment logs are used to construct check dams, the logs placed on the ground shall be buried four to six inches deep as shown on the project plans.

810-3.06 Sediment Wattles. Sediment wattles shall be installed on slopes as shown on the project plans, and in accordance with the manufacturer's instructions, or as directed by the Engineer. Trench depth shall be one-third the width of the wattle. Excavated material shall be placed along the downhill side of the trench. The wattle shall be in continuous contact with the bottom and sides of the trench. Sediment wattles shall be secured with wooden stakes spaced 5 feet apart and a maximum of 1 foot from the ends of the wattle. Stakes shall extend a minimum depth of 12 inches into the soil and a maximum height of 3 inches above the wattle surface. The ends of adjacent wattles shall be abutted tightly together.

810-3.07 Curb Inlet Guard. Curb inlet guards shall be used at curb drain inlets as shown on the project plans and in accordance with manufacturer's instructions, or as directed by the Engineer. The guard shall be anchored using gravel bags.

When sediment in front of the guard reaches one-third the height, the sediment shall be removed and disposed of in accordance with local, state, and federal laws and permit requirements.

810-4 METHOD OF MEASUREMENT

Work required by the SWPPP as included in the bid package, and as may be approved prior to construction, and "good-housekeeping" practices and requirements will be measured on a lump sum basis under AZPDES/NPDES (Original).

No measurement or direct payment will be made to the contractor for time spent in reviewing or revising the SWPPP, or providing other required documentation, the cost being considered as included in the price for the Item AZPDES/NPDES (Original).

If circumstances require changes to the approved SWPPP and such changes are determined by the Engineer to be beyond the scope of AZPDES/NPDES (Original), force account work may be authorized under Item AZPDES/NPDES (Modified).

Permanent erosion control will be measured and paid under the specific items found in the plans and listed in the Special Provisions and bid schedule.

810-5 BASIS OF PAYMENT

Payment for AZPDES/NPDES (Original) will be made at the contract lump sum price which shall be full compensation for supplying and furnishing all materials, facilities, and services and performing all work involved as specified herein.

Partial payments under this item shall be made in accordance with the following provisions:

- (1) When work shown on the (approved) SWPPP is in place, 50 percent of the amount bid for AZPDES/NPDES (Original) will be paid.
- (2) 40 percent of the bid amount will be paid incrementally over the life of the contract to cover maintenance. In the event that deficiencies exist with regard to Materials or Construction Requirements, Agency will withhold payment until such time as contractor mitigates the deficiencies.
- (3) The remaining 10 percent will be paid upon final stabilization of the project.

No additional payments will be made for this item of work.

The work under this item shall include furnishing, installing, maintaining, removing and disposing of temporary erosion control measures such as silt fences, check dams, straw barriers, and other erosion control devices or methods as shown in the Storm Water Pollution Prevention Plan (SWPPP) and in the Special Provisions.

The work shall also include maintaining permanent erosion control measures such as culvert inlet and outlet protection, cut and fill slope transitions, headwall and wingwall treatments, and other permanent erosion control devices or methods as shown in the SWPPP. The cost of furnishing and installing these items will be paid under the specific items found in the plans and listed in the Special Provisions and bid schedule.

The work shall also include regular inspections by the contractor at the frequency described in Section 810-3 and the SWPPP.

When circumstances require changes to the approved SWPPP and such changes are determined by the Engineer to be beyond the scope of AZPDES/NPDES (Original), payment will be made in accordance with the requirements of Subsection 109-5, Force Account work. Payment will be made under Item AZPDES/NPDES (Modified).

SECTION 802 - LANDSCAPE GRADING

Section 802 of the Standard Specifications is modified to add:

802-1 DESCRIPTION

The work under this section will be considered incidental to Item 8060001. The aesthetic goal for landscape grading is to create a ground plane that matches the material currently found adjacent to each improved area.

802-3 CONSTRUCTION DETAILS

Earthwork requirements shall be in accordance with Section 203 of the Standard Specifications except as modified herein.

In areas where plants are removed or salvaged and/ or bore pits are required but no additional improvements are scheduled, the Contractor shall smooth the grade and provide a finish surface to match existing grade or plating. Contractor shall rake the earth to match existing finish or natural desert floor.

In areas where vegetation is to be installed, during preliminary grading, dig out weeds from planting areas by their roots and remove from site. Also remove from site any foreign matter such as rubble, wire, cans, sticks, concrete, etc, before placing plant materials.

After planting, the Contractor shall smooth the grade and provide surface plating to match existing grade. If no surface plating exists, rocks larger than 2 inches in size and smaller cobble shall remain in place and be worked around, under direction of the Engineer, to create a raked earth/ natural desert floor appearance.

In order to accomplish the work in a most aesthetic manner, the Engineer reserves the right to review the finished grade and make minor recommendations.

SECTION 806 - TREES, SHRUBS & PLANTS

Section 806 of the Standard Specifications is modified to add:

806-1 DESCRIPTION

This section, along with the Standard Specifications, contains directions for the transplanting of the salvaged plant materials, as well as installation of new plant materials. All imported trees shall be standard form; multi-trunk is not preferred. Thorny species shall be off-set from any pedestrian use areas per applicable agency requirements.

Native plants that are to be either preserved in place or salvaged are identified on the Native Plant Preservation Plans (NPPP) as Preserve in Place (PIP) and Transplant on Site (TOS) respectively. Prior to the start of any work, the Contractor shall schedule an inspection of the project site with the Engineer. During this inspection, the plants to be preserved-in-place and salvaged will be confirmed and marked with different color flagging, white for PIP and yellow for TOS.

806-2 MATERIALS

806-2.01 General

All materials used for the boxing and banding of the salvaged plant material shall be new, shall be normal for the native plant salvage industry, and shall be suitable for the work to be performed.

All materials used for the spading of the salvaged plant material shall be of a quality and in the condition normal to the native plant salvage industry, and suitable for the work to be performed.

806-2.04 Local Stock: of the Standard Specifications is modified to add:

(A) Box Material:

If boxing is chosen, the boxes shall be of wood strong enough to allow transport of trees both to and from the storage facility or planting destination.

Boxes shall be of wood resistant to rot and fungus, and capable of lasting for at least two years. Should the box require replacement, or damage occurs to the tree as a result of poor box material, the tree shall be replaced as a warranty item at no additional cost.

(B) Nutrients:

Contractor shall apply chemical nutrients to the salvaged plants as needed to maintain them in good health. Loss of plants, from lack of nutrients or over fertilizing, shall be considered a warranty item and the plant shall be replaced at no additional cost. Soil sulfur should be agriculture grade, 99.5%.

Contractor should use an anti-transpiration agent as needed to prevent excessive wilting and wind damage.

806-2.05 Prepared Topsoil of the Standard Specification is modified to add:

The soil for backfilling the planting pits shall be native soil. Clods or stones, exceeding 2 inches in diameter or any deleterious material will not be allowed. All excess soil excavated from the plant pits with stones or material objectionable to the Engineer shall be disposed of off the project site in a manner acceptable to the Engineer. No additional payment will be made for this work.

Amendments shall consist of 25 pounds of agricultural gypsum, one pound of powdered soil sulfur and nine pounds of slow release Isobutylidene diurea fertilizer 25-4-8 with each cubic yard of site soil. Soil sulfur shall be 85-95 percent pure soil sulfur and shall be added to site soil at a rate of one pound/tree. Sulfur shall be delivered to the site in original unopened containers bearing manufacturer's guaranteed statement of analysis.

806-2.12 Existing Plant Material of the Standard Specification is modified to add:

The warranty covers all Preserved-in-Place (PIP) materials, as well as those transplanted, and includes breakage of major limbs, destruction of major root systems, scarring to the trunk, and death from stress.

806-2.13 Native Plant Protection: shall be added to the standard Specifications:

(A) Temporary Protective Fencing

Provide temporary protective fencing outside the drip line (outer perimeter of branches) to protect vegetation identified on the plans to be PIP. Temporary protective fencing shall be approved by the Engineer prior to start of demolition, clearing, grubbing, or any grading operations and shall be placed with a six-inch (6") clearance between the fencing and the plant's drip line.

Fence Fabric will consist of high visibility, heavy duty High Density Polyethylene (HDPE) that is UV resistant. The Fence Fabric shall be four feet (4') tall. Fence posts will be either wood or metal and shall be suitable for the work intended and a minimum of six feet (6') long.

(B) On-Site Monitoring

Native plants identified as PIP shall be monitored by the Contractor during the construction and maintenance periods for health and vigor. Engineer may observe these plants at any time during construction or establishment, and determine the need for replacement material.

806-3 CONSTRUCTION DETAILS

806-3.01 Planting Season of the Standard Specification is modified to add:

The planting of trees shall be performed during a period when night temperatures are consistently above 50^o Fahrenheit.

806-3.02 Excavation of the Standard Specification is modified to add:

Before planting, all planting pits should be filled with water and allowed to drain to leach out any soluble salts.

If a compaction layer is encountered while digging the plant pits, the compaction layer is to be dug through, equal to the entire width of the planting pit, thereby assuring proper drainage. To allow for proper drainage in situations where a caliche layer is present beneath the plant pit, 1/2" diameter holes shall be drilled vertically 6" on center to a depth of 12".

When excavation of any planting pit is difficult and it appears that poor drainage may result, as determined by the Engineer, the pit shall be filled with water in order to check the drainage of the planting pits. Any pit which has not fully drained six inches of water within one half-hour period shall be deepened until proper drainage is achieved.

All extra work that is required after the drainage test to achieve proper drainage in planting pits will also be included in Item 8060001 and paid for in accordance with the requirements of Subsection 109-5 of the Standard Specifications.

All planting areas shall be graded as specified and required to facilitate proper watering of all material and to leave a generally smooth appearance after the completion of planting.

806-3.04 Planting:

(B) Nursery Stock: of the Standard Specification is modified to add:

Any additional backfill required due to settling of more than 1 inch shall be provided by the Contractor at no additional compensation.

The top of the tree rootball shall be level or slightly above the soil surface. Planting pit should be backfilled with prepared topsoil. Water should be allowed to settle the backfill, and the backfill shall not be packed. After initial backfill procedure, the remainder of the pit shall be filled with backfill mix and lightly tamped to grade.

All planting areas shall be graded as specified and required to facilitate proper watering of all material and to leave a generally smooth appearance after the completion of planting.

(C) Collected Stock and Local Stock: of the Standard Specification is modified to add:

The plants to be salvaged and replanted on-site are listed on the project plans.

The Contractor shall provide all labor, tools and materials necessary to remove salvage plants from the ground, spade and move one time, or box and transport to a holding facility.

A one-time move for all transplants is encouraged. Transplant locations will be defined by the Engineer during the project's progress. They are to be within the project site, located near existing irrigation sources. All final locations will permit the collection and relocation of salvage materials to the ultimate planting location within the same day. This method is encouraged to eliminate the need for a temporary storage facility.

The Contractor is to provide a detailed salvage method and operations in writing and submit to the Engineer for approval.

Access to salvage plants shall be entirely within the project limits. Damage to surrounding areas not within the project limits, including but not limited to fencing, curbs, paving, vegetation, and utilities shall be the Contractor's responsibility.

Any damage within the nursery holding area, if the Contractor chooses that operation will be the Contractor's responsibility under Section 806-3.06.

The Contractor shall warranty trees from damage caused by his own operations. This warranty includes breakage of major limbs (exclusive of trimming), destruction of major root systems, excessive scarring to the trunk, and death from stress. If the Engineer determines that breakage, destruction of root system or scarring constitutes irreversible damage to the form and viability of the plant, the Contractor shall replace those materials with materials that match size and quality. If the plant materials are lost due to stress or other issues, the Contractor shall replace those materials with materials that match size and quality.

Should replacement material be required under this warranty, the Contractor is responsible for the procurement, transport and planting of the replacement material to the project.

806-3.05 Pruning and Staking: of the Standard Specifications is modified to add:

This section contains specifications for the pruning and care of plants to be PIP. Pruning of existing trees shall occur if the plant's location hinders the salvage or removal of plant materials, or the interceptor installation. The work will be done by or supervised by a certified arborist. The trees to be pruned will be identified by the Engineer. The work will be done with the arborist and one or more laborers. The work will include providing the necessary tools, removing all resulting debris from the area and taking them to a proper disposal place. If existing plants are located on the fringe of the boring pit area and are scheduled to be Preserved-in-Place (PIP), the Contractor is to take all precautions to work around that plant and preserve its viability.

In general, all trees will receive minimal pruning. The goal of the project is to have plant materials with a natural growth form. Trees identified as to be PIP are to be trimmed, so to

enhance growth and retain natural form. Trimming is to be done by pruning the dead, weak, disease or insect infested, low hanging, broken, or crossed branches. Minimal pruning is desirable. Tree Pruning Standards shall comply with ANSI standard A300-1995 and the International Society of Arboriculture Pruning Guidelines.

All occasions of mistletoe infestation on PIP plant material near the bore pits shall be pruned from the tree and removed from site.

806-3.06 Care and Protection of Trees, Shrubs and Plants: of the Standard Specification is modified to add:

After planting pits are refilled with approved native soil and the irrigation system has been installed and accepted, the planting pits shall be pre-watered by the irrigation system for a minimum duration of twelve hours. Planting shall be accomplished during a three-day period starting two days following the pre-wetting as specified. Areas not planted during the three-day period shall be re-watered and allowed to dry as heretofore specified.

All plant materials, except as specified, shall receive irrigation water, as specified, the same day they are planted with the installed irrigation system. The contractor shall adequately water plants to maintain a healthy and vigorous growing condition during the planting period.

All planting areas shall be graded as specified as required to facilitate proper watering of all material and to leave a generally smooth appearance after completion of planting.

The Contractor shall pay special attention to the infestation of Bermuda and nut grass. Either of these items found in the planting pits material shall be grounds for immediate removal and disposal, and replacement of that item. The planting pit shall be excavated and inspected to assure complete eradication of any roots or rhizomes that may have grown into the area. All this work and materials shall be the responsibility of the Contractor, at no additional cost to the Agency.

806-3.07 Vehicular Access to the Site

Vehicular access to the plants to be salvaged shall be from within the approved limits of work or shall be established in consultation with the Engineer.

806-3.08 Protection of Existing Plants and Natural Areas to be Preserved-in-Place

All plants and natural areas outside the limits of grading, or designated as to be preserved-in-place (PIP), shall be protected during the implementation of the native plant salvage work and all construction activities.

809-3.12 Plant Warranty

The Contractor shall warranty the survival and health of all plants imported as well as those salvaged and transplanted on site (TOS) as part of this contract for a period of one year. All plants which die during the warranty period due to the Contractor's neglect such as breakage of major limbs (exclusive of trimming), destruction of major root systems, excessive scarring to the trunk, and stress, shall be removed and disposed of properly off-site and be replaced by the Contractor with plants of the same size and species.

Contractor shall not be responsible if die-off results due to acts-of-God and/or causes deliberate. Die-off will be evaluated by the Engineer and the resultant determination for the loss will be final.

To satisfy the plant warranty requirements, at the time of final acceptance by the Engineer, the plant shall be considered established if it meets all of the following:

1. Exhibit health throughout the plant structure and/or new budding.
2. Be free from significant die back within branches or portions of the plant.
3. Be reasonably free from insects or other infestations that would reduce the plant's long-term potential for survival.
4. Be reasonably free from physical damage to the trunk, branches, or foliage that would reduce the plant's long term potential for survival.

806-3.13 Fencing:

Posts will be driven into native earth a minimum of 18 inches deep and the spacing between posts shall not exceed six feet. Fence Fabric shall be erected tight and uniformly around the drip line of each plant and with good workmanship to remain in place and in good repair so at no time is the area of the plant within the drip line in danger of being impacted or damaged throughout the duration of the Project's planting operation. Upon completion of planting operations, when the project enters Landscape Establishment and with the written direction of the Engineer, the Contractor shall remove all fencing materials from the Project.

806-4 METHOD OF MEASUREMENT of the Standard Specifications is modified to add:

Pruning will be incidental to Item 8060001 and will include the time the certified arborist is on site. Time spent taking debris to the landfill or proper disposal site is considered incidental to Item 8060001.

Temporary protective construction fencing for plant protection, as noted in 806-2.13(A) is incidental to the work.

806-5 **BASIS OF PAYMENT** of the Standard Specifications is modified to add:

The pruning work will be paid as described above, which shall include full compensation for the work described herein.

SECTION 807 - LANDSCAPING ESTABLISHMENT

807-3.01 General: of the first paragraph of the Standard Specifications is revised to read:

The landscaping establishment period shall be twelve (12) months. The establishment period shall begin after all landscape items in the contract, including grading, planting, irrigation system, etc. have been completed, and only when the Engineer is assured that the work can be performed in a continuous and consistent manner without restricting the use of any facilities by the public.

The Prime Contractor (or the Landscape/Irrigation subcontractor responsible for the initial installation) shall be the only Contractor that performs the Landscaping Establishment work. Subcontracting of this work will **not** be permitted except for weed eradication with herbicide because of special licensing requirements.

Initial pre-emergent will be applied after containerized planting or any other disturbance is completed. During the maintenance period, two pre-emergent treatments are required. One will occur approximately in February or just before the spring rains are anticipated. One will occur in the fall approximately in October or just before the winter rains are anticipated. The first application is dependent on when the job is accepted as substantially complete and the maintenance period begins.

During the establishment period, the Contractor shall pay for irrigation water.

The Engineer will make monthly inspections during the establishment period and provide punch lists. The contractor shall be responsible for weekly visual inspections to make sure the irrigation system is working properly.

At the end of this period, any plant materials that show signs of stress or damage, will be replaced by the Contractor. Determination of plant material replacement will be made by the Engineer.

During the Landscape Establishment Period, the Contractor shall be required to perform the following work, in addition to the Standard Specification requirements, on a weekly basis:

- Maintain functioning irrigation system with full coverage to all plants.
- Adjust watering schedule as needed.
- Keep distribution tubing buried except last 1 inch.
- Remove all trash and debris in general areas of boring and receiving pits
- Weed control in areas of disturbance.

In addition, the Contractor shall fulfill requirements of the monthly punch list. Any work listed above that has not been performed before the subsequent monthly inspection shall be grounds for stop payment, as well as stop time, until the work is performed in a satisfactory manner.

SECTION 808 - LANDSCAPE IRRIGATION SYSTEM

808-1 DESCRIPTION of the Standard Specifications is modified to add:

Within ten (10) days after the start of construction, the Contractor shall submit to the Engineer two copies of a list of the proposed materials and equipment to be used based on discussions with the Pima County DOT. This list shall show the manufacturer's name, model number, size, capacity, and complete specifications to determine whether or not each piece of material or equipment is acceptable and to assure that all such materials and equipment when incorporated into the work will be in accordance with the requirements of the project plans.

808-2.02 Emitter Hose of the Standard Specifications is modified to add:

Any additions or extensions to the existing irrigation lines shall be done without exceeding zone, lateral or mainline capacities. No connections, additions or extensions are allowed on existing lateral polylines. All new lateral extensions must be from PVSC hardlines and must be checked for adequate flow.

Each lateral emitter line shall be terminated with a manual self-closing flush valve, installed in a 6" plastic valve box. The valve box shall be constructed of glass filled polypropylene, and shall be round. The box shall be 6" in diameter and 9" deep. The box shall be brown.

808-2.05 Pressure Reduction Riser of the Standard Specifications is modified to add:

If possible, the Contractor shall avoid impacts to irrigation components although it may be necessary to install pressure regulator assemblies as detailed on the project plans, and in accordance with the requirements of Section 808 of the Standard Specifications and these Special Provisions.

808-2.07 Emitter Assembly of the Standard Specifications is modified to add:

Multi-port emitters shall be used whenever possible for all plant materials. Whenever there is access to 4 or more plants on the shrub or tree line, a multi-port emitter shall be used.

CONSTRUCTION DETAILS

808-3.02 Trenching and Piping of the Standard Specifications is modified to add:

Irrigation pipe shall be sleeved under any new access roads. Coordinate all locations with the Engineer. Sleeves shall be identified with wire extending from the sleeve to daylight, to ease future location, as detailed on the project plans. Sleeves shall extend a minimum of 12” beyond edge of any hardscape surface.

During trenching operations, Contractor shall take care not to disturb existing pipes and control wires. If control wires are encountered and broken, the Engineer must be notified, and new splices must conform to applicable standards and be placed in a concrete box with locking cast iron lid.

SUBSECTION 923-3.11 ARCHAEOLOGICAL ACCESS TO TRENCH is hereby added to the Standard Specifications:

Within this potentially critical area, the City of Tucson requires that qualified Archaeologists examine trench walls for evidence of Holocene-period artifacts and remnants. Trench operations shall include providing safe access to archaeological team to examine utility trench walls from bottom to surface as requested by the Archaeologist. This examination shall be ahead of bedding placement, pipe placement, and backfill at locations bilaterally agreed upon by the Contractor and Archaeologist. (Archaeologist is under the employ of PCRWRD.) Access shall be assured with sufficient notice in advance of the pipe placement to allow a comprehensive review by the Archaeologist. A written methodology agreed upon bilaterally by the Contractor and the Archaeologist shall be provided to PCRWRD for concurrence 48 hours prior to work.

MODIFICATION TO SUBSECTION 923-4 Method of Measurement is hereby modified to add the following:

No measurement shall be made for providing City of Tucson archaeologists safe access to examine trench walls as described in Sub-Section 923-3.11

ITEM 9300115 –MISCELLANEOUS WORK 5

Items 9300115 – Miscellaneous Work 5 shall be utilized for the grouting of the existing 12-inch gravity main and abandonment of existing manholes. The following additions and clarifications are included.

DESCRIPTION:

The work under this item consists of furnishing all equipment, pumping equipment, excavation over existing pipe, labor and materials required to pump CLSM No. 1 grout into the existing pipe which is to be abandoned.

The work under this item further consists of furnishing all equipment, pumping equipment, excavation over existing pipe, labor and materials required to abandon manholes as shown on the plans, including the following:

- Break manhole base per Arizona Department of Environmental Quality requirements for septic tank abandonment. Remove all concrete to depth of three (3) ft. below finish grade.
- Backfill manhole using inert material to depth of three (3) ft. below finish grade. Material shall be per Section 810 - 2.03, Gradation C. From three (3) ft. below grade to surface, backfill using ABC to 95% maximum density.

MATERIALS:

Materials shall be in accordance with these specifications and details shown on the plans and shall conform to the requirements of Sub-section 501-2.03.

CONSTRUCTION DETAILS:

Construction shall be in accordance with the details shown on the plans and shall conform to the requirements of this provision and as shown on the plans.

METHOD OF MEASUREMENT:

Grouting shall be measured by lineal foot, and per Subsection 109-1 Measurement of Quantities.

BASIS OF PAYMENT:

The accepted quantities of grouted pipe, measured as provided above, will be paid for at the contract unit price per lineal foot for the unit specified in the bidding schedule, complete-in-place.

APPENDIX A
Cured-In-Place-Pipe



Special Provisions

Cured-In-Place Pipe

Prepared by:

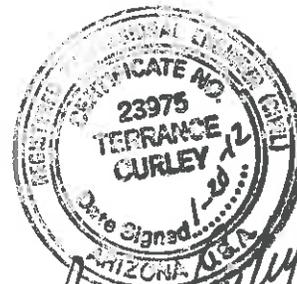
Terrance Curley, P.E.
Civil Engineer

For



**Pima County
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EXPIRES 6/30/14

January 20, 2012

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SECTION 701 - INTENT AND PURPOSE

Intent and purpose of these Special Provisions is to interpret and/or supplement all Pima County Regional Wastewater Reclamation Department (PCRWRD) Manual of Engineering Standards and Procedures and the most current version of the City of Tucson/Pima County (COT/PC) Standard Details and Specifications for Public Improvements to the extent and in the manner referred to and to provide additional Specifications.

SECTION 702 - PRIORITY OF SPECIFICATIONS

In the event of any conflict, seeming or real, between these Special Provisions and the COT/PC Standard Details and Specifications for Public Improvements, these Special Provisions and the Contract Drawings which accompany and form part of these Special Provisions, shall prevail.

SECTION 703 - LOCATION OF WORK

The project is located within Pima County, Arizona. The location is depicted in the Contract Drawings accompanying these Specifications.

SECTION 704 - DESCRIPTION OF WORK

The work to be performed consists of furnishing all materials, equipment and supplies, and performing all labor in connection with the rehabilitation of a sanitary sewer and other work shown on the Contract Drawings, complete in place, in strict accordance with the Standard Specifications, Contract Documents, and these Special Provisions. One Contractor shall perform entire rehabilitation project utilizing one lining technology. The rehabilitation work in this project shall include but not limited to:

Flow Management

Cleaning

Cured-In-Place pipe (CIPP)

Point Repair

Close Circuit Television (CCTV)

The sewer rehabilitation consists of existing gravity sewer pipe. The existing gravity sewer may include Asbestos Cement (AC), Vitriified Clay (VC) and Ductile Iron (DI) pipe.

The approved trenchless technology for this specific job is installation of a thermosetting resin-impregnated, felt fiber tube inserted, inflated, and cured in the existing conduit, henceforth referred to as Cured-In-Place pipe (CIPP).

SECTION 705 - EXISTING UTILITIES

705.1 Under Arizona State Law (ARS 40-360-21) the Contractor is required to contact all utilities in order to determine the locations of their respective utilities prior to any excavation. The Contractor is responsible for any damages to existing utilities and will make any necessary repairs at his expense. The Contractor shall brace and/or support existing utilities as necessary to protect existing facilities from disturbance and/or damage.

705.2 Contractor shall verify locations and elevations of all existing utilities prior to any construction. The Contractor shall call Blue Stake at 1-800-782-5348 two (2) full working days prior to any excavation. Saturdays, Sundays, and holidays are not considered to be working days.

705.3 The Contractor shall contact Tucson Electric Power Company at least ten (10) days prior to excavation within ten (10) feet of any power pole. Tucson Electric Power Company shall provide relocation or bracing of said pole.

705.4 All gas line relocation required, including trenching, will be performed by Southwest Gas Corporation or their Contractor. Southwest Gas will determine actual location of new and/or relocated gas lines. *Southwest Gas has high pressure gas facilities in Pima County. Southwest Gas requires a stand-by when the contractor is working within 10 feet of high pressure gas facilities. The contractor must call (520) 794-6021 to schedule the stand-by a minimum of 24 hours in advance*

705.5 Any required utility relocation shall be accomplished in cooperation with and to the satisfaction of the company or agency having jurisdiction over the particular utility. The Contractor is responsible for all costs associated with any utility relocation.

705.6 Any possible water line relocation required shall be performed by the Contractor. All existing water lines are part of the Water Company or agency having jurisdiction over the particular waterline. All water line relocation(s) shall be in accordance with the respective agencies Standard Specifications and Details and ADEQ Bulletin Number 10, except as modified on the Plans. See Section 709, "TEMPORARY UTILITIES", regarding construction water for the project.

705.7 The Contractor shall maintain utility and sewer service during construction to all parties and establishments tributary to the work. The equipment, material and manner with which any required temporary Wastewater Flow Management is constructed shall assure continuous sewer service without spill or discharge of raw wastewater during operation, installation or removal of the Wastewater Flow Management equipment. The Contractor shall submit a Wastewater Flow Management Plan (WFMP) and associated details of the proposed WFMP for review to PCRWRD. See Section 712, "INSTALLATION PROCEDURES" of these Special Provisions for additional information.

SECTION 706 - WORK WITHIN RIGHTS-OF-WAY AND EASEMENTS

706.1 This work is to be done within existing public rights-of-way of the City of Tucson Department of Transportation (TDOT)/Pima County Department of Transportation (PCDOT), and public sewer and utility easements as shown on the plans. It shall be the responsibility of the Contractor to obtain any and all necessary permits to conduct the work within the rights-of-way shown in the plans, including any permits required for temporary pavement cuts within the roadway. The Contractor shall prepare and provide control plans as necessary, including for traffic and WFMP. In addition, the Contractor shall provide dewatering plans if necessary should ground water be encountered.

706.2 The Contractor shall make every effort to minimize damage to existing improvements during all work operations. Any existing improvement which requires removal for work access shall be replaced "in kind" by the Contractor to the satisfaction of the Engineer. All costs associated with the above work within rights-of-way and easements shall be included in pipe installation costs, except as provided for by specific items in the proposal. Any existing improvement which is damaged or removed by the Contractor outside the rights-of-way and easements shall be replaced "in kind" and to a condition equal to or better than the original at the Contractor's expense.

SECTION 707 - AS-BUILT RECORDS

707.1 The Contractor shall maintain a set of the plans and specifications at the job site at all times during the work. The Contractor shall maintain a complete set of As-Built Record Drawings that are acceptable to PCRWRD. The As-Built Records shall be kept up-to-date throughout the project and will be available for examination by PCRWRD personnel and their representatives upon request. Final approval and payment of the project will not be provided until after the As-Built Record Drawings are accepted by PCRWRD.

707.2 Upon completion of sewer rehabilitation, the Contractor shall forward a complete set of Record As-Built Drawings in accordance with ARS 32-152 to PCRWRD. These drawings shall note that all CIPP installed is for fully deteriorated pipe. They shall also identify locations of reinstated Active House Connection Sewer (HCS) openings. These drawings shall indicate deviations, including CIPP thicknesses less than that for fully deteriorated pipe, from Special Provisions, Plans, and Specifications. Contractor shall provide the Contractor's Completion Date and Contractor's Comments for each sewer reach on all of the plan sheets

SECTION 708 – INTENTIONALLY NOT USED

SECTION 709 - TEMPORARY UTILITIES

709.1 The Contractor shall provide, at no additional cost to PCRWRD, all construction power used at the site. He shall make all arrangements with the electrical utility for power takeoff points, voltage and phasing requirements, transformers and metering and shall pay all costs and fees arising there from. It shall be the Contractor's responsibility to provide all special connections required for his work.

709.2 The Contractor shall provide, at no additional cost to PCRWRD, all construction water used at the site. The Contractor shall make all arrangements with the Water Company for water takeoff points and metering and shall pay all costs and fees arising there from. It shall be the Contractor's responsibility to provide all special connections required for his work. The Contractor shall make provisions for delivering the water from the connection(s) to the point(s) of use. The Contractor shall also be responsible for making provisions to locate water supply hoses below surface grade when it is necessary to extend hoses across roadways. For some above ground installations, the Contractor may consider using hose-wheel ramps to protect the hoses from vehicle traffic. The Contractor shall coordinate all hose installations within the right-of-way with TDOT, PCDOT, and PCRWRD. PCRWRD may require below grade placement at some locations independent of TDOT/PCDOT requirements.

SECTION 710 - DAMAGE TO WORK DURING CONSTRUCTION

The Contractor shall make every effort to prevent damage to the sewer and related appurtenances during construction. Any and all damage to the sewer and/or appurtenances resulting from negligence on the part of the Contractor shall be rectified by the Contractor to the satisfaction and approval of PCRWRD at the expense of the Contractor. It shall be the Contractor's responsibility to protect the sewer and related appurtenances from all reasonably foreseeable potentially damaging events until final approval and acceptance by the owner. The Engineer reserves the right to make the final determination of damage responsibility.

SECTION 711 - TRAFFIC CONTROL, DETOURING, AND ACCESS TO ADJACENT PROPERTIES

711.1 The Contractor is advised that this project is situated within TDOT/PCDOT Right-of-Way and is under the jurisdiction of the TDOT/PCDOT. All traffic plans and right-of-way permits shall be coordinated through the TDOT/PCDOT. The Contractor shall prepare and submit a Traffic Control Plan to TDOT/PCDOT for their approval before commencement of work. Traffic control shall be in accordance with Section 701 of the most current version of the COT/PC Standard Specifications for Public Improvements.

711.2 Prior to the approval of construction operations within a roadway, specific approval of traffic control, including possible detours, provisions for emergency services and public transportation access, will be required by the TDOT/PCDOT Permit and Codes. A copy of the TDOT/PCDOT approved traffic control plan shall be submitted to PCRWRD.

SECTION 712 - CURED-IN-PLACE PIPE (CIPP) INSTALLATION PROCEDURES

The following installation procedures shall be adhered to unless otherwise approved by PCRWRD's Field Engineering Section:

712.1 Safety: The Contractor shall carry out his operations in strict accordance with all applicable OSHA standards.

712.1.1 Confined Spaces: Particular attention is drawn to those safety requirements involving working with confined space entries. All Contractor and subcontractor personnel shall be made aware of the fact that work for this project is to be carried out within an operating gravity sewer line. Any entry into the sewer line or appurtenant manholes may involve but not be limited to exposure to one or more of the following hazards:

- Pathogenic microorganisms
- Oxygen-deficient atmosphere
- Flammable atmosphere
- Toxic atmosphere
- Temperature extremes
- Engulfment hazard
- Excessive noise
- Slick or wet surfaces
- Falling objects

No entrance, for any reason, into the public sanitary Wastewater system's confined spaces shall occur without the expressed consent of PCRWRD' Conveyance Division and the utilization of the required safety provisions.

712.1.2 The Contractor shall provide employees with properly fitted respiratory protection from exposure to styrene compounds; OR the Contractor shall provide monitoring of styrene concentrations in all enclosed or partially enclosed work spaces during construction and shall use the monitoring information to demonstrate to PCRWRD that employees are NOT exposed to concentrations of styrene which are above the OSHA limits for Time Weighted Average (TWA) or Short Term Exposure Level (STEL). The Contractor shall be responsible for the air monitoring of the work site during the installation of the CIPP, to test for any offsite migration of styrene. The Contractor shall provide air monitoring by an independent party during the impregnation process to determine if applicable air quality standards for the site are being met.

In accordance with Title 17, Air Quality Control, of the Pima County Code, the Contractor shall comply with monitoring requirements for styrene if applicable. The Contractor shall contact Pima County to verify these requirements.

712.1.3 Prior to issuing the project's Notice to Proceed the Contractor shall develop and submit a written procedure for confined space entry and styrene protection and require all personnel, including subcontractors involved with the project, to be familiar with it in strict accordance with OSHA and all local, state, and federal safety standards. This written procedure shall be signed by the Contractor and shall be submitted for PCRWRD approval prior to physically accessing any active sanitary sewer line or related facility. The plan shall include certification of training for all personnel assigned to the project.

712.1.4 The sewer to be rehabilitated under this project is in a deteriorated condition. The Contractor shall insure that all personnel are aware of the potential for collapse before commencing work and shall take appropriate safety precautions to protect both the workers and the pipe.

712.2 Inspection of Pipelines: Inspection of pipelines shall be performed by NASSCO certified personnel in locating breaks, obstacles and service connections by Closed Circuit Television (CCTV). All CCTV videos shall be in color

format. The interior of the pipeline shall be carefully inspected to determine the location of any conditions which may prevent proper installation of liner into the pipelines, and it shall be noted both on tape and on log sheets so that these conditions can be corrected. During inspection of the pipeline interior, the locations of any service connections, both active and capped, shall be noted and accounted for on the log sheets. The pre-insertion videos and log sheets shall be submitted to PCRWRD Field Engineering for review. Any conditions which may prevent proper insertion of the liner shall be noted and corrected prior to proceeding with liner installation. Once the liner insertion and curing process is completed for sewer reaches, CCTV video recordings and suitable logs shall be submitted to PCRWRD prior to or with requests for payment. CCTV data and logs shall use the NASSCO coding procedures and nomenclature.

712.3 **Cleaning of Sewer Line:** It shall be the responsibility of the Contractor to remove all internal debris, roots, and other protrusions from the sewer line that will prevent insertion of the liner or compromise the integrity of the finished product. The Contractor shall clean the sewer lines to the satisfaction of the Engineer. The Contractor is responsible for determining the appropriate method of cleaning based on the condition of the existing pipe.

712.4 **Line Obstructions:** It shall be the responsibility of the Contractor to clear the line of obstructions such as solids, dropped joints, protruding service connections or collapsed pipe that will prevent the insertion of the liner. If inspection reveals an obstruction that cannot be removed by conventional sewer cleaning equipment, then, upon receipt of written approval and direction from the Engineer, the Contractor shall make a point repair excavation to uncover and remove or repair the obstruction. Payment for point repairs other than those shown on the Plans shall be in accordance with Section 109, Extra and Force Account Work, of the COT/PC Standard Specifications For Public Improvements.

712.5 **Wastewater Flow Management Plan :** The Contractor shall:

712.5.1 Provide for the uninterrupted flow of wastewater around the section or sections of pipe designated to be affected by the construction work.

712.5.2 The Contractor shall prepare and submit for PCRWRD approval three copies of his Wastewater Flow Management Plan (WFMP), showing the method for each affected reach of project sewer. WFMP submittals shall be made, before a Notice to Proceed is issued, to:

Field Engineering Manager
Pima County Regional Wastewater Reclamation Department
1313 S. Mission Road
Tucson, Arizona 85713

712.5.3. Wastewater flow management operations shall not be performed by the Contractor until receipt of written approval from PCRWRD. PCRWRD Conveyance Division (520-443-6500) and the affected treatment facility Roger Road WRF (520-443-6464) must be notified at least 48 hours prior to commencement of any flow management plan.

712.5.4 The Contractor shall, at his expense, obtain all permits necessary for the installation and operation of the wastewater flow management equipment.

For wastewater flow management plans gravity type designs are typically preferred over pumped type designs. However, the most appropriate type of wastewater flow management should be used for the project.

The flow management equipment shall be quiet running and shall be equipped with noise suppression apparatus, including, but not limited to: sound boards and engine mufflers. The Contractor shall be required to meet the noise abatement requirements of the City of Tucson.

For gravity type wastewater flow management plans the following specifications apply:

- show influent & discharge points with elevations & stationing on the design plans
- survey, blue stake, and show the plan and profile on the design plans
- design sewer pipe plugs for expeditious removal during startup testing

For pumped type wastewater flow management plans the following specifications apply:

- show suction & discharge points with elevations & stationing on the design plans
- provide pump performance curves
- discharge manifolds are acceptable
- intake manifolds are not acceptable
- use separate intakes for each pump with debris control
- structural calculations are required for all aluminum pipe designs
- suction lines shall be steel reinforced pipe or better
- provide adequate intake line spacing (center to center) to avoid vortexing
- provide high level alarm notification to pagers or cell phones
- provide redundant air release valves
- submit calculations to verify suction lift of pumps has not been exceeded
- provide multiple fuel tanks with 24 hours of fuel supply
- protect discharge piping from vandalism and vehicular damage
- butt-fused HDPE (Minimum thickness SDR11) is the preferred material for the discharge piping
- provide containment under each pump and manifold

The Contractor shall be responsible for insuring that there is no unauthorized discharge or spill of raw Wastewater as a result of the flow management operation. In the event of a Wastewater spill the Contractor shall notify the PCRWRD Conveyance Division (520-443-6500), after 5:00 pm, weekends, holidays (520-741-4911). In the event of any Wastewater spill the Contractor will be responsible for the prompt cleanup and disinfecting of the spill to the satisfaction of the PCRWRD Conveyance Manager. In cases where the Contractor is not in compliance with mitigation efforts, any assistance provided by PCRWRD will be billed to the Contractor. The Contractor shall compensate PCRWRD for the cost of any fines levied as a result of a spill or unauthorized discharge. Prior to start of construction, the Contractor must also prepare a sanitary sewer overflow (SSO) spill response plan, include it within his wastewater flow management plan submittal, and obtain plan acceptance from Pima County. The Contractor shall provide an on-site disinfectant meeting EPA and PCRWRD specifications for SSO mitigation. The sanitary sewer overflow spill response plan shall include the following:

- emergency notification procedures
- list of emergency response personnel with phone numbers and/or pager numbers
- method and means for monitoring sewer levels both upstream and downstream of construction location
- list of materials and equipment for containment and remedial clean-up
- list of nearby drainageways, channels, and storm drain systems

For information regarding measured Wastewater and storm flows in the subject sewer line, the Contractor should contact Tim Rowe, PCRWRD Engineering Services, at (520) 443-6180. The Contractor is responsible for verifying this information and then providing a sufficient number of pumps to handle the normal peak flows with additional reserve capacity to handle wet weather flows and pump malfunctions.

The Contractor shall provide backup pumps equal in number to 50% of the number of pumps being used and of the same discharge capacity. Any fractional number of pumps will be rounded up to the next higher whole number. Flow management pumps are to be manned 24 hours per day. No unattended operation will be permitted. The Contractor shall be responsible for the periodic inspection of the flow management pipelines and shall provide a written log documenting the time of each inspection.

“Lay-flat” hoses may not be authorized at all locations. Where flow management pipelines cross existing paved residential roads, a ramp over the pipes will be constructed or other arrangements made to insure that local access is

maintained to homes and businesses. A minimum of 12 inches of cover will be provided over the top of the flow management pipelines located in areas where vehicular traffic must cross over them. This cover requirement may be reduced if approved in writing by PCRWRD, after the Contractor submits an acceptable cover design. The pipelines at the crossing shall be designed for an H-20 truck loading and have a slope that will permit large tractor trailer and fire apparatus to cross over the ramp safely.

712.6 Specification for Service Connections and Owner/Resident Notices:

Due to the area to be rehabilitated, the work shall be performed in sequence by areas. The Contractor shall present and submit for PCRWRD approval the proposed schedule and Official Notification letter, written in both English and Spanish languages, for distribution to property owners/residents of each work impacted area, along with mailing addresses of all affected owners/residents. Once the schedule and Official Notification letter are approved by PCRWRD Community Relations, the contractor shall hand deliver or mail the notifications using stationary and envelopes with the PCRWRD letterhead provided by PCRWRD Community Relations Department (740-6532). Mailing lists of affected property owners/residents are included in Appendix B. Mailings shall be prepared and sorted in compliance with United States Postal regulations. Owner residences are available on the Pima County Department of Transportation (PCDDOT) GIS website.

The Contractor and PCRWRD shall jointly hold a neighborhood public meeting a minimum of ten (10) calendar days prior to commencement of work on the project. The purpose of the meeting will be to discuss parameters of the project and impacts on neighborhood residents/businesses. The contractor's superintendent and PCRWRD staff shall be in attendance at the meeting. Requirements of special needs of individuals will be addressed at the meeting. Public meetings and notifications shall be coordinated through the PCRWRD Community Relations (740-6532).

For the duration of the project, contractor field crews shall carry a copy of the notification letter at all times. The notification letter will list an "after-hours" cell phone number in the event of an emergency between the hours of 5:00 p.m. and 8:00 a.m.

Prior to commencement of work affecting service connections, the Contractor shall be responsible for determining locations of all active service connections, then further identify any business, commercial, high flow, or any other service connections in which flow cannot be interrupted. Records of most service connections are included in Appendix B. If any discrepancies arise in the field, records are available to the contractor in PCRWRD Maps and Records Section located on the 5th floor of the Public Works Building, 201 North Stone Avenue. If the information is not available in the Maps and Records Section, the Contractor shall determine the locations by visiting the site, CCTV, dye testing, consulting with the owner/resident, or by other approved methods. The Contractor shall submit a proposed plan for maintaining uninterrupted use of these service connections for the Engineer's approval **at least five (5) working days prior to commencing work.**

By means of a bilingual door hanger, the contractor shall notify all residents/businesses whose service connections will be interrupted at least 48 hours in advance of the service interruption. This notification shall be in person, whenever possible, and shall include the approximate date and length of time that the interruption of service will occur. The Contractor's proposed written notification shall be submitted to PCRWRD Community Relations for review and approval prior to distribution to the public. The Contractor shall confirm the notification again verbally, whenever possible, at least 24 hours before the interruption. The 24-hour bilingual notifications shall include an "Official Notification/Notification Official" approved by PCRWRD Community Relations and contain the PCRWRD letterhead and/or logo.

The Contractor shall maintain a notification log, which will include the date and time of the notification for all involved properties, the contact person's name, or if no contact was made, that the information was left at the door. The notification log shall be submitted to PCRWRD prior to construction.

The Contractor must accommodate the special needs, if any, for the continuance of sewer service of all the owners/residents. If sewer service cannot be effectively/fully restored within 24 hours after interruption, physical flow management pumping for the house connection must be provided.

The Contractor shall provide temporary portable restroom facilities at the beginning of, and for the duration of the service interruption. The number of facilities shall be not less than one (1) portable restroom per two (2) residential units and one (1) portable restroom per business. The portable temporary restroom facilities shall be structurally stable, shall be kept clean, and shall include hand washing stations. In the case where a handicap facility would be necessary, PCRWRD will negotiate with the Contractor to determine a solution.

All workers shall use appropriate and inoffensive language whenever conducting County business, especially when working near schools, homes, or businesses. All workers will treat members of the public with respect.

SECTION 713 - CURED-IN-PLACE PIPE (CIPP) MATERIALS REQUIRED

713.1 Suitability of Material: Proposed materials shall be suitable for use in the environment and conditions of the project.

713.2 Color of Material: The product shall not be made of a dark or non-reflective material that would inhibit proper CCTV inspection.

713.3 Manufacture: The material shall be manufactured in such a manner as to result in a tight-fitting new pipe after installation. The finished pipe wall shall not include any materials that are subject to delamination.

713.4 Approved manufacture: Liner pipe approved for this project is CIPP as manufactured by Insituform Technologies Inc., First Liner USA, Spiniello Liner, Invert-A-Pipe, and Inliner Technologies. These are the only approved manufacturers of CIPP liner pipe. No substitution is permitted. Rehabilitation of the existing pipelines shall be by insertion with CIPP. Rehabilitation by CIPP pipe shall conform to Section 713 and its subsections of these Special Provisions. The CIPP system used must have a minimum proven performance record of 25,000 LF of successful CIPP installation in the United States.

713.5 Contractor: The licensed Contractor must have successfully installed a minimum of 5,000 feet of CIPP liner in sewers with nominal diameters of 6 inches and larger. In addition, the Contractor must have successfully installed an individual length of CIPP in excess of the longest length between manholes listed in the CIPP Liner Thickness Chart in Appendix A. This qualifying experience must have been completed in the United States and within the past 5 years. The Contractor Experience Form and the Superintendent Experience Form are required to be submitted at the same time with the Contractor's Bid Schedule.

713.6 Design Criteria: All liner pipe used to line the existing sewer shall be designed to have a minimum service life of 50 years and to withstand the total vertical and lateral loads, including, but not limited to, soil load, live loads and hydrostatic loads. Design shall be based on the assumption that the existing carrier pipe provides no structural support to the liner pipe, except for transmitting loads. No design shall rely on bonding to the existing carrier pipe wall

The following design criteria shall be utilized to develop suitable structural and corrosion resistant design for the pipe:

713.6.1 Dead Loads-Design is to be based on the actual depth of soil cover above the top of the pipe. The Contractor shall use the manhole depths and pipe diameters (listed on the plan set) to approximately calculate the actual depth of soil cover near the manholes. Assume a soil weight of 120 pounds per cubic foot and a modulus of soil reaction (E's) of 1,000 psi. The assumed minimum depth of cleanouts if not specified, is four (4) feet.

713.6.2 Live Loads - are based on HS20-44 (A.A.S.H.T.O Latest Edition).

713.6.3 Corrosion - All liner pipe, joints, and fittings to be furnished shall be suitable for continuous service in Wastewater environments with 10% sulfuric acid at an average wastewater temperature of 84 degrees Fahrenheit.

713.6.4 Buckling-Pipe design shall incorporate a safety factor of 2.0 for external loads in accordance with ASTM F 1216 Appendix XI.

713.6.5 Hydrostatic Pressure – The water table is at sufficient depth that hydrostatic pressure does not need to be included in the design thickness calculations.

713.6.6 Ovality - Percentage ovality of original pipe equals 2%.

713.6.7 Initial Modulus of Elasticity - Minimum value of flexural tangent modulus of elasticity = 350,000 psi. Minimum value of tensile tangent modulus of elasticity = 350,000 psi.

713.6.8 Long-Term Modulus of Elasticity - Assume this value to be 50% of the initial modulus of elasticity.

713.6.9 Flexural Strength - Minimum value of 4,500 psi.

713.6.10 Tensile Strength- Minimum value of 3,000 psi.

713.6.11 CIPP Liner Thickness - The minimum CIPP liner thickness for use on this project, measured in all cases with the plastic coating or pre-liner tube excluded, shall be the Minimum Liner Thickness as specified in Appendix A: CIPP Liner Thicknesses. *For 6" diameter pipes only, PCRWRD may, at its discretion, permit a liner thickness less than that for a 100% deteriorated pipe.*

713.6.12 Existing sewer pipe is assumed to be 100% deteriorated.

713.7 Submittals: Before commencing any work, the Contractor shall submit the following:

713.7.1 Certifications of the materials including the cell classifications, grades, types of resins, fibers, and all other materials used in the manufacture of the liner pipe.

713.7.2 Complete calculations including list of parameters, all formulas and all other data which are necessary for the design of the liner pipe. Calculations submitted shall use a design temperature of 73.4 (+/- 3.6) degrees Fahrenheit and shall include, but not be limited to: soil loads, live loads, hydrostatic loads, pipe stiffness (PS), Dimension Ratio (DR), flexural modulus, initial and long term (50 years) values of pipe deflection after installation, pipe bending strain, hydrostatic collapse resistance, constrained buckling strength, ovality reduction factor, and allowable installation length. Drawings showing the cross sectional profile of the liner pipe wall and pipe joint details shall also be submitted.

713.7.3 Submit certified copies of test reports on physical and chemical properties of the resin and flexible tube.

713.7.4 Relevant information from the resin manufacturer shall include specifications, characteristics, properties, and methods of application. A written certification that the resin material complies with the required application, along with curing temperature, and duration of the temperature depending upon the sewer size and CIPP Liner thickness shall be submitted. A blanket letter shall not be sufficient in case of varying CIPP Liner thickness and lengths. This information shall be used during field inspection to verify that proper curing procedures are being followed.

713.7.5 Submit copies of curing temperature/time log sheets in an approved format immediately after curing is complete. Information on the temperature range and cure times recommended by the resin manufacturer shall also be submitted for each run of CIPP installed.

713.7.6 Proposed corrective measures to be utilized should an inserted tube fail to extend through the entire pipe reach being rehabilitated.

713.7.7 Proposed emergency action plan including details of any specialized equipment, materials, personnel and regulatory reporting and compliance requirements which may be required should one or more of the following situations occur:

- A. Failure, blowout or collapse of inserted tube during the curing process.
- B. Boiler or heater mechanical failure during the curing process.

- C. Aborting, removing, handling and proper disposal of resin impregnated tube after insertion into carrier pipe but prior to curing.
- D. Mechanical failure of Wastewater flow management equipment prior to a rehabilitated pipe reach being placed back into service.
- E. Finding of incorrect measurement(s) or fabrication error(s) after tube has been inserted into pipe.
- F. Emergency action spill plan for wastewater spill.

Submission and approval of the aforementioned emergency action plan by the Contractor shall not relieve him of his responsibilities to take action for any other emergency, not specifically stated herein, which may arise during the course of the work.

713.8 Inspection: One (1) copy of each video recording shall be delivered to PCRWRD as a permanent record via CD/DVD/portable hard drive. Video recordings shall be formatted in latest Granite XP version used by PCRWRD.

713.9 Specification for CIPP:

713.9.1 This section covers the reconstruction of pipelines and conduits by the installation of a resin-impregnated flexible tube that is inserted and inflated into the original conduit by use of a hydrostatic head or air pressure. When cured, the finished CIPP pipe will be continuous and formed to the original conduit.

This specification references ASTM F1216 and ASTM F1743 which is made a part hereof by such reference and shall be the latest edition and revision thereof. ASTM F 1216 and ASTM F1743 shall govern when this specification does not address installation methods and materials. If there is a conflict between ASTM F1216 or ASTM F1743 and this specification, this specification shall govern.

713.9.2 Materials: Tube - The tube material shall meet the requirements of ASTM F1216, Section 5. The tube shall be sized for the final position in the pipe and shall be fabricated to a size that when installed will form to the internal circumference and length of the original pipe with no noticeable bulges or folds present. Allowance should be made for variations in internal pipe diameters and circumferential stretching during inflation. Stretching and cut of liner shall be within the range of the manufacturer's recommended tolerances. Should inserted liners at the beginning of the project indicate excessive bulges or folds, PCRWRD shall be permitted to request changes in the Contractor's tube fabrication to eliminate said defects. The outside layer of the tube shall be plastic coated with a material that is compatible with the resin system used. The tube shall contain no intermediate or encapsulated impervious elastomeric layers that would prevent the resin from migrating and filling the annular spaces between the host pipe and the cured liner. No materials shall be included in the tube that are subject to delamination in the cured CIPP. *UV cured fiberglass material is not approved as an acceptable material for this project.* PCRWRD reserves the right to direct the Contractor to make changes to the cut of material before or after work commences.

Resin: The resin system shall be isophthalic polyester meeting the requirements of ASTM F1216, section 5.2 except as modified herein. In addition, the resin shall be high-grade corrosion resistant isophthalic polyester specifically designed for the CIPP being installed. The resin vendor must be able to reference the corrosion scale with the resin itself having a heat deflection temperature greater than 100 degrees centigrade. The wall color of the interior pipe surface of the CIPP after installation shall not be of a dark or non-reflective nature that could inhibit proper closed circuit television inspection. No fillers shall be added to the resin without the specific approval of PCRWRD.

713.9.3 Structural Requirements: The CIPP shall be designed as per ASTM F1216 with the following additional requirements:

- Design criteria within Section 713.6.
- External Buckling Design-The CIPP shall be designed as a stand alone pipe in a fully deteriorated condition.

All layers, after the cure, must form one homogenous structural pipe wall with no part of the tube left unsaturated by resin.

713.9.4 Previous CIPP Field Samples: To verify past performance, the manufacturer shall submit a minimum of 5 test results from previous field installations of the same resin system and tube materials as proposed for the actual installation. These test results must verify that the CIPP physical properties as specified in Section 713.9 of these Special Provisions have been achieved in previous field applications. The previous field samples shall be provided to PCRWRD as shop drawing type submittals.

713.9.5 Installation: CIPP installation shall be in accordance with ASTM F1216, Section 7, or ASTM F1743, Section 6, with the following additional requirements:

Resin Impregnation: The quantity of resin used for tube impregnation shall be sufficient to fill the volume of air voids in the tube with additional allowance for polymerization shrinkage and the loss of resin through cracks and irregularities in the original pipe wall. The Contractor shall be responsible for the air monitoring of the work site during the installation of the CIPP, to test for any offsite migration of styrene. The Contractor shall provide air monitoring by an independent party during the impregnation process to determine if applicable air quality standards for the site are being met.

Finish: The finished CIPP shall be continuous over the entire length of an insertion run and be free from visual defects such as foreign inclusions, dry spots, pinholes, wrinkles, seam separation, and delamination. During the warranty period any defects which will affect the integrity or strength of the CIPP shall be repaired at the Contractor's expense, in a manner mutually agreed by PCRWRD and the Contractor.

Wrinkles in the finished project which cause a backwater of one inch or more or reduce the hydraulic capacity of the pipe (wrinkles which exceed five per cent of the pipe diameter) are unacceptable and shall be removed or repaired by the Contractor at no additional cost to PCRWRD. Wrinkles in the finished liner that reduce the structural stability of the existing sewer pipe are unacceptable. If a void between the liner and the existing pipe exists, the Contractor shall repair or replace that section of liner at no additional cost to Pima County. Methods of repair shall be proposed by the Contractor and submitted to PCRWRD review and approval.

Separations of the seams in the finished liner are unacceptable and shall be removed or repaired by the Contractor at no additional cost to PCRWRD. Methods of repair shall be proposed by the Contractor and submitted to PCRWRD review and approval.

Sealing CIPP at Manholes: The CIPP shall make a tight fitting seal with the existing pipe(s) in the manhole. If due to broken or misaligned pipe at the manhole wall, CIPP fails to make a tight seal at any point, the Contractor shall apply a seal at that point. The seal shall be of a resin mixture compatible with the CIPP. The top half of the pipe shall be neatly cut off and not broken or sheared off, a maximum of four (4) inches from the walls, and shall leave a maximum of two (2) inches of CIPP extending from the edge of the channel on both sides. The channel in the manhole shall be a smooth continuation of the pipe(s) and shall be merged with other lines or channels, if any. Channel cross-section shall be U-shaped with a minimum height of half pipe diameter to three-fourths of the pipe diameter for fifteen (15) inches and larger. The side of the channels shall be built up with mortar/concrete to provide benches at a maximum of 1 in 12 pitch towards the channel.

After the curing of the CIPP is complete and inspected, existing active house connection sewers shall be re-opened without excavation, utilizing a remotely controlled cutting device, monitored by CCTV. ***Existing capped house connection sewers shall not be re-opened.*** The cut liner shall have no jagged edges and shall be trimmed smooth

713.9.6 Sealing of House Connection Sewers

The contractor shall provide a resin saturated reinforced piece of CIPP liner, consisting of a brim and vertical section of liner ("top hat") seal, recommended by the lining manufacturer, at each house connection sewer so that no leakage of fluids may infiltrate between the liner and the existing sewer pipe surface. The Contractor shall have a minimum of two complete functional cutters plus key spare components on the jobsite before each installation or in the immediate area of the jobsite that can be quickly obtained. *This project includes six (6) inch diameter sewer to be lined. The Contractor*

shall be solely responsible for appropriate equipment to re-instate service connections without excavation in six inch diameter sewers.

713.9.7 CIPP Testing:

713.9.7.1 The Contractor shall provide restrained samples of the installation by lining through a short piece of pipe of the same diameter of the existing sewer. The sample shall be obtained from either or both ends of the CIPP section so a representative sample of the CIPP lining installed is provided for each reach.

713.9.7.2 Thickness: It is the responsibility of the Contractor to demonstrate to PCRWRD that the CIPP liner wall thickness is not less than the minimum thickness as specified in Appendix A, CIPP Liner Thickness Table. If necessary, the Contractor shall do an additional liner insertion, approved by Pima County, to meet the minimum liner thickness specification requirement or else pay a penalty based on the amount of liner thickness deficit. The monetary penalty option will only be allowed at Pima County's discretion and then only after it has been demonstrated that the installed liner can handle the structural loads imposed upon it.

The monetary penalty for liner thickness deficit shall be calculated as follows:

Penalty per l.f. = (amount of liner thickness deficit in mm/minimum liner thickness specified in mm) x (l.f. bid price of installed liner)

For each inversion or insertion length designated by PCRWRD, one CIPP sample (for testing liner wall thickness) shall be prepared using the stated above in Section 713.9.7.1.

All CIPP samples shall be properly marked with the date of inversion or insertion and the inversion or insertion number, once the sample is removed from the source. The PCRWRD inspector must be present during all sample taking. There shall be no splitting of the sample. If the Contractor wishes to have a sample, he is required to take a separate sample from the source and have it tested at his own expense.

Sample testing shall be compliance with ASTM F 1216, Section 8, as applicable.

713.9.7.3 Water Tightness: The water tightness of the CIPP shall be gauged during or immediately following curing and under a positive head in compliance with ASTM F1216, Section 8. Visual inspection of the CIPP shall be in compliance with ASTM F1216, Section 8.6. After the work is completed for each sewer reach, the Contractor will provide PCRWRD with one copy ~~two copies~~ of the video recording showing the completed work including the restored conditions.

713.9.7.4 Chemical Resistance: The CIPP shall meet the chemical resistance requirements of ASTM F1216, Appendix X2. CIPP samples for testing shall be of tube and resin system similar to that proposed for actual construction. It is required that CIPP samples with and without plastic coating meet these chemical testing requirements.

713.9.7.5 Physical Properties: A minimum of 1 sample of the CIPP from each insertion shall be tested for tensile strength and modulus of elasticity in accordance with the latest version of ASTM D638 utilizing the full thickness of the CIPP and with the plastic coating of pre-liner tube removed. In addition, a minimum of 1 sample of the CIPP from each insertion shall also be tested for flexural strength and the flexural tangent modulus of elasticity in accordance with the latest version of ASTM D790, Procedure A. These tests shall be done utilizing the full thickness of the CIPP and with the plastic coating or pre-liner tube removed. The lower value of the modulus of elasticity from either ASTM D638 or ASTM D790 shall be used to determine whether or not the minimum value for the initial modulus of elasticity has been met for each insertion. If the tests cannot be run on the full thickness of the CIPP in one test, then the testing laboratory shall coordinate with PCRWRD to determine what should be done. If the minimum modulus of elasticity is not met, then the following penalties will apply at the option of PCRWRD:

<u>Modulus of Elasticity Deviation</u>	<u>Penalty</u>
1 to 9,999 psi	\$3.00/linear foot reduction in payment
10,000 to 24,999 psi	\$6.50/linear foot reduction in payment
25,000 to 49,999 psi	\$13.50/linear foot reduction in payment
50,000 to 74,999 psi	\$21.00/linear foot reduction in payment
75,000 psi and greater	Add additional liner thickness to meet the required thickness of liner calculated using the lower modulus of elasticity.

If the minimum tensile or flexural strength is not met, then the following penalties will apply at the option of PCRWRD:

<u>Tensile or Flexural Strength Deviation</u>	<u>Penalty</u>
1 to 199 psi	\$6.00/linear foot reduction in payment
200 to 399 psi	\$12.00/linear foot reduction in payment
400 to 599	\$21.00/linear foot reduction in payment
600 psi and greater	Insert new liner that meets the minimum tensile and flexural strength requirements.

If an additional liner is installed over an existing liner, the Contractor must utilize a procedure whereby the additional liner will adhere to the existing liner in a manner acceptable to PCRWRD.

Strength properties shall be tested per the latest edition of ASTM D790 and ASTM D638. Samples shall be taken from each insertion. Contractor shall ship the samples to an approved (by Engineer) lab for analysis at his expense

Laboratory test results shall be submitted to PCRWRD prior to or with each request for payment for completed CIPP work.

The Contractor can use the following pre-approved laboratories for CIPP sample testing:

Hauser Laboratories
 4750 Nautilus Court South
 Boulder, Colorado 80301
 Tel: (303) 581-0079
 Fax: (303) 581-0195

Ramtech Laboratories
 14104 Orange Avenue
 Paramount, California 90723
 Tel: (562) 633-4824
 Fax: (562) 633-4128

SECTION 714 -- INTENTIONALLY LEFT BLANK

SECTION 715 - PAVEMENT REMOVAL AND REPLACEMENT

Existing pavement may be removed to facilitate sewer rehabilitation. Pavement replacement shall be two (2) inches of asphaltic concrete over four (4) inches of aggregate base course at a minimum or equal to the structural thickness of the existing pavement, whichever is greater, and shall extend the full width of the traffic lane disturbed by pavement removal.

Existing pavement shall be power saw cut (wheel cut not permitted) to provide a clean edge for new pavement. Damaged pavement outside pavement width limits shall be saw cut in perpendicular cuts and shall also be removed and replaced by the Contractor at his expense. Aggregate Base Course shall meet the material and placement requirements of Section 303 of the COT/PC Standard Details and Specifications for Public Improvements. Asphaltic Concrete shall meet the material and placement requirements of Section 406 of the COT/PC Standard Details and Specifications for Public Improvements. Mix No. 1 (Table 406-2, page 226) shall be used in all locations.

Compaction test results for aggregate base course shall be submitted to COTDOT. In addition test results for density, gradation, and asphaltic percent content shall be provided for new asphaltic concrete pavement

SECTION 716 - MISCELLANEOUS OTHER WORK

Miscellaneous other work shall consist of the removal and the replacement of existing improvements that will be encountered within the area of the construction of the project and items of work which are necessary for the completion of the project work and necessary to protect, maintain, serve, and restore the property of the owner to its original and intended use and for other items of work which are not included in any of the bid items of the contract work. This work shall be considered incidental to the Contract work and no measurement or payment shall be made unless expressly approved PCRWRD, in which case it shall be paid for as a FORCE ACCOUNT item.

SECTION 717 - MEASUREMENT AND PAYMENT

717.1 General: The method of measurement and payment for the various items comprising the completed work follows. Payment for the items shall be compensation in full for the furnishing of all overhead, material, labor, tools, equipment, and using or installing appurtenances necessary to complete all the work in a good, neat, and satisfactory manner as shown on the plans or as specified. Each item, fixture, piece of equipment, etc. shall be complete with all necessary connections and appurtenances for satisfactory use or operation. No additional payment will be made for work on appurtenances related to each item unless particularly noted or specified. Measurement shall be made of the completed work in place with no allowance for waste. All work not particularly noted or specified to be included in a bid item is considered appurtenant to the appropriate bid item, and no additional payment shall be made.

The Contractor will receive and shall accept compensation provided for in the Contract as full payment for furnishing all material and for performing all work under the Contract in a complete and acceptable manner, and for all risk, loss, damage or expense of whatever nature arising from this Contract or prosecution of this work.

The *successful* Contractor shall prepare a Schedule of Values for this project and submit it after notification of recommendation for award of contract. The Schedule of Values is an itemized list that has a format similar to the contract Bid Proposal except that additional cost subdivisions are required for lump sum and other items that represent a combination of subordinate components. The purpose of the Schedule of Values is simply to provide Pima County with more detailed information regarding the component cost makeup of lump sum bid items and other combined items in the bid.

717.2 Bid Item No.1: Mobilization: Mobilization will be measured for payment by the lump sum as a single complete unit of work. The basis for payment shall be in accordance to Section 901, Mobilization, of the COT/PC Standards Specifications For Public Improvements.

717.3 Bid Items No.2: Furnish, Operate and Maintain Wastewater Flow Management Systems/Equipment: Measurement on this item shall be by LUMP SUM for preparing a Flow Management Plan acceptable to PCRWRD and furnishing, operating, and maintaining Wastewater flow management systems/equipment necessary to accomplish the sewer rehabilitation work. Payment shall be compensation in full for furnishing all materials, labor and equipment necessary to provide the Wastewater flow management systems/equipment in accordance with the Plans and Specifications.

717.4 Bid Items Nos. 3 – 7: Furnish and Install CIPP Liner in Existing 6", 8", 10", 12", and 15" Gravity Sewer Pipe: The pipe will be measured for payment along the center line of the pipe from the center of manhole to center of manhole. The respective unit prices specified to be paid, per LINEAL FOOT, of rehabilitated pipe, shall be compensation in full for furnishing all pipe, sewer fittings and other materials required for rehabilitating pipe lines by trenchless technology; for laying, setting, and jointing of all pipes and fittings; for all testing, including leakage tests; de-watering by any and all methods; all cleaning up; all labor, tools, and construction equipment; and for all other work and incidental expenses, and for reinstatement of house service connections and laterals if any. Payment includes all costs obtaining necessary permits and licenses, property owner notifications and neighborhood meetings, water required for liner installation and curing, all costs for root removal, removal of service lateral intrusions, and cleaning before video recording, video recording before and after CIPP installation, temporary and all costs for providing traffic control. When the Contractor requests payment from Pima County for constructing a portion of the CIPP work, he is required to submit (with the invoice) redlines of project plans and specifications, laboratory test results, and video recordings which show the as-built information for the completed CIPP work.

717.5 Bid Items No.8: Sealing with "Top Hat" House Connection Sewer: Measurement for this item shall be for sealing EACH existing open (not capped) house service connection with a "Top Hat". Payment shall be compensation in full for furnishing all materials, labor and equipment necessary to seal each house connection sewer in accordance with the Plans and Specifications.

717.6 Bid Item No. 9: Force Account: Measurement and payment for miscellaneous labor, construction, materials, and equipment required for work which is outside of the scope of the contract as bid shall be done as outlined in Section 109-5 EXTRA AND FORCE ACCOUNT WORK of the COT/PC Standard Details and Specifications for Public Improvements, and per Section 315 (Part 3) of the Pima County Regional Wastewater Rehabilitation Department General Conditions. Work under this item must be authorized by the Engineer or his designated representative prior to the commencement of the work. This item will only be used as needed; all the monies for this item may not be spent during the course of construction on this project.

SECTION 718 - PERMITS AND SUBMITTALS

The Contractor shall obtain and pay for all required construction permits and licenses before starting project construction, including but not limited to: PCRWRD Project Observation Permit, PCRWRD Project Construction Permit, TDOT Right-Of-Way Permit, PDEQ Fugitive Dust Activity Permit, and Water Construction Water Permit.

There will be no direct payment to the Contractor for time and expenses related to obtaining the necessary permits and licenses. Payment for obtaining these permits and licenses is understood to be included in the total contract price awarded to the Contractor.

718.1 Formal submittals of the work are considered to be milestones. The periods of time at which these submittals are due are in calendar days and are firm to the extent that the due date will be extended to the next PCRWRD business day should the scheduled due date fall on a Saturday, Sunday, or Holiday. The Contractor shall conduct the work to complete the tasks in accordance with the respective approved schedules

718.2 The Contractor submittals to PCRWRD shall include, but not limited to the following:

SUBMITTALS SCHEDULE		
CIPP		
Item No.	Description	Applicable Section
1.	Contractor Experience Form	713
2.	Superintendent Experience Form	713
3.	Contractor's Calculations for Liner Thickness	713
4.	Wastewater Flow Management Plan	712
5.	Traffic Control Plan	711
6.	Emergency Action Plan	713
7.	Resin Manufacturer's Information	713
8.	Certifications of Materials	713
9.	Confined Space Entry Procedures	712
10.	PCRWRD Project Observation Permit	718
11.	PCRWRD Project Construction Permit	718
12.	PDEQ Fugitive Dust Activity Permit	718
13.	Construction Water Permit	709
14.	TDOT/PCDOT Right-of-Way Permit	711, 718
15.	Residents' Notification Letter And Schedule	712
16.	Pre-Insertion (Pre) Videos and Log Sheets for each insertion	712, 713
17.	Test Results from Field Installations	713
18.	For each Insertion – Samples for tensile and flexural strength, wall thickness, and water tightness	713
19.	Curing temperature/time log sheets	713
20.	After Insertion (Post) Videos and Log Sheets for each insertion	712, 713
21.	Certified Test Results for resin and flexible tube	713
22.	Record As-Built Drawings	707
23.	CCTV Report of completed work including house service connection "top hat" re-activation	719
24.	Final Summary Report	719

SECTION 719 – TELEVISION SPECIFICATIONS

719.1 Closed Circuit Television (CCTV):

The Contractor shall perform a video survey of all sewers shown on the plans proposed for CIPP lining. The Contractor shall be a qualified firm experienced in televised inspection of sanitary sewers. If accumulated sediments are suspected or if so determined by the PCRWRD representative, the sewer line shall be cleaned in order to facilitate an accurate and reliable camera operation. If the Contractor does not have the cleaning capability, then it shall engage a qualified firm experienced in flushing of sanitary sewers to perform the work.

The following is an estimate of the total extent of CCTV requirement for the project:

Pipe Diameter (in inches)	Total Reach Length (LF)
6"	
8"	
10"	
12"	
15"	
TOTAL LENGTH	

As a minimum, the CCTV equipment shall consist of a tilt and pan color camera, capable of illumination and recording features. The data collected shall be PC based software, capable of recording the TV logs. The camera shall be either a boat or tractor capable of centering the camera in the center of the pipeline.

The Contractor is responsible for maintaining sewer service at all times during the CCTV inspection. Because the actual depth of the flow within the sewer may vary greatly throughout each 24hour period, the Contractor shall schedule the CCTV inspection during low flow conditions to maximize exposed pipe surfaces.

The Contractor shall provide PCRWRD with one copy (1) of the indexed video recordings and three (3) copies of completed logs for completed CIPP lengths, with a final Project Summary report with the video inspection on CD-ROMs.

719.2 Sewer Inspection Report:

A report shall be submitted after the completion of CCTV for completed CIPP lengths. The report will serve as a reference book for the project and for future engineering evaluation.

Sewer CCTV Report Content: The report shall contain the following elements:

1. Cover page identifying the subject sewer in the report and the dates of CCTV work;
2. Base map identifying the general location of the sewer lines in the report;
3. Reference map identifying the report subsections as a part of the whole report;

4. Labeled tabs for each subsection;
5. Reference list of all reaches (using PCRWRD identifiers) in the subsection, in the order of upstream to downstream, with a comment column to document any major issues with each reach, and a column identifying the media number it resides on;
6. List of all CD/DVD/portable hard drive media numbers and a subheading of all reaches contained in each unit in recorded order;
7. List of all reaches with a subheading of all digital images recorded for that reach;
8. Copies of all CCTV logs acquired for that subsection, in the order of the reference list.

Report Deliverable:

The report shall be compiled in 3-ring binder format. Three copies of the report shall be submitted to the PCRWRD project manager with each payment request.

719.3 Final Summary Report:

The final report shall summarize the entire project, including a time-line of start and completion dates for the CCTV work detailed in each separate report. All contract issues, project difficulties, scheduling problems, or other specific information relating to the execution of this contract shall be communicated and summarized. Receipt of the final report shall constitute completion of the project.

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APPENDIX A

CIPP LINER THICKNESS TABLE

APPENDIX B

PROPERTY ADDRESSES

1-20-12

APPENDIX C

EXISTING FLOW DATA

APPENDIX B
Cathodic Protection Specifications

CATHODIC PROTECTION SPECIFICATIONS

SECTION 1 – GENERAL

1.1 Description of System

1.1.1 Sacrificial Cathodic protection is required for the following:

- a) Approximately 935 linear feet of 18-inch diameter, well coated, fully welded steel pipe.
- b) 30 each pipe support piles consisting of well coated 14HP89 drive piles, 10WF60 cross brace, 10WF60 pipe saddle, and U-bolt connection hardware
- c) 2 each manhole support piles consisting of 3 each well coated 14HP89 drive piles per manholes.

1.1.2 Cathodic protection relies on a sacrificial anodes system in combination with protective coatings, repair coating, electrical continuity bonds, and test stations to provide a 100-year minimum design life.

1.1.3 Refer to coating specifications for coating and repair coating types.

1.2 Scope of Work

1.2.1 The scope of work includes, but is not limited to, the following:

- a) Install 4 each flush grade test stations, concrete collars, test cables, exothermic welds, and repair coating.
- b) Install 2 each high potential 32 lb. prepackaged sacrificial magnesium anodes and electrical continuity bonds per each of the 29 well coated pipe support piles.
- c) Install 3 each high potential 32 lb. prepackaged sacrificial magnesium anodes and electrical continuity bonds per each of the 3 well coated manhole support piles.

1.2.2 Contractor shall furnish all corrosion engineering services, labor, materials, equipment, and incidentals required for a complete installation of the cathodic protection system.

1.3 Submittals

1.3.1 The following items shall be submitted to the Engineer/Owner for review and approval.

- a) **Materials Submittal:** Include manufacturer information and catalog sheets for anodes, test stations, wire/cable, wire terminals, micarta board and hardware, exothermic weld material, weld covers, and coating repair compound.
- b) **Qualifications:** Include NACE certifications and personnel experience.

- c) Final Report: Include cathodic protection system test data, date tested, test personnel, test equipment used, conclusions, recommendations, and as-built drawings indicating installation locations of anodes, test lead cables, and test stations.

SECTION 2 – MATERIALS

2.1 Prepackaged Magnesium Anodes

- 2.1.1 Prepackaged high potential magnesium anodes shall be used.
- 2.1.2 Pile anodes are to have a bare anode ingot weight of 32 pounds. The nominal combined weight of the anode ingot and backfill mixture shall be approximately 64 pounds.
- 2.1.3 The anode ingot shall contain the following alloy combinations:

Aluminum	0.01% Maximum
Manganese	0.50-1.3% Maximum
Silicon	0.05% Maximum
Copper	0.02% Maximum
Nickel	0.001% Maximum
Iron	0.03% Maximum
Other each	0.05% Maximum
Magnesium	Remainder
- 2.1.4 Anodes shall be packaged in a permeable cloth bag containing a backfill mixture of the following composition:

Ground Hydrated Gypsum	75%
Powdered Bentonite	20%
Anhydrous (Sodium Sulfate)	5%

2.2 Anode Container

- 2.2.1 A 12-inch diameter, Schedule 40 PVC or equal, 30-inch minimum long container shall be used to house the pile magnesium anode. The container shall be capped at the bottom and top.
- 2.2.2 The anode container shall be configured as shown on Drawing No. CP-1, Detail 1 – Anode Container, with 2-inch slots spaced on 7-inch centers. The 2-inch slots openings shall be 1/3 the circumference of the container diameter.
- 2.2.3 A 1-inch diameter hole shall be drilled or cut into the top of the top cap to allow the anode wire to pass through for connection to the pile.
- 2.2.4 The anode container shall be secured to the piling with 2 each 3/8-inch minimum diameter stainless steel bolts, washers, and nuts.

- 2.2.5 A 1-inch steel angle iron shall be welded to the pile below the container for support.

2.3 Test Stations

- 2.3.1 Cathodic protection monitoring test stations shall be flush type test stations such as Brooks 1-RT or equal. The test station cover (lid) shall have the letters "CP" stamped or welded in place. Letters are to be 3-inches tall and clearly legible.
- 2.3.2 Each test station will house a 5-inch by 4-inch by 1/4-inch thick micarta board for termination of the test leads. Each micarta board is to be labeled with the project name, number, and stationing. The station number is to be the pipe station associated with the test station wire connection to the pipeline.
- 2.3.3 Each 2-wire micarta board will be labeled with NORTH or SOUTH depending on what side of the manhole the test wires are connected to the pipe.
- 2.3.4 Each 4-wire micarta board is to be labeled NORTH with the north side wires connected to the top hardware and SOUTH with the south side wires connected to the back side of the bottom hardware.
- 2.3.5 Wire termination hardware is to be 1/4" – 20 brass or stainless steel bolts, lock washers, washers, and nuts.
- 2.3.6 A 6-inch thick concrete collar is to be poured around each test station. The concrete collar shall be 2 by 2-foot square or 2-foot diameter.
- 2.3.7 Concrete for the concrete collar shall be 3,000 pound strength.

2.4 Wire and Cable

- 2.4.1 AWG No. 10 cable shall be stranded single conductor copper with high molecular weight polyethylene (HMWPE) insulation suitable for direct buried.
- 2.4.2 AWG No. 6 cable shall be stranded single conductor copper with high molecular weight polyethylene (HMWPE) insulation suitable for direct buried.
- 2.4.3 Test station wires are to be one AWG No. 10 and one AWG No. 6 per test station. Test station wires are to be exothermic welded to the pipe. Welds are to be spaced 6-inches apart along the top of pipe. Wires are to be connected to the micarta board hardware using non-insulated crimp type ring terminals, suitable for wire size and connection to the brass or stainless steel hardware.
- 2.4.4 For non-brass terminals a corrosion prevention fluid such as No-Ox shall be introduced inside the crimp end of the terminal prior to inserting the test cable.
- 2.4.5 Electrical continuity bond wires are to be minimum AWG No. 6 cable.

2.5 Exothermic Weld Equipment

- 2.5.1 Wire and cable connections to the pipeline and piles shall be made with exothermic weld kits specifically designed by the manufacturer for such applications. Acceptable weld material manufacturers are Cadweld or Thermoweld.
- 2.5.2 Type of exothermic weld and mold shall be as follows:
 - Horizontal connection:
 - No. 10 AWG stranded Cable:
 - Erico – Cadweld: Welder CAHAA-1G, weld metal CA15, copper sleeve CAB-133-1H.
 - Continental – Thermoweld: Welder M-104, weld metal CA15, copper sleeve 38-0208-00.
 - No. 6 AWG stranded cable:
 - Erico – Cadweld: Welder CAHAA-1H, weld metal CA15.
 - Continental – Thermoweld: Welder M-102, weld metal 15CP.
 - Vertical connection:
 - No. 6 AWG stranded cable:
 - Erico – Cadweld: Welder CAVST-1H, weld metal CA15.
 - Continental – Thermoweld: Welder M-144, weld metal 15CP.
- 2.5.3 “One Shot” weld material is not acceptable.
- 2.5.4 Individual components shall not be interchanged between different manufacturers.

2.6 Exothermic Weld Coating

- 2.6.1 All exposed weld, pipe, and cable metallic surfaces are to be coated using a pre-formed weld cap or two part epoxy coating. Locations where weld caps will not fit and/or insufficient to properly cover the exposed metal surfaces, a two part epoxy coating is to be used per manufacturer’s recommendations.
- 2.6.2 Pre-formed weld caps shall be self adhesive, pre-filled, caps designed to cover exothermic weld connections. Acceptable products are Handy Cap IP as manufactured by Chase - Royston Products or ThermOcap PC as manufactured by Continental Industries – Thermoweld.
- 2.6.3 Epoxy coating compound shall be Denso Protal 7200 used with repair cartridge or equal or product per coating specifications for this project.

SECTION 3 – PERFORMANCE

3.1 Electrical Continuity Bonds

- 3.1.1 One electrical continuity bond is to be installed from the pipe saddle to the pipe on the downstream side of the pipe in reference to wash flow.
- 3.1.2 Two each electrical continuity bonds shall be installed on all non-welded joints.

- 3.1.3 Each end of the electrical continuity bond is to be exothermic welded in place.

3.2 Sacrificial Magnesium Anodes

- 3.2.1 Prior to installation the anodes shall be protected from inclement weather. Prepackaged anodes damaged by improper handling or during construction shall be removed from the construction site.
- 3.2.2 Care shall be exercised to preclude damaging the cloth bag and lead cable during installation.
- 3.2.3 Damaged anodes, cloth bags, and/or anodes wires maybe repaired given approval by the Engineer. Repairs are to be inspected and performance of the anode verified prior to reusing the anode.
- 3.2.4 The paper or plastic shipping bags around the outer cloth bag of the packaged anode shall be removed and discarded prior to installation.
- 3.2.5 The anodes shall not be lifted or supported by their lead cable.
- 3.2.6 Just prior to backfilling, anodes shall be thoroughly soaked until the prepackaged backfill is thoroughly saturated.
- 3.2.7 Anodes shall be backfilled with soil free from debris and rocks larger than 4-inches. Native soil is preferred however engineered soil maybe used.
- 3.2.8 Under no circumstance shall an imported sand backfill be used.
- 3.2.9 During backfill the soil around the anode shall be thoroughly soaked with water.
- 3.2.10 Sufficient slack shall be provided in the anode led cable to prevent the lead wire from becoming unduly stressed or broken during backfilling.

3.3 Pile Anodes

- 3.3.1 One 32-pound prepackaged magnesium anode shall be installed on each pile.
- 3.3.2 All pile anodes shall be installed in 12-inch diameter by 30-inch minimum long plastic anode containers.
- 3.3.3 For the pipe support piles, the top of the container shall be located at the bottom of the cross brace.
- 3.3.4 For the manhole support piles, the top of the container shall be located a minimum of 2-feet from the bottom of the concrete structure. The anode wire exothermic weld connection is to be located a minimum 1-foot below the concrete structure.
- 3.3.5 Each container shall rest on a 1-inch coated angle iron welded in place and be bolted in place to the pile beam.
- 3.3.6 The anode leads shall be exothermic welded to the web of the pile beam.

3.3.7 Refer to Drawing CP-2 for installation details.

3.4 Cathodic Protection Test Stations

- 3.4.1 A flush type test station with two test leads shall be installed at Manhole No. 2741-01, station 10+60.67 and Manhole No. 3. The test station and test leads shall be installed on the new steel pipe side of the manhole.
- 3.4.2 A flush type test stations with four test leads shall be installed at Manholes No. 1 and 2. A pair of test leads shall be installed on the pipe on both sides of the manholes.
- 3.4.3 The test station concrete collar shall be located 1-foot from the edge of the manhole. The concrete collar shall be poured in place around each test station.
- 3.4.4 Test leads shall be exothermic welded to the top of the steel pipe a minimum 6-inches apart with the first weld being 1 to 2 feet from the edge of the manhole.
- 3.4.5 To relieve stress on the weld connections, the test lead cables shall be wrapped twice around the pipe. To protect the test lead cables during backfill and from soil scour the leads are to connected to the downstream side of the manhole every 5-foot using pipe tape. The pipe tape shall be wrapped twice around the manhole.
- 3.4.6 Test lead cables shall be brought up into the test station and extended 2-feet minimum above the test station lid. After test station installation the leads shall be coiled inside the test station and terminated on the test station micarta board.
- 3.4.7 Test station leads shall consist of one AWG No. 10 and one AWG NO. 6 cable.
- 3.4.8 Each test station will house a 5-inch by 4-inch by 1/4-inch thick micarta board for termination of the test leads.
- 3.4.9 Micarta board labeling and hardware are to be as called out in Section 2.3.

3.5 Exothermic Weld Connection

- 3.5.1 All electrical continuity bonds and test lead cables shall be attached to the steel pipe and piles by exothermic weld technique and materials.
- 3.5.2 The existing coating shall be removed by chipping or grinding with an emery or sand paper wheel.
- 3.5.3 The steel surface shall be cleaned by filing or grinding with an emery or sand paper wheel until a clean, bright surface, free from dirt, oil, and debris is obtained.
- 3.5.4 Exothermic weld the lead cables in place in accordance with the manufacturer's instructions.
- 3.5.5 Upon completion of the exothermic weld, before application of the coating, the Contractor shall strike the weld with two sharp blows from a hammer to assure proper weld adhesion.

- 3.5.6 All defective welds, loose welds, broken wire strands, and poorly formed welds shall be removed and a new weld performed.
- 3.5.7 The weld area shall be covered with a protective cover or coated with coating repair compound as specified in 2.6 Exothermic Weld Coating.
- 3.5.8 During the welding process only the necessary amount of coating and wire insulation is to be removed. Care shall be taken to prevent excessive damage to the wire insulation.

3.6 Cathodic Protection System Tests

- 3.6.1 All cathodic protection system tests shall be performed by a NACE certified Cathodic Protection Specialist or a NACE certified Corrosion Technologist under the supervision of the Cathodic Protection Specialist.
- 3.6.2 NACE certified personnel shall have five years minimum experience with sacrificial cathodic protection systems for buried metallic pipelines.
- 3.6.3 NACE certification and personnel qualifications shall be submitted to the Owner for review and approval
- 3.6.4 Tests shall be conducted to determine the following:
 - a) Pipeline electrical continuity
 - b) Test station integrity
 - c) Protective potentials at each test station
 - d) Proper connection of test cables to micarta board
- 3.6.5 Final report shall be submitted in accordance with Section 1.3, Submittals and project requirements.

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APPENDIX C
Rebar Coating Specifications

TIE BAR AND REBAR COATING SPECIFICATIONS

1. Submittals

- 1.1 The Contractor shall submit the following items to the Engineer/Owner for review and approval in accordance with project Specification _____, Submittals.
- 1.2 Prior to construction, submit; rebar manufacturer, prefabricated epoxy coating, in field repair coating, dry film thickness (DFT) to be used, and test procedures.
- 1.3 Prior to field installation, submit manufacturer's coating thickness DFT tests results and verification document.
- 1.4 Three days after installation of the tie bar and rebar structure, the Contract shall provide to the Engineer/Owner, documentation showing test results. The document shall include as a minimum test dates, personnel performing tests, and DFT thickness test results performed on prefabricated and repair coating. Performed tests shall be per Section 4. Coating Thickness Tests.

2. Scope of Work

- 2.1 All rebar and tie bars are to be pre-fabricated epoxy coated. Epoxy coating dry film thickness (DFT) shall be the more stringent of 3.75 mils minimum or manufacturer's recommendation for 100 year design life use in concrete in wet soil environment. Pre fabrication epoxy coating shall be designed for coating tie bars and rebar used for this project. Coating application shall be performed per ASTM A884.
- 2.2 All exposed tie bar and rebar metal shall be coated using epoxy repair coating suitable for use in concrete in wet soil environment. Repair coating DFT shall be equal to the pre-fabricated epoxy DFT. The repair coating shall be applied after welding of the ties bars and construction of the rebar cage. Sufficient drying time shall be allowed prior to pouring concrete.

3. Coating Materials

- 3.1 3M Scotchkote™ Fusion Bonded Epoxy Rebar Coating 413 or equal shall be used to coat the tie bars and rebars.
- 3.2 Repair coating shall be a product manufactured by or shown to be compatible with the pre-fabricated epoxy coating.
- 3.3 Harris Supply Solutions is one supplier of epoxy coated tie bars and rebar.

4. Coating Thickness Tests

- 4.1 Coating thickness DFT tests shall be performed by the manufacturer prior to shipping. Type of testing is at the manufacturer discretion. The manufacturer shall provide a signed document verifying the DFT thickness. Results of the tests and verification document shall be submitted to the Engineer/Owner prior to field installation of the product.
- 4.2 Onsite coating thickness DFT tests shall be performed by the Contractor using a coating thickness gauge. The coating thickness gauge shall be in good working condition, designed for testing rebar coating. At contractor's option, in place of the gauge thickness test, holiday coating tests can be performed in accordance with test equipment manufacturer's recommendations.
- 4.3 Pre-fabricated coating tests shall be performed, prior to installation, by random selection of 10% of the tie bars and rebar. One test per selected tie bar and rebar shall be performed and recorded. Results of the tests shall be submitted accordingly.
- 4.4 Repair coating test shall be performed, after sufficient drying time, by random selection of at least one each; weld repair, exposed tie bar and/or rebar end, and surface repair (if any).
- 4.5 The onsite project inspector shall witness testing of the coating thickness.

APPENDIX D
Pamtight Manhole Covers

PAMTIGHT Manhole Covers



PAMTIGHT manhole covers are the optimum choice for applications where air- and watertightness are required. Made from ductile iron — an engineered material that offers many advantages over traditional cast iron — PAMTIGHT covers deliver all the benefits of pressure tightness, resistance to traffic shock and enhanced ergonomics, providing advanced solutions for today's public works departments, engineers and maintenance personnel.

There are over 6 million PAM units in the ground around the world utilizing technically advanced materials and engineering. Our focus on the needs of the end-user — rather than developing products merely to meet a minimum performance standard — led us to ductile iron, a superior alternative to cast iron in terms of weight, strength and designability.

Highlights

- Available in 24" opening
- Two rings:
 - Elastomer sealing ring
 - Polyethylene seating ring
- Fastened by 6 bolts and clamping claws
- Ductile iron
- Class D 400 EN 124
- Exceeds H20 AASHTO loading
- Closed handling box



Pressure Tight Design



PAMTIGHT manhole covers are designed to prevent the infiltration or escape of air and water to a 14-psi (1-bar) positive or negative pressure rating.

- Elastomer sealing ring ensures watertightness (confirmed during seven-day trial in hydraulic laboratory).
- Design incorporating both stainless steel bolts (6) and clamping claws allows higher performance sealing.
- After opening, cover can be put back in any orientation and remain pressure tight.



Safety

PAMTIGHT manhole covers are designed for safe use by installers and maintenance personnel.

- Ductile iron:
 - Product weighs 50% less than typical cast-iron covers, reducing risks of manual material handling (MMH).
 - Safe mode of failure — even in unlikely event that cover dishes and/or cracks, it remains strong and therefore protects the public from accidents.

Strength and Durability

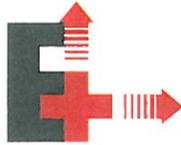
PAMTIGHT manhole covers are designed to be highly durable, a benefit that is made possible by the excellent mechanical performance of ductile iron.

- Three times the load strength of typical cast-iron covers.
- Exceeds the AASHTO (American Association of State Highway and Transportation Officials) H20 heavy duty load resistance requirement and is rated at 100,000 lbs.

- Polyethylene seating ring ensures perfect seating, resistance to traffic shock.
- Bolts are in an enclosed pocket, and thus are not exposed to hydrogen sulfide attack and corrosion through sewer gases. This feature ensures that bolts won't rust to the frame and have to be drilled out.

Ergonomics

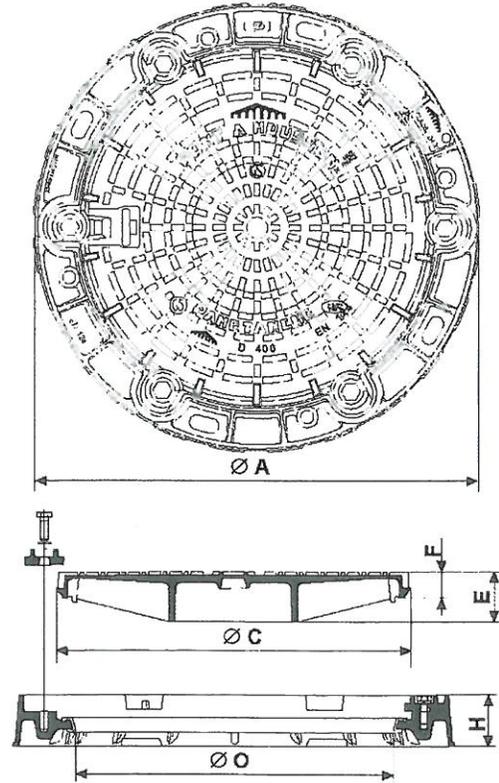
- Clamping device can be rotated and the cover opened simply by loosening the bolts.
- Handling is facilitated by the relatively low cover weight (116 lbs.) and the presence of a closed handling box.
- Bolts do not need to be fully removed to gain access, lessening the chance they'll be misplaced.



Quality Assurance

The PAMTIGHT manhole cover unit has been designed and manufactured within a certified ISO 9000 quality management system, certified by an independent, internationally recognized third party.

- Extensive field testing, including heavy traffic situations.



The PAMTIGHT Range

TYPE	FRAME	REFERENCE	MASS (LBS.)		DIMENSIONS (INCHES)					
			TOTAL	COVER	A	C	E	F	H	O
Pressure	Rcund	CDPE70AF	225	116	33-1/2	26-7/9	3-5/7	2	4	24

Installation Notes:

- Care shall be taken that frame is properly secured to concrete or brickwork shafts.
- Use of anchoring devices is highly recommended.

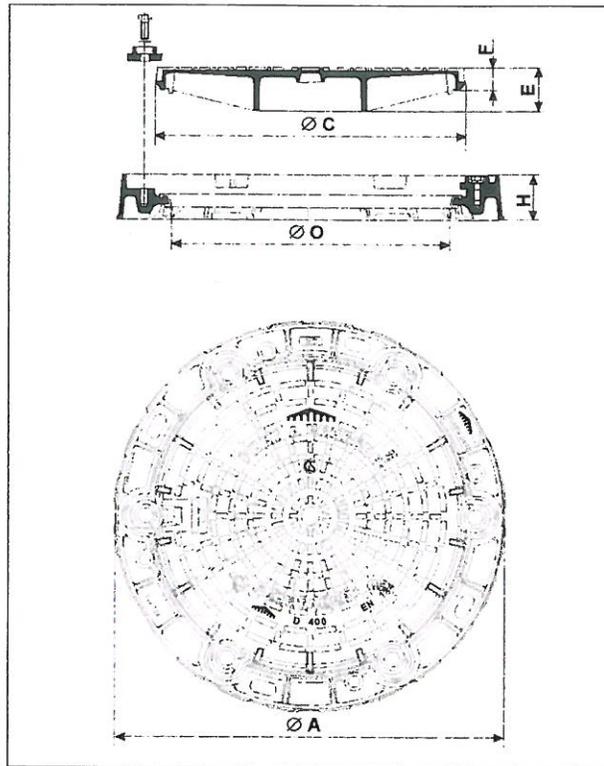
Specification

- PAMTIGHT or similar approved Manhole Cover and Frame.
- Covers and Frames shall be manufactured from Ductile Iron in accordance with ISO 1083.
- Covers shall be one-man operable using standard tools and shall be capable of withstanding an average load of 100,000 lbs.
- Frames shall be circular and shall incorporate a sealing gasket; Frame depth shall not exceed 4".
- Cover shall withstand pressure of 14-psi positive or negative rating.
- The flange shall incorporate bedding slots and bolt holes.
- Cover shall be held in place by six clamping claws with fully enclosed bolts.
- All components shall be black coated.

Technical Specification Information

PAMTIGHT Pressure Tight Manhole Cover and Frame

Manhole cover and frame shall be called PAMTIGHT or approved equal. Cover and frame shall be manufactured from Ductile Iron. Covers shall be fastened to the frame by six clamping claws held by stainless steel bolts. Covers shall incorporate a sealed handling box and be one-man operable using standard tools, and shall be capable of withstanding a test load of 100,000 lbs. Frames shall be circular and be available in a 24-inch clear opening. The frame depth shall not exceed 4 inches, and the flange shall incorporate bedding slots and bolt holes. Cover and frame shall incorporate a seating ring to prevent the ingress and escape of air and water to 14 psi (1 bar) positive or negative. Cover and frame shall be black coated. Frame weight: 109 lbs. Cover weight: 116 lbs. Total weight: 225 lbs. PAMTIGHT is available from **CertainTeed, Tel: (877) 351-3323; Fax: (877) 351-3320**



A inches	O inches	H inches	C inches	E inches	F inches	Reference	Total Weight lbs	Cover Weight lbs
33 1/2	24	4	26 7/9	3 5/7	2	CDPE70AF	225	116



For more information contact:

- Your authorized PAM access covers and gratings distributor.
- U.S. headquarters: 877.351.3323; fax 877.351.3320.
- Or visit www.certainteed-pamcovers.com.

CertainTeed

APPENDIX E
Pile Coating System Specifications

PROTAL 7200

Fast Cure, High Build Pipeline Coating

Description

Protal 7200 is a VOC free, 100% solids, 2 part epoxy coating specially formulated to compliment FBE coated pipe. It is a high build liquid coating that is brush or spray applied (referred to as Protal 7250 in Canada) in one coat in the field or shop. It cures very fast to allow quick handling and backfill times.

Uses

On-site protection of girth welds, tie-ins, welds for boring applications, repairs to FBE, push-rack applications, station piping, fittings and fabrication. Also used for main line pipe coating, sacrificial coating for directional drill and road bore pipe, and rehabilitation of existing pipelines.

Features

- Fast touch dry and set times
- High temperature resistance (up to 185°F)
- High build (up to 50 mils in one coat)
- Excellent adhesion (compliments FBE coated pipe)
- High abrasion resistance for drilling applications
- Safe and environmentally friendly
- Does not shield cathodic protection
- Can be applied with brush, roller or spray
- Available in a variety of packaging options

Application

Brush: Prepare surfaces by grit blasting to a clean near white finish, SSC-SP 10/ NACE No. 2. Appropriate angular grit shall be used to achieve a 2.5 to 5 mil anchor profile. Initially stir the base and hardener. Add the hardener to base and mix at a slow speed until a constant color is achieved making sure all sides of container are scraped. Apply mixed material onto surface and brush, trowel or roll to required mil thickness. A wet film thickness gauge shall be used to measure mil thickness. If surface temperature falls below 50°F (10°C), surface should be preheated to achieve faster cure. Preheat may be achieved with a propane torch or induction coil. Resin and hardener component shall be kept warm, at a minimum of 60°F (15°C), to mix easily.

Spray: Prepare surfaces by grit blasting to a clean near white finish, SSC-SP 10/ NACE No. 2. The equipment should be a plural component airless spray unit with a proportioning pump capable of a volume mixing ratio of 3:1. Standard ancillary equipment should include minimum 10 gallon hoppers, 2 ea. static mixers, 25 ft. max x 1/4" whip hose, and mastic gun with a 19 to 27 thou tip. (Applicator should consult with Denso regarding recommended equipment). Part A should be heated to 140°F - 150°F and Part B heated to 100°F - 110°F. Hose bundle shall be set at 140°F - 150°F. A wet on wet spray technique should be used to achieve a minimum thickness of 20 mils. The coating thickness should be measured using a wet film thickness gauge.

For complete application instructions please refer to Protal 7200 application specifications.



Protal 7200

TECHNICAL DATA

PROPERTIES	VALUE
Solids Content	100%
Base Component - (Unmixed) @ 77°F (25°C)	
Specific Gravity	1.63
Viscosity	255,000 cps
Color	White
Hardener - (Unmixed) @ 77°F (25°C)	
Specific Gravity	1.05
Viscosity	5,500 cps
Color	Dark Green
Mixed Material - (Mixed) @ 77°F (25°C)	
Specific Gravity	1.63
Viscosity	170,000 cps
Color	Green
Mixing Ratio (A/B) by Volume	3 Parts Base: 1 Part Hardener
Cure Times	
Pot Life @ 77°F (25°C)	14 - 17 Minutes
Pot Life @ 97°F (36°C)	7 - 8 Minutes
Handling Time @ 77°F (25°C)	2.5 - 3 Hours
Handling Time @ 117°F (47°C)	1 Hour
Handling Time @ 157°F (69°C)	20 Minutes
Recoat Window	
@ 57°F (14°C)	5 Hours
@ 77°F (25°C)	2 Hours
@ 97°F (36°C)	1 Hour
Theoretical Coverage	14 ft ² /30 mils/liter
Thickness - Weld Joints / FBE Repairs	
Minimum/Maximum	20/60 mils
Recommended	25 - 30 mils
Thickness - Bore Pipe	
Minimum/Maximum	35/60 mils
Recommended	45 - 55 mils
Holiday Detection - based on min. mil. thickness specified	125 volts/mil
Cathodic Disbondment Test (ASTM G95)	
28 Days @ 77°F (25°C)	3 mm
28 Days @ 150°F (65°C)	4 mm
28 Days @ 175°F (80°C)	7 mm
Hardness (ASTM D-2240-02)	Shore D 85 +/-2
Impact Resistance (ASTM G14-88)	60.89 in-lbs.
Adhesion to Steel/FBE (ASTM D-4541-02)	3,200 psi
Application and Service Temperature	-30°F to 185°F (-34°C to 85°C)

Note: If temperature falls below 50°F (10°C), surface must be preheated.

STORAGE: Minimum 24 months when stored in original containers @ 40°F (4°C) to 105°F (41°C). On job site where temperatures are below 50°F (10°C) product should be kept warm to mix properly (65°F to 85°F optimal).

CLEANING: Clean equipment with MEK or equivalent solvent cleaner.

HEALTH AND SAFETY: Wear protective clothing and ensure adequate ventilation. Avoid contact with skin and eyes. See material safety data sheet for further information.

PACKAGING: 1, 1.5, 1.75 and 2 liter kits and 75 liter & 800 liter kits standard. Dual cartridge repair tubes (400 ml & 50 ml) and dispensing guns available for small repair areas.



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Protal 7200

Spray Application Specifications

1.0 Scope

- 1.1 This specification covers the external surface preparation and coating of pipelines for rehabilitation, welds, directional drill, fittings and fabrication.

2.0 Material and Storage

- 2.1 Material shall be Denso Protal liquid coating system as manufactured by Denso North America, 9747 Whithorn Drive, Houston, TX 77095 (Tel) 281-821-3355 (Fax) 281-821-0304 or 90 Ironside Crescent Unit 12, Toronto, Ontario, Canada M1X1M3 (Tel) 416-291-3435 (Fax) 416-291-0898. E-mail: info@denso.com.
- 2.2 Material shall meet the physical properties of the attached product data sheet.
- 2.3 Storage of the material shall be in a warm dry place, between 40°F (4°C) to 105°F (41°C)
The containers shall be stored up right.

3.0 Equipment

- 3.1 Equipment shall be a plural component airless or hydraulic spray unit capable of pumping at the correct ratio for the specified Protal coating (see product data sheet). Heated hoppers, manifolds, and hoses are recommended in most cases. A Graco mastic gun, used with a 19 thou to 27 thou tip size, is recommended.
- 3.2 A solvent such as Xylene, MEK, Toluene, or a combination of the three is recommended to clean the equipment.
- 3.3 Wet film thickness gauges.

4.0 Surface Preparation

- 4.1 All contaminants shall be removed from the steel surface to be coated. Oil and grease should be removed in accordance with SSPC SP-1 using the solvent Xylene.
- 4.2 Material for abrasive cleaning shall be the appropriate blend of grit to produce an angular surface profile of 2.5 - 5 mils (0.063 - 0.125 mm).

- 4.3 All surfaces to be coated shall be grit blasted to a near-white finish (SSPC SP-10, NACE No. 2 or Sa 2 1/2). *Note: Near-white finish is interpreted to mean that all metal surfaces shall be blasted clean to remove all dirt, mill scale, rust, corrosion products, oxides, paint and other foreign matter. Very light shadow, very light streaks or slight discoloration's shall be acceptable; however, at least 95% of the surface shall have the uniform gray appearance of a white metal blast-cleaned surface as defined by Swedish Pictorial Surface Preparation Standard Sa 2 1/2 or SSPC VIS-1.*

- 4.4 Edges of the existing coating shall be roughened by power brushing or by sweep blasting the coating for a distance of 1" (25 mm) minimum.
- 4.5 The Contractor shall check the surface profile depth by using a suitable surface profile gauge (Press-O-Film Gauge or equal).
- 4.6 Metal areas that develop flash rust due to exposure to rain or moisture shall be given a sweep blast to return them to their original blasted condition.

5.0 Application

- 5.1 The surface shall have no condensation, precipitation or any other forms of contamination on the blasted surface prior to coating.
- 5.2 The substrate temperature range for application of Protal is 50°F (10°C) to 212°F (100°C). The substrate temperature must be a minimum of 5°F (3°C) above the dew point temperature before proceeding with the coating operation. Ambient temperature can be lower if the substrate is heated. (Prior to blasting, preheating may be accomplished by either flame heating the surface with a propane torch or induction coil).
- 5.3 Using the prescribed equipment (Sect. 3.0), Protal shall be applied using a wet on wet spray technique to the specified Dry Film Thickness (DFT). Protal 7200 can be applied in a single coat from 20 to 60 mils WFT.
- 5.4 The thickness of Protal should be checked continuously by wet film gauge to achieve the minimum/maximum film thickness specified. Notification to the applicator of any inadequately coated sections must be made immediately and repaired.

6.0 Inspection

- 6.1 The finished coating shall be smooth and free of runs, sags and/or holidays. All surfaces shall have the required minimum/maximum DFT. In general, the surface of the coating shall be no rougher than the base or substrate material.
- 6.2 After the Protal has cured to a hard cure condition, the owner's representative and/or contractor's inspector should measure the film thickness by magnetic gauge and notify the applicator of their acceptance.
- 6.3 For most applications, backfill can be accomplished when the coating reaches a Shore D of 70. The "thumb nail test" can also be used. The thumb nail test is defined by when one can no longer make a permanent indentation in the coating using one's thumb nail.
- 6.4 An acceptable field test to check to see if the coating has a full chemical cure, a solvent such as Xylene, MEK or Toluene can be rubbed on to the coating. If the gloss/sheen is removed the coating is not fully cured.
- 6.5 Spark testing shall be performed to ensure proper film thickness and for holiday inspection. The voltage used for testing weld joints and field applications shall be equal to that used for testing the mainline coating in the field or 125 volts/mil. based on the specified min. mil. thickness.
- 6.6 Denso and/or the owner's representative immediately upon completion of the work shall make final inspection of the completed application. Notification of all defects must be made within a reasonable time frame from completion of the work to allow for all repairs within the allowed time frame for the project.
- 6.7 Recoating: If a second coat is required and passes the cure test as described in section 6.3, the surfaces shall be roughened by sweep blasting. If the coating is soft, no surface preparation is required.

7.0 Repairs

- 7.1 Pinhole repairs may be repaired by using Protal Repair Cartridge. Areas shall be roughened a minimum 1 in. around holiday using Carborundum cloth or 80 grit sandpaper and wiped clean with a xylene soaked cloth prior to patching.
- 7.2 Areas larger than 0.15 sq. in. (0.3 sq. cm.), but less than 1.0 sq. ft. (100 sq. cm.) shall be repaired using a Protal Repair Cartridge. The surface to be coated shall be clean and dry prior to applying the coating. Surfaces below 40°F (4°C) shall be pre-heated in accordance with Section 5.2. Areas requiring repair shall be prepared with a surface grinder or by grit blasting prior to application of the coating. All edges of the surrounding area should be feathered prior to performing the repair.
- 7.3 Refer to "7200 Accelerated Cure Specifications for Repairs" for additional information.

8.0 Safety Precautions

- 8.1 Follow the guidelines detailed in the Material Safety Data Sheets (MSDS).
- 8.2 Keep containers closed when not in use. In case of spillage, absorb with inert material and dispose of in accordance with applicable regulations.
- 8.3 No open flames, smoking or welding will be allowed in the immediate vicinity during the spray application of Protal 7200 liquid coatings.
- 8.4 Always refer to project specifications as they may supersede Denso specifications.



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PROTAL 7200 REPAIR CARTRIDGE

Fast Cure Epoxy Repair Coating

Description

Protal 7200 Repair Cartridges are specially formulated for patching and repairing damaged FBE and other liquid coated pipelines. The repair cartridges are packaged in 2-component tubes that are applied with a dispensing gun (sold separately). Two convenient sizes (400 ml and 50 ml) are available.

Uses

Repair coating for damaged FBE and other liquid coated pipelines. Also used as coating of cadweld areas.

Features

- Excellent adhesion (compliments FBE coated pipe)
- Fast cure
- High build (in one coat)
- High abrasion resistance for drilling applications
- Does not shield cathodic protection

Application

Surface shall be roughened approximately 1" around all repair areas using a Carborundum cloth or 60 to 80 grit sandpaper and then remove the remaining dust with a clean, dry cloth, brush or clean compressed air. Material can be applied by injecting material into a small container and mixing until a uniform color is achieved or utilizing the Protal Static Mixing Tip. Material can then be brush applied to specified mil thickness (minimum 20 mils). Cure times are dependent on temperature and will be extended at cooler temperatures.

*Please refer to "Protal 7200 Accelerated Cure Specifications for Repairs" to achieve a 5 minute cure time.



**Protal 7200
Repair Cartridge
(400 ml)**



**Protal Cartridge Gun
3:1 (400 ml)
Sold Separately**



**Protal Cartridge Gun
3:1 (50 ml)
Sold Separately**



**Protal 7200
Repair Cartridge
(50 ml)**

Denso[®]

Protal 7200 Repair Cartridge

TECHNICAL DATA

PROPERTIES

VALUE

Solids Content/Percent Reactive	100%
Mixed Material - (Mixed) @ 77°F (25°C)	
Specific Gravity	1.63
Viscosity	170,000 cps
Color	Green
Mixing Ratio (A/B) by Volume	3 parts base:1 part hardener
Handling Times	
Substrate Temp. @ 70°F (21°C)	3 hours
Substrate Temp. @ 105°F (40°C)	1 hour
Substrate Temp. @ 140°F (60°C)	30 minutes
Substrate Temp. @ 175°F (79°C)	15 minutes
Substrate Temp. @ 210°F (100°C)	5 minutes
Recommended Thickness	25 - 30 mils
Thickness - Weld Joints / FBE Repairs	
Minimum/Maximum	20/60 mils
Recommended	25 - 30 mils
Thickness - Bore Pipe	
Minimum/Maximum	35/60 mils
Recommended	25 - 30 mils
Cathodic Disbondment	
28 Days @ 77°F (25°C)	3 mm
28 Days @ 150°F (65°C)	4 mm
28 Days @ 175°F (80°C)	7 mm
Adhesion to Steel	3,200 psi
Adhesion to FBE	2,600 psi
Hardness (ASTM 2240)	Shore D 85 min.
Gouge Resistance	3 Passes = 0 Fail @ 50 kg
Application Temperatures*	-30°F to 212°F (-34°C to 100°C)
Service Temperature	-40°F to 185°F (-40°C to 85°C)
Holiday Detection	125 volts/mils
Impact Resistance (ASTM G14-88)	60.89 in-lbs.
Adhesion to Steel/FBE (ASTM D-4541-02)	3,200 psi

*If temperature falls below 50°F (10°C), surface should be preheated.

STORAGE: Minimum 24 months when stored in original containers @ 40°F (4°C) to 105°F (41°C). On job site where temperatures are below 50°F (10°C) product should be kept warm to mix properly (65°F to 85°F optimal).

CLEANING: Clean equipment with MEK or equivalent solvent cleaner.

HEALTH AND SAFETY: Apply under well ventilated conditions. Wear suitable protective clothing and glasses. See material safety data sheets.

PACKAGING: 400 ml and 50 ml dual cartridges.

Dispensing guns and static mixing tips (400ml or 50ml) sold separately.



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