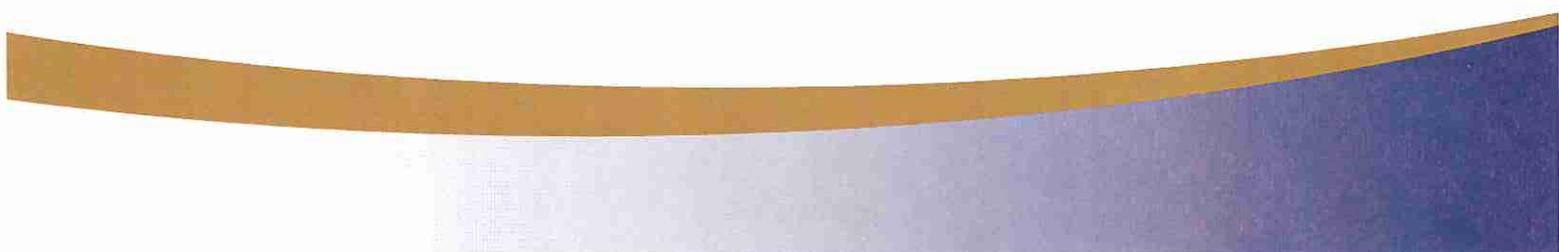


DIVISION 2

SITE CONSTRUCTION



SECTION 02200

EXCAVATION, BACKFILLING AND COMPACTION

PART 1 - GENERAL

1.01 SCOPE OF WORK:

The Contractor shall furnish all labor, materials, equipment, and incidentals necessary to perform all excavation, backfill, grading, and wall protection required to complete the structure and piping work shown on the Drawings and specified herein. The Work shall include but not necessarily be limited to excavation, filling and grading under and around precast and cast-in-place structures to attain the subgrades and grades indicated on the Drawings; trenching operations to install pipe, manholes, vaults, electrical duct conduit, pump station wet wells and valve pits, and other structures, including all backfilling, grading, disposal of surplus and unsuitable materials; and all related work such as sheeting, bracing and water handling.

1.02 QUALITY ASSURANCE:

The Contractor shall perform excavation work in compliance with applicable requirement codes and standards of governing authorities having jurisdiction.

The Owner will engage and pay for soil testing and inspection services for quality control testing during earthwork operations.

1.03 EXISTING CONDITIONS:

Contractor shall comply with L.R.S. 40:1749.11-22, "Louisiana Underground Utilities and Facilities Damage Prevention Law."

1.04 PROTECTION:

- A. Slope sides of excavations to comply with OSHA regulation and any applicable local codes and ordinances. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated. Maintain sides and slopes of excavations in a safe condition until completion of backfilling.
- B. Sheeting and Bracing in Excavations:
 - 1. In connection with construction of below-grade structures and piping, the Contractor shall design, construct, brace, and maintain cofferdams consisting of sheeting and bracing as required to support the sides of excavations, to prevent any movement which could in any way diminish the width of the excavation below that necessary for proper construction, and to protect adjacent structures, existing yard piping and/or foundation material from disturbance, undermining, or other damage. Care shall be taken to prevent voids outside of the sheeting, but if voids are formed they shall be immediately filled and rammed.
 - 2. Trench sheeting for pipes is not to be withdrawn when driven below mid-diameter of any pipe, and no wood sheeting shall be cut off at a level lower than one (1) foot above the top of any pipe unless otherwise directed by the Owner. If during the progress of the Work the Owner decides that additional wood sheeting should be left in place, he may direct the Contractor in writing and the Contractor shall be reimbursed in accordance with the Bid

Documents. If steel sheeting is used for trench sheeting, removal shall be as specified above, unless written approval is given for an alternate method of removal.

3. All sheeting and bracing not left in place shall be carefully removed in such a manner as not to endanger the construction or other structures, existing utilities, existing piping, or personnel and property. Unless otherwise approved or indicated on the Drawings or in the Specifications, all sheeting and bracing may be carefully removed after completion of the substructure. Care shall be taken not to disturb or otherwise injure any finished masonry. All voids left or caused by withdrawal of sheeting shall be immediately refilled with sand by ramming with tools especially adapted to that purpose, by hydraulic compaction or otherwise as may be directed.
4. The right of the Owner to order sheeting and bracing left in place shall not be construed as creating any obligation on his part to issue such orders, and his failure to exercise his right to do so shall not relieve the Contractor from liability for damages to persons or property occurring from or on the Work occasioned by negligence or other cause, growing out of a failure on the part of the Contractor to leave in place sufficient sheeting and bracing to prevent any caving or moving of the ground.
5. The Contractor may construct the cofferdams and sheeting outside the neat lines of the foundation for pipes and manholes, unless indicated otherwise, to the extent he deems it desirable for his method of operation. Sheeting shall be plumb and securely braced and tied in position. Sheeting, bracing, and cofferdams shall be adequate to withstand all pressures to which the existing or new structure will be subjected. Pumping, bracing, and other work within the cofferdam shall be done in a manner to avoid disturbing any completed construction or personnel injury. Any movement or bulging which may occur shall be corrected by the Contractor so as to provide the necessary clearances and dimensions.
6. The Contractor is fully responsible for any design, sheeting, bracing and cofferdams that are required to perform any of the Work under the Contract. As part of his submittal of schedules and other data indicating his planning of the Work, the Contractor shall provide drawings of the planned supporting system, not for review by the Owner but for informational purposes only and use by the Owner in tracking the progress of the Work. Such drawings shall be of sufficient detail to adequately disclose the method of operation that the Contractor plans to use for each of the various stages of construction. The Work shall not be started until such drawings are received.
7. Establish requirements for trench shoring and bracing to comply with OSHA regulations and any applicable local codes and ordinances.
8. Maintain shoring and bracing in excavations regardless of time period excavations will be open. Carry down shoring and bracing as excavation progresses.
9. As an alternate to sheeting, the Contractor is authorized to utilize a mechanical trench box, the size and construction of which shall be submitted to the Owner for review.

C. Dewatering, Drainage and Flotation:

1. The Contractor shall furnish all materials and equipment and perform all work required to install and maintain the drainage systems he proposes for handling groundwater and surface water encountered during construction of structures, pipelines, and compacted fills.
2. The Contractor shall construct and place all pipelines, concrete work, structural fill, bedding, and base course in-the-dry. In addition, the Contractor shall make the final twenty-four

inches (24") of excavation for this work in-the-dry, and not until the water level is a minimum of twelve inches (12") below proposed bottom of excavation.

3. The Contractor shall, at all times during construction, provide and maintain proper equipment and facilities to promptly remove and dispose of all water entering excavations and keep such excavations dry so as to obtain a satisfactory undisturbed subgrade foundation condition, until the fill, structure, or pipes to be built thereon have been completed to such extent that they will not be floated or otherwise damaged by allowing water levels to return to natural elevations.
4. Dewatering shall at all times be conducted in such a manner as to preserve the natural undisturbed bearing capacity of the subgrade soils at proposed bottom of excavation.
5. Wellpoints may be required for predrainage of the soils prior to final excavation for some of the deeper below-ground structures or piping, and for maintaining the lowered groundwater level, until construction has been completed to such an extent that the structure, pipeline, or fill will not be floated or otherwise damaged. Wellpoints shall be surrounded by suitable filter sand and no fines shall be removed by pumping. Pumping from wellpoints shall be continuous and standby pumps shall be provided.
6. If requested by the Owner, the Contractor's proposed method of dewatering shall include a minimum of two (2) 4-inch, Schedule 40, operating groundwater observation wells at each structure to be used to determine the water level during construction of the structure. Locations of the observation wells shall be at structures and along pipelines as approved by the Owner and at additional cost to the Owner prior to their installation.
7. Prior to excavation, the Contractor shall submit his proposed method of dewatering and maintaining dry conditions to the Owner. The Contractor shall be responsible for the satisfactory performance of the system. The Contractor shall be responsible for correcting any disturbance or natural bearing of soils or damage to structures caused by an inadequate dewatering system or by interruption of the continuous operation of the system as specified.
8. As part of the submittal of his dewatering system, the Contractor may be required to demonstrate the adequacy of the proposed system and wellpoint filter sand by means of a test installation. Discharge water shall be clear, with no visible soil particles in a one quart sample.
9. During backfilling and construction, water levels shall be measured in observation wells located as directed by the Owner.
10. Continuous pumping will be required as long as water levels are required to be below natural levels.
11. While dewatering for new construction in the vicinity of existing structures, depletion of the groundwater level underneath these existing structures may cause settlement. To avoid this settlement, the groundwater level under these structures shall be maintained by appropriate methods of construction.

D. Protection of Persons and Property:

1. Barricade open excavations occurring as part of this Work and post with warning lights in accordance with local requirements. Operate warning lights as recommended by authorities having jurisdiction.

2. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining washout and other hazards created by earthwork operations.

PART 2 - PRODUCTS

2.01 SOIL

A. Definitions

1. **Select Material:** Select fill shall conform to LA DOTD designation TR 423 Classes A-I-a, A-I-b, A-3, A-2-4, A-2-6, A-4 or A-6 having a maximum liquid limit of 35 and a maximum plasticity index of 15. This material is referred to as "selected soils" in the DOTD Specifications. Based on an approved geotechnical engineering report, particularly A-6 soils, a higher plasticity index of up to 25 will be considered.
2. **Sand:** Sand embankment shall consist of nonplastic material with at least 75 percent passing the No. 4 sieve and containing not more than 15 percent passing the No. 200 sieve.
3. **Bedding Materials:** Bedding material shall be No. 8, 67 and/or 78 limestone. The limestone shall be one hundred percent (100%) quarried. The stone shall pass the soundness test and abrasion test. Soundness loss shall not exceed fifteen percent (15%) when subjected to five (5) cycles of the magnesium sulfate soundness test in accordance with AASHTO 104. The stone shall show an abrasion loss of not more than forty percent (40%) when tested in accordance with AASHTO 96.
4. **Stabilization Materials:** Stabilization materials shall be one of the following:
 - a. Stabilization materials shall be a blended, manufactured aggregate conforming to the requirements for concrete aggregate as stated in ASTM C33 except for gradation which shall be sizes 8, 67 and/or 78 as specified in ASTM D448.
 - b. Same as bedding except 610 limestone.
5. **Special Stabilization Materials:** Where special stabilization materials are required by the Engineer or called for under a specific Bid Item, the following specification shall apply:
 - a. **General:** The special stabilization material shall be "Perma-Soil" soil stabilizer or approved alternate. This is a product which will dry, strengthen and bond soils so as to increase the load-bearing properties of the soil while minimizing subsidence, without exceeding a compressive strength which would prevent easy re-excavation. It should exhibit quick setting properties.
 - b. **Performance characteristics:** All soils treated with the stabilizer and routinely compacted shall attain unconfined compressive strengths greater than the same soils which are untreated and compacted to 95% of the modified laboratory dry density.

Treated soil should attain a California Bearing Ratio (CBR) of fifty (50) or greater when used in accordance with manufacturer's instructions.

Treated soils shall gain in compressive strength and maintain their size and shape when subjected to damp environments.

Treated soils should attain sufficient strength to allow for repaving, removal of any traffic control devices and provide for the return to normal traffic on any site where the stabilizer is used within one (1) hour or less of the final compaction lift, when used in accordance with manufacturer's instructions.

Treatment of soil will create less than **100 F** exothermic reaction, so as to prevent possible damage to pipe or other underground conduits, plant or animal life. The stabilizer shall not pose a threat of thermal injury to workers, nor will it cause the ground to expand after compaction which would prevent immediate re-paving.

The stabilizer shall be environmentally safe and shall not exceed EPA standards for ingestion or inhalation, nor cause hazards to work crews or the environment.

The stabilizer will be non-corrosive to underground pipe and other conduits.

The stabilizer shall be packaged in water-tight, puncture-resistant fifty pound (50 lb.) pail-type containers to provide ease of handling and storage. Alternate products must be available in containers of a size and weight to allow for ease of handling by one (1) person.

- c. Specific mixing instructions: It is the Contractor's responsibility to insure that proper, updated application instructions from the manufacturer are being followed. The instructions included below are representative of the procedure to be followed, but must be certified as correct by the manufacturer prior to use of the product:

Survey moisture content: All soils must have a minimum of seven percent (7%) moisture content. A quick field check is to squeeze a handful of soil into a ball; if it retains its shape the minimum is present. The only exception to this moisture content is in clay soils without silt or sand (when rubbed between thumb and forefinger this clay will shine). To field test, roll a sample between the hands; it should elongate into a roll, without breaking, down to one-half inch (1/2") diameter. Should it break before reaching one-eighth inch (1/8") diameter it is too dry and more water should be added.

Determine mixture amount: In all soils a minimum mix of one pail (50 lbs.) per cubic yard is required; if the soil is super-saturated with moisture it should have two pails per cubic yard. The clay soil identified above will require some special action to ensure proper reaction. This soil should be broken up with the proper equipment into pieces two to three inches in diameter and completely covered with Perma-Soil stabilizer. If this is done, the proper ratio will be obtained for this soil type. (Perma-Soil stabilizer will assist breaking up the clay structure as it is mixed into the soil.)

Mixing: Mixing should be accomplished with a backhoe or front end loader, where available. When working in clay soil without silt or sand content the procedure described in paragraph B above is necessary to obtain proper reaction and ensure proper mixture ratio of stabilizer to soil. In all other cases the last two lifts, or twelve inches of spoil, should have a higher ratio of stabilizer added to the soil. This is done by holding back one pail to be added and mixed immediately prior to compaction of the last twelve inches (12"). It is not necessary to allow more curing of this spoil.

Curing instructions: This mixture should be allowed to set from forty-five minutes to one hour for curing, or until the mixture becomes compactible. A field check is to squeeze a handful of soil into a ball. When dropped from waist-high it should break into two or three pieces to be at its best compactible state. If it shatters it is too dry. If it stays in one piece and deforms on impact, it is too wet. When this is completed the material is ready to be compacted back in the repair site. Heavy clay soils may take longer to become compactible.

Compaction of the spoil: The material should be replaced in the repair site in six to eight inch (6-8") lifts and compacted so that all air voids are removed. Gasoline rammers and hydraulic tampers can be used to accomplish compaction.

NOTE: VIBRATORY PLATE COMPACTORS ARE NOT SUITABLE FOR COMPACTION EXCEPT FOR OVERLAY MATERIAL OR GRANULAR (NONCOHESIVE SOILS AND THEN ONLY IN THIN LIFTS). COMPACTION WITH THE BACKHOE BUCKET OR ANY OTHER HEAVY APPARATUS NOT DESIGNATED SPECIFICALLY FOR SOIL COMPACTION IS NOT ALLOWED.

Overlaying the repair: When compaction is completed the repair site may be overlaid with overlay material immediately. Traffic should be kept from traveling over the repair site for a minimum of one hour after compaction, or until the overlay material has cured.

5. Sand-Clay-Gravel: Sand-clay-gravel shall be composed of either a natural mixture of sand, clay and gravel, or an artificial mixture prepared by either the mixing of washed sand-gravel and binder; washed gravel or crushed stone, sand and binder; or by the addition of washed gravel or crushed stone to natural sand-clay-gravel. It shall be free from an excess of soft or disintegrated pieces, alkali, adobe, vegetable matter, or other deleterious substances and shall be of such quality that it will compact thoroughly when watered and rolled to form a firm, well-bonded surfacing.
 - a. Physical requirements: When sampled and tested in accordance with standard test methods, the aggregate shall meet the following requirements:

Combined Gradation: When tested in accordance with ASTM C136, or AASHTO T27, the material shall meet the following sieve analyses:

Sieve Sizes	Percent Passing (By Weight)	
	Grade A	Grade B
2-1/2"	100	100
1-1/2"	85-100	85-100
No. 4	40-60	50-75
No. 40	20-45	20-50
No. 200	10-20	12-25

Plasticity Index: When tested in accordance with ASTM D424, or AASHTO T90, the plasticity index of the material passing the No. 40 Sieve shall not be more than six (6) nor less than two (2).

Liquid Limit: When tested in accordance with ASTM D423, or AASHTO T89, the liquid limit of the material passing the No. 40 Sieve shall be not more than 25%.

Either grade may be used unless otherwise shown on the plans or specified in the Special Provisions.

As a matter of information, but no limitation, the several materials may be combined in approximately the following proportions:

	Grade A	Grade B
Gravel or crushed stone, Percent	45	35
Sand, Percent	40	47-1/2
Binder, Percent	15	17-1/2

However, the exact proportion by volume shall be determined by an approved testing laboratory from test samples of the materials proposed to be used.

Binder material shall not have a plasticity index in excess of the plasticity index indicated above for the terminal product.

Usable Excavated Soils: Usable excavated soils, referred to as "usable soils" in LADOTD specifications, shall conform to Classes A-I-a, A-I-b, A-2-4, A-2-5, A-2-6, A-2-7, A-3, A-4, A-5, A-6, A-7-5, and/or A-7-6, except that soils in Classes A-5, A-6, A-7-5 and A-7-6 which are considered unusable by the Owner and any soil with a plasticity index exceeding 60 will not be accepted in accordance with paragraph 203.06 in the DOTD Specifications. Soil shall be tested at Owner's option.

Soil classifications used herein are to be in accordance with the AASHM table for "Classification of Soils and Soil-Aggregate Mixtures (With Suggested Subgroups)" as shown on LADOTD designation TR423.

- (b) General: The Contractor shall notify the Owner of the source of each material and shall furnish to the Owner for testing and approval a representative sample of each material weighing approximately 50 pounds, at least ten (10) calendar days prior to the date of anticipated use of such material.

Additional materials shall be furnished as required from off-site sources and hauled to the site.

Disposal of unsuitable material is specified in this Section, paragraph 203-12.

- (c) Structural Fill: Structural fill shall be used below spread footing foundations, slab-on-grade floors, and other portions of structures, except that, when stabilization layers or courses are shown on the Drawings, stabilization material shall be placed and compacted over the structural fill material in accordance with the requirements for the structural fill.

Select material, bedding material and sand-clay-gravel are acceptable structural fill materials. Any structural fill material encountered during the excavation may be stored in segregated stockpiles for reuse. All material which, in the opinion of the Owner, is not suitable for reuse shall be spoiled as specified herein for disposal of unsuitable materials.

- (d) Trench Backfill: Backfill methods for trenches, as shown on the Drawings, are classified into four (4) zones; bedding, initial backfill, intermediate backfill, and final backfill.

Bedding is the material a minimum of six inches (6") under the pipe up to a level even with six-tenths (0.60) of the outside diameter of the pipe. Limestone, size 8, 67 and/or 78 is the only acceptable bedding material.

Initial backfill is the material above the bedding material to a distance of one foot above the pipe. Acceptable initial backfill material is useable excavated soils (no direct pay) or if directed by the Engineer, use select material, limestone size 8, 67 and/or 78, 610 or sand-clay-gravel.

Intermediate backfill is the material placed above the initial backfill extending up to the final backfill. Acceptable intermediate backfill materials are useable excavated soil (no direct pay) or if directed by the Engineer, use select material, limestone size 8, 67 and/or 78, 610 or sand-clay-gravel.

Final backfill is the material placed in the upper six to eighteen inches (6-18") of the trench after densification of the intermediate trench backfill. Acceptable final backfill materials are the same as intermediate backfill

except in locations under pavements, roads, streets, drives, or walks. Pavement replacements (improved surfaces) over trenches are detailed on the Drawings.

Foundation is the material below the pipe bedding material. Furnish foundation material where shown on the Drawings or where directed by the Engineer. Foundation material shall be as specified for pipe bedding, size 8, 67 and/or 78 limestone.

2.02 EXCAVATION:

A. General

Excavation consists of removal and disposal of material encountered when establishing required grade elevations and in accordance with the Drawings.

1. For situations where it is determined by the inspector that repairs require vertical stack replacement in lieu of trunk line replacement, Contractor will be paid a minimum of Bid Items 1 through 12 (whichever applies) for actual length of excavation at the elevation of the repair (distance below ground) to a maximum length of eight feet (8'), and a minimum length of six feet (6').
2. Where Contractor uses a device which allows a vertical excavation in lieu of the sloped excavation shown on the Drawings, payment for excavation under Bid Items 1 through 12 (whichever applies) shall be based on actual length of pipe replaced plus one (1) foot additional on each end of the replacement pipe. The minimum quantity to be paid under this condition shall be considered to be eight feet (8') in length for main line pipe only.

B. Excavation Classifications:

The following classifications of excavation will be made when unclassified excavation is encountered in the Work. Do not perform such Work until material to be excavated has been cross-sectioned and classified by Owner or specialized geotechnical consultant.

1. Authorized earth excavation includes removal and disposal of pavements and other obstructions visible on ground surface. Other materials encountered that are not classified are unauthorized excavation.
2. Unauthorized excavation consists of removal of material beyond the limits needed to establish required grade and subgrade elevations without specific direction of Owner. Unauthorized excavation, as well as remedial work directed by the Owner shall be at no additional expense to the Owner. Backfill and compact unauthorized excavation, as specified for authorized excavations, except that bedding material as specified above shall be used for backfill under footings, foundation bases, or retaining walls unless otherwise directed by the Owner. If acceptable to the Owner or specialized geotechnical consultant and soil conditions allow the extra loading, the Owner may approve the use of lean concrete fill, reinforced or unreinforced as required by the site conditions and as required by the Owner.

C. Additional Structural Excavation:

When excavation has reached required subgrade elevations, notify the Owner who will contact a specialized geotechnical consultant and make an inspection of conditions.

If unsuitable, unsatisfactory bearing materials are encountered at the required subgrade elevation, carry excavation deeper and replace the excavated material as directed by the Owner.

Removal of unsuitable material and its replacement as directed beyond the authorized limits will be paid on the basis of Contract conditions relative to changes in the Work as provided in Part I, General Provisions.

D. Excavation for Structures:

Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10 feet, and extending a sufficient distance from footings and foundations to permit placing and removal of concrete framework, installation of services, other construction, and for inspection, or as shown on the Drawings.

In excavation for footings and foundations, take care not to disturb bottom of excavation. Excavate by hand to final grade just before concrete reinforcement is placed. Trim bottoms to required lines and grades to leave solid base to receive any required stabilization material or concrete.

in the event that excavations subsequent to the placement of the fill are performed by the Contractor to install piping, conduit, or other appurtenances, any fill placed above the level of the planned excavation shall be fully compacted in accordance with the requirements of this specification prior to beginning the excavation.

2.03 FILL PLACEMENT:

A. General:

1. Material placed in fill areas under and around structures within the pipe trench limits shall be deposited within the lines and to the grades shown on the Drawings or as directed by the Owner, making due allowance for settlement of the material. Fill shall be placed only on properly prepared surfaces which have been inspected and approved by the Owner. If sufficient fill material is not available from excavation on site, the Contractor shall provide borrows as may be required.
2. Ground Surface Preparation: Remove vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placement of fills. Plow strip or break-sloped surfaces steeper than 1 vertical to 4 horizontal so that fill material will bond with existing surface.
3. Fill shall be brought up in substantially level lifts throughout the site, starting in the deepest portion of the fill. The entire surface of the Work shall be maintained free from ruts, and in such condition that construction equipment can readily travel over any section. Fill shall not be placed against concrete structures until they have attained sufficient strength.
4. Fill shall be dumped and spread in layers by a bulldozer or other approved method. During the process of dumping and spreading, all roots, debris, and other objectionable material shall be removed from the fill areas, and the Contractor shall assign a sufficient number of men to this Work to insure satisfactory compliance with these requirements.
5. If the compacted surface of any layer of material is determined to be too smooth to bond properly with the succeeding layer, it shall be loosened by harrowing or by an other approved method before the succeeding layer is placed.
6. All fill materials shall be placed and compacted "in-the-dry." The Contractor shall dewater excavated areas and is required to perform the Work in such manner as to preserve the undisturbed state of the natural inorganic soils.

2.04 COMPACTION:

A. General:

Contractor shall control soil compaction during construction and obtain the minimum required percentage of the total maximum dry densities as specified herein and as shown on the structural or civil drawings. Soil compaction with the backhoe bucket or any other heavy apparatus not designed specifically for soil compaction is not allowed. The Contractor shall maintain the backfill for a period of one (1) year after Final Acceptance and shall restore any backfill that fails and repair any pavement or other structures which may be damaged as a result of backfill failure. It shall be the Contractor's responsibility to notify the Owner in writing that compaction tests of either the nuclear gauge, sand-cone, or other method as required can be performed.

The frequency for density tests will be a minimum of one (1) test per lift per 1,000 linear feet of excavation under pavements, within street and highway rights-of-way, and under building slabs and one (1) randomly selected test per 2,500 linear feet of excavation for open areas (testing of each lift in open areas is not required). If the density tests indicate that the Work does not meet specified density requirements, the Owner may require additional density tests to determine the extent of the deficient Work. The Contractor will not be allowed an extension of Contract Time as a result of any density testing.

It is the Contractor's responsibility to provide equipment and labor as needed to achieve the required compaction as specified herein. Should the rates of compaction fall below the values specified herein, the Owner has the right to instruct the Contractor to alter his work to assure that the required backfill quality is consistently achieved. Any decision by the Owner to forgo such instructions shall in no way relieve the Contractor of his responsibility to provide backfill of the specified quality.

B. Percentage of Maximum Density Requirements:

Compact soil to not less than the following percentages of maximum dry density as determined in accordance with AASHTO T-180 (ASTM D1557) Modified Proctor or seventy-five percent (75%) relative density as determined by ASTM D2049 as applicable.

Structures and 5-feet, 0-inches Around Perimeter of Building: Compact top 36 inches of subgrade and each layer of backfill or fill material to a minimum of ninety-five percent (95%) of the maximum dry density.

Building Slabs: Compact top 12 inches of subgrade and each layer of backfill or fill material to a minimum of ninety-five percent (95%) of the maximum dry density.

Compaction of Backfill Near Highways or Streets: Where the trench limit falls under the roadway pavement or within two (2) feet of the edge of pavement, requiring 610 limestone backfill, and in other areas designated on the plans where future roadways are to be constructed, backfill for the balance of the trench above a point one (1) foot above the top of the pipe shall be placed in layers of not more than six (6) inch compacted thickness and compacted with mechanical tampers or by any satisfactory method or methods that will obtain the density hereinafter specified. The density of compacted material in each layer of backfill shall not be less than ninety-five percent (95%) of the maximum dry density.

Walkways: Compact top six (6) inches of subgrade to a minimum of ninety-five percent (95%) of the maximum dry density.

Driveway Pavements and Steps: Special stabilization material, when required, shall be used to a depth of five feet (5'), or maximum portion thereof for excavations of less than five feet (5') in depth, not to extend below the depth of the top of the pipe. Compact to 95% of the maximum density.

Bedding Material: Compact to a minimum of ninety-two percent (92%) of the maximum dry density.

Compaction of All Other Backfill: Where a trench is in open ground and the backfill is not influenced by the loading conditions as described in the other listed backfilling requirements, the balance of the trench above a

point one (1) foot above the top of the pipe may be filled and compacted in layers of not more than 12 inches to obtain a minimum density of the measured insitu condition prior to excavation. If the Contractor has to dry the excavated soil to a moisture content below the insitu moisture content in order to achieve the required rate of compaction, he shall do so at no additional expense to the Owner. The final surface shall be left in a condition equal to that originally found at the start of the Work.

C. Moisture Control: Condition subgrade or layer material correcting moisture content:

When the material is too dry to be compacted efficiently, the Contractor shall uniformly apply water to surface of subgrade or layer of soil material and thoroughly mix the soil to achieve a moisture content near the optimum level to facilitate compaction.

Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density.

Soil material that has been removed because it is too wet to permit compaction but is otherwise satisfactory may be stockpiled or spread and allowed to dry. The Contractor may assist the drying process by dicing, harrowing or pulverizing to reduce the moisture content to a satisfactory value.

D. Structural fill and base course in open areas shall be placed in layers not to exceed the thicknesses specified above. Each layer shall be compacted to the minimum dry density as stated herein, incidental compaction due to traffic by construction equipment will not be credited toward the required minimum compaction as required for any material.

E. All other fill shall be placed and compacted in a manner similar to that described above for structural fill except that dike or levee fill required below water level in peat excavation areas, may be placed as one lift, in-the-wet, to an elevation one (1) foot above the water level at the time of filling.

F. Areas adjacent to structures and other confined areas inaccessible to roller-type equipment shall be compacted with approved hand-guided mechanical compaction equipment. The Contractor shall also conform to additional backfilling requirements at structures as specified in this Section. Compaction of the fill by such means shall be to the same degree of compaction as obtained by roller type equipment and the Owner may make the necessary tests to determine the amount of compactive effort necessary to obtain connection. Unless such tests indicate that modifications may be made, the fill compacted by mechanical compactors shall be placed in six (6) inch layers and thoroughly tamped over the entire surface. Compaction equipment is subject to approval by the Owner.

2.04 PIPE EXCAVATION AND BACKFILLING:

A. Excavation of all trenches required for the installation of pipes and electrical ducts shall be made to the depths indicated on the Drawings and in such manner and to such widths as will give suitable room for laying the pipe or installing the ducts within the trenches, for bracing and supporting and for pumping and drainage facilities. The bottom of the excavations shall be firm and dry, and in all respects acceptable to the Owner.

B. Where pipes or ducts are to be laid in bedding or encased in concrete the trench may be excavated by machinery to or just below the designated subgrade provided that the material remaining in the bottom of the trench is no more than slightly disturbed.

- C. Where the pipes or ducts are to be laid directly on the trench bottom, the lower part of the trenches shall be excavated to grade by machinery. The material being excavated shall be done in such a manner that will give a flat bottom true to grade so that pipe or duct can be evenly supported on undisturbed material. Bell holes shall be made as required.
- D. Backfilling over pipes shall begin as soon as practicable after the pipe has been laid, jointed, and inspected and the trench filled with suitable compacted bedding material up to a level even with six-tenths (0.60) of the outside diameter of the pipe or as otherwise required on the Drawings. Acceptable pipe bedding material is no. 8, 67 and/or 78 limestone.
- E. All backfilling shall be completed expeditiously and as detailed on the Drawings.
- F. Any space remaining between the pipe and sides of the trench shall be packed full by hand shovel with bedding material no 8, 67 and/or 78 limestone and thoroughly compacted with a tamper as fast as placed in lifts no greater than six (6) inches in thickness, up to a level even with six-tenths (0.60) of the outside diameter of the pipe.
- G. The backfilling shall be carried up evenly on both sides of the pipe with at least one man tamping for each man shoveling material into the trench.
- H. Acceptable initial backfill material, either no. 8, 67 and/or 78 limestone, sand-clay-gravel or select material, shall then be placed and compacted from the top of the bedding material to a minimum depth of one (1) foot above the top of the pipe.
- I. The remainder of the trench intermediate and final backfill shall be select material, no. 8, 67 and/or 78 limestone, special stabilization material, no. 610 limestone, usable excavated soils, or sand-clay-gravel, described above. The trench shall be filled and thoroughly compacted to the required density by acceptably specified methods.

2.06 BACKFILLING AROUND STRUCTURES:

- A. Fill shall be placed in layers having a maximum thickness of eight (8) inches in loose state and shall be compacted sufficiently to prevent settlement. If compaction is by rolling or ramming, material shall be wet down as required. Where material can be suitably compacted by flooding, the Contractor may use this method.
- B. Backfilling shall be carried up evenly on all walls of an individual structure simultaneously. A longitudinal variation of two (2) feet and a horizontal variation of three (3) inches in elevation will be the maximum allowable. No backfill shall be allowed against walls until the walls and their supporting slabs, if applicable, have attained sufficient strength. Backfilling shall be subjected to approval by the Owner.
- C. In locations where pipes pass through building walls, the Contractor shall take the following precautions to consolidate the backfilling up to an elevation of at least one (1) foot above the bottom of the pipes:
 - 1. Place structural fill in such areas for a distance of not less than three (3) feet either side of the center line of the pipe in level layers not exceeding six (6) inches in thickness.
 - 2. Wet each layer to the extent directed by the Owner and thoroughly compact each layer with a power tamper to the satisfaction of the Owner.

3. Structural fill shall be of the quality specified in 203-5 of this Section.
- D. The final finished surface of filled areas shall be graded to smooth, true lines, strictly conforming to grades indicated on the grading plan, and no soft spots or uncompacted areas will be allowed in the Work.
- E. Temporary bracing shall be provided as required during construction of all structures to protect partially completed structures against all construction loads, hydraulic pressure, and earth pressure. The bracing shall be capable of resisting all loads applied to the walls as a result of backfilling.

2.07 GRADING:

- A. General: Uniformly grade areas within limits of grading under this Section, including adjacent transition areas. Smooth finished surface within specified tolerances, compact with uniform levels or slopes between points where elevations are shown, or between such points and existing grades as are required or shown on the Drawings.
- B. Grading Outside Building Lines: Grade areas adjacent to building lines, as shown on the Drawings, to drain away from structures and to prevent ponding. Finish surface free from irregular surface changes, and as follows:

Lawn or Unpaved Areas: Finish areas to within not more than 0.10 feet above or below the required elevation.

Walks: Shape surface of areas under walks to line, grade and cross-section, with finish surface not more than 0.10 feet above or below the required subgrade.
- C. Grading Surface of Fill Under Building Slabs: Grade smooth and even, free of voids, compacted as specified, and to required elevation. Provide final grades within a tolerance of one-half (1/2) inch when tested with a ten (10) foot straightedge.
- D. Compaction: After grading, compact subgrade surfaces to the depth and percentage of maximum dry density for each area classification.
 - (1) Grading shall be performed at such places as are indicated on the Drawings, to the lines, grades, and elevations shown or as directed by the Owner and shall be made in such a manner that the requirements for formation of embankments can be followed. All unacceptable material encountered, of whatever nature within the limits indicated, shall be removed and disposed of in accordance with paragraph 3.07. During the process of excavation, the grade shall be maintained in such condition that it will be well drained at all times. When directed, temporary drains and drainage ditches shall be installed to intercept or divert surface water which may affect the prosecution or condition of the Work.
 - (2) If at the time of excavation it is not possible to place any material in its proper section of the permanent structure, it shall be stockpiled in approved areas for later use. No extras will be considered for the stockpiling or double handling of excavated material.
 - (3) The right is reserved to make adjustments or revisions in lines or grades if found necessary as the Work progresses, due to discrepancies on the Drawings or in order to obtain satisfactory construction.
 - (4) All fill slopes shall be uniformly dressed to the slope, cross section and alignment shown on the Drawings, or as directed by the Owner.

- E. In cuts, all loose material on the back slopes shall be barred loose or otherwise removed to line or finished grade of slope. All cut and fill slopes shall be uniformly dressed to the slope, cross section and alignment shown on the Drawings or as directed by the Owner.
- F. No grading is to be done in areas where there are existing pipelines that may be uncovered or damaged until such lines, which must be maintained, are relocated, or where lines are to be abandoned, all required valves are closed and drains plugged at manholes.

2.07 DISPOSAL OF UNSUITABLE AND SURPLUS MATERIAL:

- A. Unsuitable and surplus excavated materials, unless specified otherwise below, and pavement, shall become the property of the Contractor to be removed and disposed of by the Contractor off the project site to the to the appropriate permitted landfill.
- B. Usable excavated material may be used for fill or backfill if it meets the Specifications and is approved by the Owner. Excavated material so approved may be neatly stockpiled at the site where designated by the Owner provided there is an area available that will not interfere with the Owner's access nor inconvenience traffic or adjoining property owners.
- C. Surplus suitable excavated material shall be used to fill depressions as the Owner may direct.

2.08 FOUNDATIONS:

The Contractor shall furnish and install a foundation for gravity sewer pipe and manholes or other pipes when directed in writing by the Engineer. The foundation shall be 8, 67 and/or 78 limestone and installation shall be same as for bedding

PART 3 – EXECUTION

3.01 MAINTENANCE:

- A. Protection of Graded Areas: Protect newly graded areas from traffic and erosion. Keep areas free of trash and debris and repair and reestablish grades in settled, eroded, and rutted areas to specified tolerances.
- B. Reconditioning Compacted Areas: Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, reshape and compact to required density prior to further construction.

END OF SECTION

SECTION 02740

PAVING AND SURFACING

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

This Section of the Specifications details requirements of work and materials to be used in connection with all hauling, rolling, compacting, and other operations pertaining thereto for the construction of various roadways, driveways, sidewalks, curbs, and gutters all in accordance with the items of work shown on the Plans and contained in the Proposal Form.

1.02 REFERENCED STANDARDS

All work in this Section shall be in accordance with "Louisiana Standard Specifications for Roads and Bridges", 2000 edition with revisions. This standard specification will hereinafter be referred to as "LA DOTD Standards". When the term department is used in this specification, it shall mean Engineer.

PART 2 - PRODUCTS

2.01 ASPHALTIC CONCRETE

Asphaltic concrete pavement materials shall conform to the following Subsections of LA DOTD Standards:

Asphalt	1002.01
Additives	1002.02
Aggregates	1003.01, 1003.06

2.02 PORTLAND CEMENT CONCRETE PAVEMENT

Portland cement concrete and associated paving materials shall conform to the following Subsections of LA DOTD Standards:

Portland Cement Course	901
Joint Materials	1005
Reinforcing Steel and Wire Rope	1009
Curing Materials	1011

All Portland cement concrete used for pavement in this Contract shall be pavement type "B" or "C" as defined by Section 901 of LA DOTD Standards.

2.03 PORTLAND CEMENT CONCRETE, CURBS, AND GUTTERS

Portland cement concrete and associated materials for curbs and gutters shall conform to the following Subsections of LA DOTD Standards:

Portland Cement Concrete (Class A)	902
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Joint Materials	1005
Reinforcing Steel	1009
Curing Materials	1011

2.04 PORTLAND CEMENT CONCRETE, CONCRETE WALKS, DRIVES, AND INCIDENTAL PAVING

Portland cement concrete and associated materials for concrete walks, drives, and incidental paving shall conform to the following Subsections:

Portland Cement Concrete (Class A)	902
Joint Materials	1005
Reinforcing Steel	1009
Curing Materials	1011

2.05 BASE COURSE MATERIALS

Material for the various types of base courses shall conform to the following Subsections:

Hydraulic Cement	1001
Asphalt	1002
Sand, Clay, Gravel	1003.03(A)
Shell	1003.03(B)
Sand - Shell	1003.03(C)
Stone	1003.03(D)
Water	1018.01

2.06 AGGREGATE SURFACE

Material for the various types of aggregate surface courses shall conform to the following Subsections:

Stone	1003.04(A)
Sand Clay Gravel	1003.04(B)
Lime Treated Sand Clay Gravel	1003.04(B), 1018.03
Asphalt Treated Sand Clay Gravel	1003.04(B), 1002.02
Shell	1003.04(C)

Unless otherwise approved in writing, the same type of material shall be used throughout the project.

2.07 LIME TREATMENT

Materials for lime treatment subbase shall conform to the following Subsections:

Emulsified Asphalt	1002.02
Water	1018.01
Lime	1018.03

2.08 RAISED PAVEMENT MARKERS (REFLECTORIZED)

Materials for raised pavement markers (reflectORIZED) shall conform to LA DOTD Standards Section 1015.09b.

2.09 TRAFFIC PAINT

Materials for traffic paint shall conform to LA DOTD Standards Section 1015.12.

PART 3 - EXECUTION

3.01 BASE AND SUBBASE COURSES

This work consists of furnishing and placing a base course or courses on a prepared surface in accordance with these Specifications, in conformity with the lines, grades, thicknesses and typical cross sections shown on the Plans or established by the Engineer. Unless approved in writing, the same base course material shall be used throughout the project.

Base and subbase courses shall conform to the following Sections of LA DOTD Standards:

Base Course	301
Scarifying and Compacting Roadbed	302
In-Place Cement Stabilized Base Course	303
Lime Treatment (Type C)	304
Subbase Treatment	305

All grade courses (roadbeds), base courses, and subbase covers requiring lime stabilization shall be in accordance with "Type C" treatment as specified in Section 304. The Owner has obtained the services of a qualified soils laboratory to recommend the percentage of lime and cement to be incorporated in each type of course to be furnished by the Contractor.

3.02 ASPHALTIC PAVEMENTS

These Specifications are applicable to asphaltic concrete wearing, binder, and base course mixtures of the plant mix type.

This work consists of furnishing and constructing one or more courses of asphaltic concrete mixture applied hot to the prepared and approved foundation in conformance with lines, grades, thicknesses, and typical cross sections shown on the Plans or established by the Engineer within tolerances specified. The mixture shall consist of aggregates and asphalt with additives, combined in such proportions to meet the requirements as specified in the Sections below.

Asphaltic concrete wearing, binder, and base course mixtures shall conform to the following Sections of LA DOTD Standards:

Asphaltic Concrete Mixtures	501
Asphaltic Concrete Friction Course	502
Asphaltic Concrete Equipment and Processes	503
Asphaltic Tack Coat	504
Asphaltic Prime Coat	505
Asphaltic Curing Membrane	506
Asphaltic Surface Treatment	507
Asphalt Treated Drainage Blanket	508
Temperature-Volume Conversion for Asphaltic Materials	509

3.03 PORTLAND CEMENT CONCRETE PAVEMENT

This work consists of constructing portland cement concrete pavement, with or without reinforcement as specified, on a prepared subgrade or base course in accordance with these Specifications in conformity with the lines, grades, thicknesses and typical cross sections shown on the Plans or established by the Engineer.

Portland cement concrete pavement shall conform to Section 601 of LA DOTD Standards.

3.04 AGGREGATE SURFACE COURSES

This work consists of furnishing and constructing aggregate surface courses for roadways, shoulders, drives or other facilities in accordance with these Specifications, and in conformity with the lines, grades, thicknesses and typical Sections shown on the Plans or established by the Engineer.

Aggregate surface courses shall conform to Section 401 of LA DOTD Standards.

3.05 CURBS AND GUTTERS

This work consists of furnishing and constructing curbs and gutters in accordance with these Specifications and in conformity with lines, grades, dimensions and typical sections shown on the Plans and established by the Engineer.

Curbs and gutters shall conform to Section 707 of LA DOTD Standards.

3.06 CONCRETE WALKS, DRIVES AND INCIDENTAL PAVING

This work consists of furnishing and constructing portland cement concrete walks, drives, and incidental paving slabs in accordance with these Specifications and in conformity with lines and grades shown on the Plans or established by the Engineer.

Concrete walks, drives, and incidental paving shall conform to Section 706 of LA DOTD Standards.

3.07 PAVEMENT PATCHING, WIDENING, AND JOINT REPAIR

This work consists of patching, widening, and joint repair of existing pavements in accordance with these Specifications and in conformity with the lines, grades, and typical cross sections shown on the Plans or as established by the Engineer.

Pavement patching, widening, and joint repair shall conform to Section 724 of LA DOTD Standards.

3.08 RAISED PAVEMENT MARKERS (REFLECTORIZED)

This work consists of placing raised pavement markers (reflectORIZED) to replace those covered or removed during the overlaying process.

Raised pavement markers (reflectORIZED) shall be in accordance with Section 731 of the LA DOTD Standards.

3.09 TRAFFIC PAINT

This work shall consist of striping areas as indicated on the plans or as directed by the project engineer.

Traffic paint striping shall be in accordance with Section 737 of the LA DOTD Standards.

3.10 SAWING AND SEALING JOINTS

This work consist of locating, marking, sawing and sealing an asphalt joint over an existing concrete joint. Joints are longitudinal and transverse.

This work shall be in accordance with Section 501, 601 and 1005 of the LA DOTD Standards.

END OF SECTION

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SECTION 02741

PAVING REPAIR AND RESTORATION

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment, and incidentals required and remove and replace pavements over trenches excavated for installation of pipe lines as shown on the Drawings and/or specified herein.
- B. This Section does not include the construction of new roadway surfaces or the complete restoration of existing pavements.

1.02 GENERAL

- A. The Contractor shall keep the surface of the backfilled area of the excavation in a safe condition and level with the remaining pavement until the pavement is restored in the manner specified herein. All surface irregularities that are dangerous or obstructive to traffic shall be removed. The repair shall conform to applicable Owner or State requirements for pavement repair and as described herein.
- B. All materials and workmanship shall be first class and nothing herein shall be construed as to relieve the Contractor from this responsibility. The Owner reserves the right to require soil bearing or loading tests or materials tests, should the adequacy of the foundation or the quality of materials used be questionable.
- C. All street and road repair shall be made in accordance with the details indicated on the Drawings and in accordance with the applicable requirements of the Specifications of the Parish and Louisiana Department of Transportation and Development.
- D. Existing curbing shall be protected. If necessary, curbing shall be removed from joint to -joint and replaced after backfilling. Curbing which is damaged during construction shall be replaced with curbing of equal quality and dimension.

1.03 QUALITY ASSURANCE

- A. Applicable provisions of the Louisiana Standard Specifications for Road and Bridge Construction, latest edition, and Specification hereunder govern the work under this Section.
- B. There shall be no allowances or adjustment of payment for deficient materials or thicknesses. The Contractor shall remove and replace all deficient materials, remove and replace Portland cement concrete pavement that is deficient in thickness, and either remove and replace or provide an additional overlay of a minimum one and one-half inch thickness, including adjustment of any manhole or other utility access covers, for asphaltic concrete pavement courses deficient in thickness.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. All materials utilized in pavement and base course shall be as specified in the Louisiana Standard Specifications for Road and Bridge Construction, 2000 or latest edition, except as modified below.
- B. Asphaltic Concrete Pavement for Parish Streets and Driveways:

Asphaltic concrete used for repair, replacement, and repaving the streets and driveways shall be Type 3 Wearing Course Asphaltic Concrete as specified by LDOTD.
- C. Material used for temporary granular surfaces shall be the same as the base course material specified above with the exception of sand-clay-gravel. Sand-clay-gravel shall not be used as a temporary granular surface.

PART 3 - EXECUTION

3.01 CUTTING PAVEMENT

- A. The Contractor shall cut and remove pavement as necessary for installing the new pipelines and appurtenances and for making connections to existing pipelines.
- B. Before removing pavement, the pavement shall be marked for cuts nearly paralleling pipe lines and existing street lines. Asphalt pavement, including soil-cement or Portland cement concrete base course, and where allowed on concrete driveways and sidewalks shall be cut along the markings with a rotary saw. Concrete street and roadway pavement shall be removed and replaced from joint to joint.
- C. No pavement or base course shall be machine pulled until completely broken and separated along the marked cuts.
- D. The pavement adjacent to pipe line trenches shall neither be disturbed nor damaged. If the adjacent pavement is disturbed or damaged, irrespective of cause, the Contractor shall remove the damaged pavement. The damaged area shall be replaced concurrently with the trench paving and the extra pavement replacement shall not be measured for payment.

3.02 TEMPORARY GRANULAR SURFACE

- A. To provide for the comfort and safety of the traveling public, it is the Contractor's responsibility to provide and maintain temporary granular surface material, or as specified in the plans, up to the top of the adjacent pavement and maintain it at the elevation until the roadway is closed to traffic during the street restoration work. Minimum allowable thickness of the temporary granular surface material shall be the thickness of the adjacent existing pavement. Maintenance shall consist of regrading the temporary granular surface material and of restoring said surface to proper grade and cross section daily or more frequent as directed by the Engineer together with wetting as required for dust abatement.

3.03 GENERAL RESTORATION

- A. The restoration of street paving and extra pavement replacement shall use the same type of

construction as existed prior to the beginning of the Work, unless otherwise allowed in writing by the Engineer and approved by the Owner's, Department of Public Works. The Contractor shall be responsible for restoring all such work, including subgrade and base courses where present. The Contractor shall obtain and pay for at his own expense such local or other governmental permits as may be necessary for the opening of streets and shall satisfy himself as to any requirements other than those herein set forth which may effect the type, quality and manner of carrying on the restoration of surfaces by reason of jurisdiction of such governmental bodies.

- B. The Contractor will be required to maintain without additional compensation all permanent replacement of street paving performed by him under this Contract, until accepted by the Owner, including the removal and replacement of such work wherever surface depressions or underlying cavities result from settlement of trench backfill.
- C. The Contractor shall perform all final resurfacing and repaving of streets or roads over the excavations required as a part of the work. He shall be responsible for relaying paving surfaces of roadway that have failed or been damaged at any time prior to acceptance by the Owner and within the required one (1) year warranty period on account of the work. He shall resurface or repave over any tunnel, jacking, or boring excavation that shall settle, crack or break the roadway surface to the satisfaction of the Owner. Backfilling of trenches and the preparation of subgrades shall conform to the requirements of Section 02315.

3.04 SUBGRADE COMPACTION

- A. Subgrade compaction will be required for all areas to be paved not designated to receive subgrade stabilization. Compaction shall be in accordance with Section 02315 of these Specifications. No base course shall be placed until such time as approved subgrade test results have been delivered to the Engineer. The compacted subgrade shall be shaped to conform with the finished lines, grades and cross sections indicated on the contract drawings.

3.05 BASE COURSE

- A. Base course material shall conform to the requirements of Section 301 of the LADOTD Specifications and shall be constructed on the compacted or stabilized subgrade in conformity with the lines, grades and typical cross sections as shown on the Drawings. when the base is to be constructed to a compacted thickness greater than 6-inches, it shall be constructed in a minimum of two courses of no more than 6-inch thickness for each course. The base shall be constructed in conformance with Section 301 of the LADOTD Specifications except that the base course thickness shall be as shown on the Drawings. Upon completion of the initial compaction, the entire base surface shall be scarified and then shaped to the exact crown and cross section. The finished surface of the base course shall be checked with a template cut to required crown and cross section, and with a 15-foot straight edge laid parallel to the centerline of the road. All irregularities greater than 1/4-inch shall be corrected by scarifying, and removing or adding material as required, rolled and brought to a satisfactory state of compaction. Density requirements shall be in accordance with LADOTD Specifications Section 301.11.

3.06 PRIME AND TACK COATS

- A. The work shall consist of the application of bituminous prime and tack coats on the previously prepared base or asphaltic concrete course in accordance with either Section 504 or 505 of the LADOTD Specifications as applicable.

3.07 PORTLAND CEMENT CONCRETE PAVEMENT

- A. The work shall consist of construction of Portland cement concrete pavement to the thickness indicated in the Drawings conforming to the requirements of Section 601 of the LADOTD Specifications except that the Portland cement concrete shall be in accordance with Section 03300 of these specifications.

3.08 ASPHALTIC CONCRETE COURSES

- A. Within LADOTD Rights-of-way

The work shall consist of the construction of plant-mixed hot bituminous pavement courses to the thickness indicated in the Drawings conforming to Type 3 Wearing Course in accordance with Section 501 of the LADOTD Specifications. The requirements for plant and equipment are specified in Section 503 and the general construction requirements for asphaltic concrete pavement are contained in Section 501 of the LADOTD Specifications.

- B. Asphaltic Concrete Placed On Parish Streets and Driveways

The work shall consist of the construction of plant-mixed hot bituminous pavement courses to the thickness indicated on the Drawings, conforming to Type 3 Wearing course in accordance with these Specifications. The requirements for the plant, equipment, and general construction requirements shall be in accordance with LADOTD requirements for other asphaltic concrete pavements as specified in paragraph "A" above.

3.09 TESTING

- A. All field testing shall be performed by an independent laboratory employed by the Owner. All materials shall be tested and certified by the producer. Tests repeated because subgrade or base does not meet specified compaction shall be borne by the Contractor and at no additional cost to the Owner . Testing frequency shall be as specified for the material being placed in accordance with the applicable requirements of LADOTD and these specifications.

3.10 ADJUSTING EXISTING STRUCTURES

- A. Existing manholes, inlets, valve boxes, etc., within the limits of the proposed work, which do not conform to the finished grade of the proposed pavement or the finished grade designated on the Drawings for such structure shall be cut down or extended and made to conform to the new grade. The materials and construction methods for this work shall be approved by the Engineer.

3.11 MISCELLANEOUS RESTORATION

- A. Sidewalks cut or damaged by construction shall be restored in full sections or blocks to a minimum thickness of four inches. Concrete curb and gutter shall be restored to the existing height and cross section in full sections or lengths between joints . Concrete driveways shall be restored to a minimum thickness of six inches. Grassed yards, shoulders and parkways shall be restored to match the existing sections with grass seed or sod of a type matching the existing grass as required in Section 02920.

3.12 CLEANUP

- A. After all repair and restoration or paving has been completed, all excess asphalt, dirt, and

other debris shall be removed from the roadways. All existing storm sewers and inlets shall be checked and cleaned of any construction debris.

END OF SECTION

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SECTION 02920

LAWNS AND GRASS

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. Work to be performed under this section shall be either restoration or establishment of vegetative cover for aesthetic and erosion control purposes. This work shall be considered incidental to other work in the contract. The Contractor shall make investigations of the project to determine types of existing vegetative cover that will require restoration and shall take all measures necessary to restore the vegetative cover in like kind to that which existed prior to the beginning of the Work.
- B. Furnish all labor, materials, and equipment necessary to satisfactorily return all construction areas to their original conditions or better.
- C. Work includes furnishing and placing seed or sod, fertilizer, planting, watering, and maintenance until acceptance by the Owner.
- D. Reestablish vegetative cover in all areas where such cover existed prior to beginning of the Work.

1.02 QUALITY ASSURANCE

A. Requirements

It is the intent of this specification that the Contractor is obliged to deliver a satisfactory stand of grass as specified. If necessary, the Contractor shall repeat any or all of the work, including grading, fertilizing, watering, and seeding or sodding until a satisfactory stand is obtained.

B. Satisfactory Stand

For purposes of grassing, a satisfactory stand of grass is herein defined as a full lawn cover of the predominant vegetative species existing prior to the beginning of the Work over areas to be seeded or sodded, with grass free of weeds, alive and growing, leaving no bare spots larger than 1 sq. yd. within a radius of 10 feet.

- C. If a satisfactory stand of grass has not been obtained within a reasonable period of time, the Engineer shall instruct the Contractor in writing that the vegetative cover is not adequate and that additional measures as determined by the Engineer, including installation of sodding on areas previously treated with seed applications, shall be undertaken by the Contractor to establish the required satisfactory stand of grass.

1.03 REFERENCE

- A. All work shall conform to general requirements and references of the Louisiana Standard Specification for Roads and Bridges, latest edition.

PART 2 - MATERIALS

2.01 MATERIALS

A. Fertilizer

Fertilizer shall be in accordance with LADOTD Specifications latest revision, Section 718.

B. Seeding

1. The Contractor shall sow grass seed on all unpaved areas disturbed during construction which do not require sod. All seeding shall be completed in conformance with LADOTD Specifications latest revision, Section 717. The grassed areas shall be mulched and fertilized in accordance with LADOTD Specifications.
2. The following grass species may be established by seeding procedures.
 - a. Hulled Bermuda
 - b. Pensacola Bahia
 - c. Kentucky 31 Fescue
 - d. Crimson Clover

C. Sodding

1. Sod shall be provided as required in accordance with LADOTD Specifications latest revision, Section 714. The Contractor shall furnish sod equal to and similar in type as that disturbed. Placement and watering requirements shall be in accordance with LADOTD requirements.
2. The following grass species shall be established by sodding procedures:
 - a. Carpet
 - b. St. Augustine
 - c. Centipede
 - d. All other species not listed under Seeding
3. In addition to the above list, the following areas shall have vegetative cover restored by sodding procedures irrespective of the grass species.
 - a. Slopes steeper than four (4) horizontal and one (1) vertical.
 - b. Locations subject to concentrations of water flow or erosion including but not limited to roadway ditch bottoms and flume areas where storm water runoff is concentrated.
 - c. Repair of eroded areas within areas previously seeded.

D. Topsoil

Topsoil stockpiled during excavation may be used. If additional topsoil is required to replace topsoil removed during construction, it shall be obtained off site and provided by the Contractor. Topsoil shall be fertile, natural surface soil, capable of providing an adequate growing medium for all trees, plants, and grassing specified herein.

E. Mulch

Mulch shall be in accordance with LADOTD Specifications latest revision, Section 716.

F. Water

It is the Contractor's responsibility to supply all water to the site, as required during seeding and sodding operations and through the maintenance period and until the work is accepted. The Contractor shall make whatever arrangements may be necessary to ensure an adequate supply of water to meet the needs for his work. He shall also furnish all necessary hose, equipment, attachments, and accessories for the adequate irrigation of lawns and planted areas as may be required. Water shall be suitable for irrigation and free from ingredients harmful to plant life.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Finish Grading

Areas to be seeded or sodded shall be finish graded, raked and debris removed. Soft spots and uneven grades shall be eliminated; the Engineer shall approve the finish grade of all areas to be seeded or sodded prior to application of seed or sod.

B. Time of Seeding and Sodding

When the trench backfill has stabilized sufficiently and for a period of time not to exceed sixty (60) days from the initial removal of the vegetative cover, the Contractor shall commence work on lawns and grassed areas, including fine grading as required and in accordance with the following:

1. Seed for specific grass species shall be placed in accordance with Table 1 of Section 717 of the LADOTD Specifications.
2. Sod may be placed during the period of January through October 20, but no sod shall be placed during the period of October 21 through December 31.

C. Watering

When necessary, additional water shall be applied to seeded and sodded areas, including those locations where trees, shrubs and other vegetative plantings have been replanted or replaced in accordance with the DOTD Standard Specifications, to supplement natural rainfall in accordance with Table A. Water shall be applied with approved sprinkling equipment that will spread the water evenly and in a manner that will not cause erosion of the soil surface. Application of water shall be suspended during any period when temperatures are expected to drop below thirty-five degrees Fahrenheit (35° F) and shall be resumed when the weather

moderates.

D. Protection

Seeded and sodded areas shall be protected against the traffic or other use by placing warnings signs or erecting barricades as necessary. Any areas damaged prior to actual acceptance by the Owner shall be repaired by the Contractor as directed by the Engineer.

3.02 CLEANUP

Soil, mulch, seed, or similar materials spilled onto paved areas shall be removed promptly, keeping those areas as clean as possible at all times. Upon completion of seeding and sodding operations, all excess soil, stones, and debris remaining shall be removed from the construction areas.

3.03 LANDSCAPE MAINTENANCE

- A. Any existing landscape items damaged or altered during construction by the Contractor shall be restored or replaced as directed by the Engineer.
- B. Maintain landscape work for a period of at least ninety (90) days immediately following complete installation of the Work or until Owner accepts project. Watering, weeding, cultivating, restoration of grade, mowing and trimming grass, protection from insects and diseases, fertilizing and similar operations as needed to ensure normal growth and good health for live plant material shall be the responsibility of the Contractor and at no additional cost to the Owner.

TABLE A
WATER REQUIREMENTS FOR ESTABLISHMENT
OF GROWTH OF GRASS

Vegetative Establishment Method	Growth Period	Amount of Water Required (Inches/Acre)*	Frequency and Duration of Application
Seeding	After Initial Planting	0.25	Daily for first two weeks after planting
Seeding	Establishment of Coverage	1.00	Twice weekly for growth period from fifteen to thirty days after planting
Sodding	March 1 through November 5	0.30	Every other day for the first two weeks after placement
Sodding	March 15 through November 20	0.50	Twice weekly for the growth period from fifteen to thirty days after placement
Sodding	Dormant Period January	1.00	Single application to set the

	1 through last day of February		sod then proceed with other applications listed above beginning March 1
Seeding and Sodding	Maintenance of Growth	1.00	Every other week after completion of above applications to maintain growth and coverage

* Quality of water is to be measured by providing a rain gauge on the site mounted 6" above ground level and logging both natural rainfall and supplemental watering on at least a daily frequency.

3.04 REPAIRS TO LAWN AREAS DISTURBED BY CONTRACTOR'S OPERATIONS

Lawn areas planted under this Contract and all lawn areas damaged by the Contractor's operation shall be repaired at once by proper topsoil backfill, soil preparation, fertilizing, and reseeding or sodding, in accordance with the following:

- A. Areas damaged by placement of excavated material where existing grass is still living and more than fifty percent (50%) of the existing grass is left in place shall be repaired by filling depressions and scars created by equipment tires, tracks, or scarification teeth with topsoil, application of fertilizer over the entire area at the rates prescribed for other vegetative cover, hand raking soil to a uniform grade, and assure application of water at rates required for sodding until adequate regrowth of grass and coverage has been obtained.
- B. Areas damaged by placement of excavated material where existing grass has died or where fifty percent (50%) or more of the existing grass has been removed shall be repaired by excavating the dead and/or remaining material to a uniform grade, placing topsoil to regrade the area to its original topography upon placement where sod is required, preparing the ground surface as required including fertilizing, placing seed or sod as applicable under the above specifications, placing mulch as required, and watering as required for other vegetative cover.
- C. Areas damaged by other material or equipment storage or movement shall be repaired as applicable for areas described above for excavation storage.

END OF SECTION

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SECTION 02921

SEEDING AND MULCHING

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

- A. Work consists of providing all labor, material and equipment for installing grass seed and mulch as indicated below.
 - 1. The CONTRACTOR shall furnish and spread mulch and furnish and sow grass seed mixtures on miscellaneous fill areas, borrow areas, permanent cutslopes, roadways, trenches and ditches. The limits to which the above described surfaces are to be seeded shall be prescribed by the ENGINEER. Seeding shall include areas where construction operations have removed the existing grass cover, where such areas have otherwise been denuded of grass cover, or where due to other reasons grass seeding is determined to be necessary.
 - 2. The CONTRACTOR shall maintain the seeded areas until final acceptance thereof and any damage caused to the seeded area shall be repaired by and at the expense of the CONTRACTOR.
 - 3. Where the grass seed and mulch is intended to replace existing grass, the CONTRACTOR has the option of carefully removing the grass surface, keeping it alive during construction, and replacing it once construction is complete. Areas where the existing surface does not re-take shall be replaced by the CONTRACTOR at no additional cost.

1.02 QUALIFICATIONS

- A. Work performed as described in this section shall be done under the supervision of a CONTRACTOR having experience in landscape construction.

1.03 REFERENCE STANDARDS

- A. United States Department of Agriculture (USDA).
- B. State of Louisiana Standard Specifications for Roads and Bridges, 1992 Edition.

1.04 SUBMITTALS

- A. Guaranteed analysis of lawn seed mixture.
- B. Guaranteed analysis of field grass seed mixture.
- C. Samples of seed mixtures.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver grass seed in original containers showing analysis of seed mixture, percentage of pure seed, year of production, net weight, date of packaging and location of packaging.

Damaged packages are not acceptable.

1.06 JOB CONDITIONS

- A. Weather Conditions: Seeding is not permitted during the following conditions:
1. Cold Weather: When air or ground temperature is less than 32 degrees F.
 2. Hot Weather: When air temperatures is greater than 95 degrees F.
 3. Wet Weather: When ground becomes saturated.
 4. Windy Weather: When wind velocity is greater than 30 mph.

PART 2 - PRODUCTS

2.01 SEED MIXTURE

- A. Seed
1. Seeds shall be labeled in accordance with USDA Rules and Regulations under the Federal Seed Act.
 2. Seed shall conform to requirements of Louisiana Law. The minimum percentage of pure live seed and the maximum percentage of weed seed permitted shall be in accordance with Section 2.01C.
 3. Each variety of seed shall be furnished and delivered in separate bags or other containers. Each bag or container shall bear an analysis tag which is a minimum No. 6 standard shipping tag having all information required by the Louisiana Seed Law.
- B. Field grass seed mixtures and application rates shall be:

<u>Seed Mixture</u>	<u>Pounds per Acre</u>	<u>Planting Dates</u>
Hulled Bermuda	30	March - September
Hulled Bermuda	20	February - March
Crimson Clover	25	
Kentucky 31 Fescue	25	September - February
Unhulled Bermuda	20	
Unhulled Bermuda	20	September - February
Crimson Clover	40	
Pensacola Bahia	25	March - September
Bald Clover	25	February - March
Unhulled Bermuda	20	
Vetch (Common)	40	September - October

Unhulled Bermuda	20	
Lespedeza	40	March - May

C. Seed Quality

1. The minimum purity of grass seeds that will be acceptable are as follows:

<u>Variety</u>	<u>Minimum Percentage of Pure Live Seed (Purity Times Germination Including Hard Seed by Count)</u>	<u>Maximum Percentage of Weed Seed, by Count</u>
Hulled Bermuda	83	1
Pensacola Bahia	81	2
Crimson Clover	78	1
Kentucky 31 Fescue	80	1
Unhulled Bermuda	80	1
Balled Clover	80	1
Vetch (Common)	80	1
Lespedeza	80	1

2. Noxious Weeds: Noxious weeds shall be interpreted to mean that list of weeds, except Bermuda, which has been adopted by the Louisiana Seed Commission as being noxious in Louisiana. Noxious weed seeds shall not exceed the limitations prescribed in the regulations and in no case shall they exceed 500 per pound.

Analysis tags shall be removed from each bag or container only by the ENGINEER or an authorized representative.

D. The CONTRACTOR shall furnish suppliers certificate guaranteeing that the seed conforms to the above requirements and USDA certification. Seed shall be delivered to the contract site in unopened containers bearing the USDA and suppliers certificates.

2.02 TEMPORARY SEEDING

During construction, temporary seeding shall be placed as directed. Temporary seeding may be any of the types listed or rye grass. Rye grass is the only acceptable grass for winter cover.

2.03 WATER

A. Water shall be free from oil, acid, alkali, salt and other substances harmful to growth of grass, and shall be from a source approved prior to use.

2.04 VEGATIVE MULCH

A. Mulch shall consist of pine straw, stems or stalks of oats, rye, rice, or the approved straws. The CONTRACTOR may also use hay obtained from various legumes and greases such as lespedezas, vetches, soybeans, Bermuda, Dallis, carpet sedge, fescue or other approved legumes or grasses of any combination thereof. Straw or hay shall be reasonably dry and free from mold, Johnson grass or other noxious weeds.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Verify that grading has been completely correctly. Notify ENGINEER of any discrepancies; do not proceed with work until discrepancies have been resolved.
- B. Seedbed Preparation: Boulders brought to the surface by construction operations shall be buried at least 6 inches below the ground surface. After the seeding areas have been leveled and compacted to the required thickness, it shall be brought to a friable condition by harrowing or otherwise loosening and mixing to a depth of at least 3 inches.
- C. Notify ENGINEER at least 24 hours prior to planting or seeding operations.

3.02 SEEDING

- A. Sowing Seed:
 - 1. Method: The mixture specified herein shall be sown by drilling with either an approved disc, shoe-type grass drill or by mechanical or hand broadcasting.
 - 2. Drilling Seeding: If the drill seeding method is used, the drill shall be regulated to uniformly distribute the seed at the rate specified herein on the areas to be seeded. Where possible to safely operate equipment as determined by the ENGINEER, drilling shall be done crosswise to the general slope. The drill shall be regulated so that the seed is properly placed in the soil and covered with soil to a depth of 1/2 to 3/4-inch.
 - 3. Broadcast Seeding: In areas inaccessible by methods prescribed in 2 above, the seed may be applied by either mechanical or hand broadcasting. When either of these methods are used, the seed shall be applied separately.
 - a. Mechanical Broadcasting: A mechanical broadcaster of either the centrifugal or pull type similar to fertilizer spreaders are acceptable. Any equipment of this type used for broadcast seeding shall be designed and regulated to ensure that the proper seeding rate per acre specified herein is uniformly applied on areas to be seeded.
 - b. Hand Broadcasting: Seed application may be performed by using an approved hand broadcaster or by broadcasting the seed by hand from a sack or other suitable container. Whichever means is used, the seed shall be uniformly applied at the rates specified herein.
 - 4. Immediately after broadcasting the seed they shall be properly covered with soil to the depths prescribed above by means of a hand rake or float. Covering broadcast seed by dragging a log chain or similar device will not be permitted.

3.03 MULCHING

- A. The CONTRACTOR shall furnish and uniformly place after seeding a minimum of 4 tons per acre (1.6 pounds per square yard) of hay mulch on all seeded areas. Mulching material shall not be applied when in the judgement of the ENGINEER and wind velocity is such as to

prevent uniform distribution of the material. The mulch material shall be firmly anchored with a treader or by other approved methods. Treader shall be operated at a depth of 3 to 4 inches and crosswise to all slopes. Mulch shall be anchored at 6- to 12-inch intervals across the slope.

3.04 ESTABLISHMENT

- A. General: The CONTRACTOR will be responsible for proper care of seeded areas while grass is becoming established for a maintenance period of 6 months after completion of treatment on entire project unless desired cover is established in a shorter period of time and the ENGINEER shortens the responsibility period.
- B. Reseeding: The ENGINEER will designate areas requiring reseeding at least 15 days before specified for reseeding. Reseeding shall occur as specified for original seeding unless written permission is obtained from the ENGINEER.
- C. Watering: Water to ensure uniform seed germination and to keep surface of soil damp. Avoid water puddling.

3.05 ACCEPTANCE

- A. Seeded areas will be accepted at end of maintenance period when seeded areas are properly established and otherwise acceptable.

END OF SECTION

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SECTION 02950

POLYVINYL CHLORIDE GRAVITY SEWER PIPE FOR REPAIR AND REPLACEMENT

PART 1 – GENERAL

1.01 SCOPE OF WORK

The Contractor shall furnish all labor, materials, equipment and incidentals required to repair and/or replace gravity sewer pipe and appurtenances as shown on the Drawings and specified herein.

1.02 SUBMITTALS

- A. The Contractor shall submit to the Owner within thirty (30) days after the date of Notice to Proceed, a list of materials to be furnished and the names of the suppliers.
- B. The Contractor shall submit for approval, complete, detailed shop drawings of all PVC pipe and fittings, including materials, descriptions and dimensions.
- C. The Contractor shall submit and shall comply with the pipe manufacturer's recommendations for handling, storing, and installing pipe and fittings.
- D. The Contractor shall submit pipe manufacturer's certification of compliance with these Specifications.

PART 2 - PRODUCTS

2.01 POLYVINYL CHLORIDE (PVC) PIPE

- A. Polyvinyl chloride (PVC) gravity sewer pipe and fittings 4-in. through 15-in. diameter shall conform to the latest edition of ASTM D-3034, SDR 35.
- B. Polyvinyl chloride (PVC) gravity sewer pipe and fittings 18-in. through 27-in. diameter shall conform to the latest edition of ASTM F-679, (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings, T-1 wall.
- C. The supplier shall be responsible for the performance of all inspection and testing requirements specified in ASTM D-3034 or ASTM F-679, as applicable. Complete records of inspections, examinations and tests shall be kept and submitted to the Owner. The Owner reserves the right to perform any of the inspections set forth in the Specifications where such inspections are deemed necessary to assure that material and services conform to the prescribed requirements.
- D. New pipe shall be joined with an integral bell and spigot-type rubber gasketed joint conforming to ASTM D3212. Joints shall permit contraction, expansion and settlement, and yet maintain a watertight connection.
- E. Connections between existing and new pipe shall be jointed with rigid non-shear

couplings as specified herein or, when not available, with flexible elastomer couplings as specified herein.

- F. Pipe shall be furnished in standard laying lengths not exceeding 20 feet.
- G. All fittings and accessories shall be furnished by the pipe supplier and shall have bell and/or spigot compatible with the pipe.

PART 3 - EXECUTION

3.01 DESCRIPTION

- A. Sewer pipe repair and replacement may include, but shall not be limited to, replacement and repair of cracked pipe, broken pipe, faulty tap, protruding tap, sheared joint, dropped joint, manhole connection, service line riser pipe or other similar conditions. All necessary material shall be furnished and installed by the Contractor to ensure proper sewer services after work is completed.
- B. Sufficient barriers and other traffic control methods shall be in place around the excavation at all times as specified in Section 02200. All flow control required for the work is the responsibility of the Contractor. Flow shall not be bypassed to outside of the sanitary sewerage system.
- C. Care shall be exercised during initial excavation of the defective pipe or fittings so as not to disturb the existing pipe and fittings to remain. After the defective pipe has been exposed, the Owner's resident inspector shall authorize additional pipe to be uncovered as is necessary to allow space for the installation of the new pipe.
- D. The defective pipe shall be cut out in such a way that the ends remaining are straight, smooth and free of chips or cracks. The defective pipe shall be removed from the trench and disposed of by the Contractor.
- E. Trenching, bedding, and backfill for the new pipe shall be as described in Section 02200. The finish grade shall match existing.
- F. New pipe or fittings shall be furnished and installed as described herein.

3.02 LAYING POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS

- A. Polyvinyl chloride (PVC) gravity sewer pipe shall be laid in accordance with the instructions of the manufacturer and as specified herein. As soon as the excavation is completed, the defective pipe has been removed, and the remaining existing pipe is prepared to the satisfaction of the Owner's resident inspector, the Contractor shall:
 - 1. Tightly stretch mason's line above sewer trench at parallel intervals of 25 feet (maximum); or where pipe gradient exceeds 1.0 percent, support intervals may be lengthened to 50 feet.
 - 2. Obtain correct grade and alignment for each section of pipe by measuring and plumbing down from this line to invert of pipe.
- B. Embedment of pipe shall conform to the details on the Drawings and in Section 02200.

Bell holes shall be excavated so that after installation only the pipe barrel shall bear upon the trench bottom. Proper selection and placement of bedding and backfill materials are necessary to minimize deflection of the pipe diameter. No blocking under the pipe will be permitted. Pipe laying shall not precede backfilling by more than 100 feet without approval by the Engineer.

- C. The Contractor shall use care in handling and installing pipe and fittings. Storage of pipe on the job site shall be done in accordance with the pipe manufacturer's recommendation and with approval of the Engineer. Under no circumstances shall pipe or fittings be dropped either into the trench or during unloading. The interior of the pipe shall be kept clean of oil, dirt and foreign matter, and the machined ends and couplings shall be wiped clean immediately prior to jointing.
- D. The Contractor shall use a PVC pipe cutter where necessary to cut and machine all PVC pipe in the field. A "full insertion mark" shall be provided on each field cut pipe end. Field-cut pipe shall be beveled with a beveling tool made especially for plastic pipe.
- E. Each length of pipe and each fitting shall be marked with the nominal size, the SDR designation, the name of the manufacturer or his trademark, and the date of manufacture.
- F. Rubber gaskets, if shipped separately from the pipe, shall be marked with manufacturer's identification sizes and proper insertion direction.
- G. Pipe stubs for all manhole connections shall not exceed 2.0 ft. in length. Install caps where required.
- H. The laying of new pipe in finished trenches shall begin at the lowest point, with the spigot ends pointing in the direction of flow. Extreme care shall be exercised to keep pipe in exact alignment and elevation. The interior of the pipe and the jointing seal shall be free from sand, dirt, and trash before installing in the line. Extreme care must be taken to keep the bells of the pipe free from dirt and rocks so joints may be properly assembled without overstressing the bells. The jointing of the pipe shall be done in strict accordance with the pipe manufacturer's instructions and shall be done entirely in the trench.
- I. Connections between existing and new pipe shall be jointed with rigid non-shear couplings with a corrosion resistant 300 stainless steel band for each end and 304 stainless steel adjusting screws capable of sustaining an applied torque in excess of 60 inch-pounds. The coupling shall be a molded unit consisting of a rigid insert surrounded by elastomeric polyvinyl chloride (PVC) which is unaffected by soil conditions and resistant to chemicals, ultraviolet rays, and normal sewer gases. When dissimilar pipe materials are joined, the Contractor shall use non-shear couplings that are resistant to the corrosive action of the soils and sewage, and that provide a permanent watertight joint.

When rigid non-shear couplings are not available for a particular size or material, connections between existing and new pipe shall be jointed with flexible elastomer couplings with a 304 stainless steel band for each end and adjusting screws capable of sustaining an applied torque in excess of 80 inch-pounds. The flexible couplings shall be as manufactured by Fernco, Inc. or approved equal. When dissimilar pipe materials are joined, the Contractor shall use flexible couplings that are resistant to the corrosive action of the soils and sewage, and that provide a permanent watertight joint.

- J. Each time the work on the sewer is halted for more than one (1) hour, the ends of the pipe shall be sealed to prevent foreign material from entering the pipe.
- K. Connections between the service line and a main line which has previously been repaired by a lining process shall be made with six-inch (6") flexible saddle wyes with corrosion resistant series 300 stainless steel clamps capable of sustaining an applied torque of 60 inch-pounds. The saddle shall be a molded unit consisting of an insert surrounded by elastomeric polyvinyl chloride (PVC) which is unaffected by soil conditions and resistant to chemicals, ultraviolet rays, and normal sewer gases.

Pipe shall be removed to expose the full circumference of the liner around the wye connection to allow for installation of the saddle. The interface between pipe and liner on both sides of the wye connection shall be sealed around the entire circumference. Sealant shall be AV-202 Multigrout, as manufactured by Avanti International, or approved equal.
- L. Connections between new pipe and existing manholes shall be made and sealed with a hydraulic cement material having a set time of no more than two (2) minutes; compressive strength of 600 psi at one hour, 1,000 psi at 24 hours; bond of 40 psi at one hour, 80 psi at 24 hours. Such hydraulic cement material shall be Strong-Plug, EMACO 503, Preco Plug, or approved equal.

3.03 CLEANING

Before being laid in place, each section of pipe and fitting shall be thoroughly cleaned. If the entire length of pipe between one or more manholes is replaced, then at the conclusion of the Work the Contractor shall thoroughly clean all of the pipe by flushing with water or other means to remove all dirt, stones, pieces of wood, or other material which may have entered during the construction period. Debris cleaned from the lines shall be removed from the lowest outlet. If, after this outlet cleaning, obstructions remain, they shall be removed.

3.04 TESTING

- A. After the replacement pipe has been installed and cleaned and if the groundwater level is above the pipe, or following a heavy rain, the Owner will examine the pipe for leaks. If defective pipes or joints are discovered at this time, they shall be repaired by the Contractor.
- B. After the replacement pipe has been installed, the Contractor shall smoke test the repaired pipe section. The Contractor will supply all labor, equipment, blowers, smoke bombs, sand bags, and incidentals required for testing.
- C. Smoke testing shall be done in accordance with Section 02957.
- D. If any defective pipes or joints repaired or replaced by the Contractor disclose leakage, then the Contractor shall locate and repair the cause of leakage and retest the line all at no additional cost to the Owner.

END OF SECTION

SECTION 02952

REHABILITATION OF SEWERS BY CURED-IN-PLACE-PIPE (CIPP)

PART 1 – GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall furnish all labor, materials, tools, equipment and incidentals necessary, to provide for the complete rehabilitation of deteriorated sanitary sewer pipes, by forming a new tight fitting liner within the existing pipe. The installation of the cured-in-place pipe (CIPP) within-a-pipe shall be accomplished by the process as described herein. The process in general consists of providing a flexible fiber tube impregnated with an approved resin which is inserted into an existing pipe and cured with heat. Later, the curing is accomplished by circulating heated water to effect the desired cure throughout the length of the tube, extending full length from manhole to manhole. The resin shall be cured into a hard impermeable pipe of the desired thickness, providing a structurally sound, uniformly smooth interior and tight fitting liner within the existing pipe. It shall provide a hydraulic flow approximately equal to, or greater than, the original new sewer capacity.
- B. Contractor shall provide materials, labor, equipment, and services necessary for sewer flow control, pre-installation cleaning, rehabilitation of existing sanitary sewer mains by lining, initial and final Closed Circuit Television inspection (CCTV), and final testing of the CIPP system.
- C. It is the intent of this Section to provide for the rehabilitation of existing sewer host pipe. A resin-impregnated flexible felt tube will be inserted utilizing an inversion process to fit against the original host pipe. The liner is then heated to cure the resin to a hard smooth liner.
- D. CIPP Contractors shall have a minimum of three (3) years of active continuous experience installed CIPP liners in pipe of similar size, length and configuration as proposed in the project. In addition, Contractor shall have successfully installed at least 500,000 feet of CIPP liner product in the wastewater collection system applications.

1.02 REFERENCE STANDARDS

- A. The Contractor shall comply with ASTM F-1216, Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin Impregnated Tube, as well as ASTM F1743, Rehabilitation of Existing Pipelines and Conduits by Pulled-in-Place Installation of Cured-in-Place Thermosetting Resin Pipe (CIPP).

1.03 REGULATORY REQUIREMENTS

- A. Observe and comply with all applicable federal, state and local laws, municipal ordinances, and the rules and regulations of all authorities having jurisdiction over the construction of the project.
- B. Observe and comply with all applicable safety and health standards published by the Secretary of Labor under Section 107, Part 1585 of the Contract Work Hours and Safety Standards Act.
- C. Observe and comply with all applicable safety procedures for entering manholes as "Confined Space Entry".
- D. Observe and comply with all applicable traffic control procedures.
- E. Observe and comply with all applicable OSHA standards. Particular attention is drawn to those safety requirements involving the use of steam.
- F. Contractor shall notify property owners at least twenty-four (24) hours prior to beginning work on any day affecting their service.

1.04 SUBMITTALS

- A. Contractor shall obtain approval of all data requested in this specification prior to beginning work. The Contractor shall submit Material Safety Data Sheets for all products to be used, manufacturer's printed instructions for delivery, storage, preparation, application and finishing information on, physical properties, chemical resistances, etc. Contractor shall follow all recommended procedures outlined by the manufacturer. The test data generated during the project-including but not limited to video inspection and physical tests-shall be submitted to the Engineer upon completion of the work.
- B. Certified copies of all tests reports on the properties of the selected resin and on the liner shall be submitted by the Engineer. Results of additional product testing(s), normally performed for "in-house quality control" and process improvement, shall also be provided to the Engineer, at no cost to the Owner. The Contractor shall provide the Engineer in writing the name and designation of all in in-house quality control test(s) and the sampling frequency of the tests on the resin and liner materials.
- C. Relevant information from the resin manufacture shall include: specifications, characteristics and properties, as well as methods of application. This data shall be submitted to the Engineer for approval. A written certification that the resin material complies with the required application, along with curing temperature, and duration of the temperature (step cooking temperatures/hours at each and final stages) depending upon the sewer size and liner thickness, shall be supplied to the Engineer.

1.05 WARRANTY

- A. During the warranty period, which shall be defined as twelve calendar months after acceptance by the Owner, any defects which will affect the integrity or strength of the liner pipe or hydraulic capacity shall be repaired at the Contractor's expense, in a manner mutually agreed to by the Owner and the Contractor.

PART 2 - MATERIALS

2.01 MATERIALS

- A. The Contractor shall use a thermosetting resin impregnated inversion liner conforming to the requirements of the latest version of ASTM F1216 (Rehabilitate Pipelines by Inversion and Curing a Resin Impregnated Tube), ASTM D5813 (Cured-in-Place, Thermosetting Resin Sewer Pipe), and ASTM F1743 (Rehabilitation of Existing Pipelines and Conduits by Pulled-in-Place Installation of Cured-in-Place Thermosetting Resin Pipe (CIPP)).
- B. The tube shall consist of one or more layers of absorbent non-woven fabric capable of carrying resin, and capable of withstanding installation pressures and curing temperatures. The tube material shall be able to stretch to fit irregular pipe sections and negotiate bends. The outside layer of the tube shall be plastic coated with a material that is compatible with the resin system used. The tube should be fabricated to a size that will fit the internal circumference and the length of the existing pipe when installed. Allowance should be made for circumferential stretch during installation. The inside of the installed tube shall be marked along its full length at regular intervals not to exceed ten (10) feet. Markings shall also include the manufacturer of the liner that must appear in at least one location per setup.
- C. Unless otherwise specified, the Contractor shall furnish a general purpose, unsaturated, polyester or thermosetting vinyl ester resin and catalyst system compatible with the reconstruction inversion process that provides the cured physical strengths and properties specified herein. The resin shall be cured in the presence of steam or water as specified in the curing section in this specification.
- D. Resins shall be shipped directly to the wet-out facility from the resin manufacturer.
- E. PET resins, resin filters, resin additives, and resin enhancement agents are prohibited. Only neat resins are acceptable. Old resins and reworked resins are prohibited, regardless of whether or not they are mixed with new resin.
- F. Catalysts: Primary catalyst shall not exceed 1 percent of resin by volume; secondary catalyst shall not exceed ½ percent of resin by volume.
- G. 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 (CCTV) inspection.
- H. The bond between all CIPP layers shall be strong and uniform. All layers, after cure, shall be completely saturated with resin.

2.02 DESIGN PARAMETERS:

- A. The CIPP system felt and resin composite shall have the minimum physical properties given below and in accordance with the guidelines in the appendix of the latest version of ASTM F1216.
 - 1. Design Life: 50 years
 - 2. Pipe Diameters: Per Contract Documents

3. Ovality: 2%
4. Pipe Condition: Fully deteriorated
5. External Water: ground surface
6. Flexural Strength 4,500 psi
7. Short Term Flexural Modules: 250,000 psi
8. Reduction Factor: 50%
9. Long Term Flexural Modules: 125,000 psi
10. k Enhancement Factor: 7
11. Soil Modules: 1,000 psi
12. Soil Density: 120 pcf
13. Highway Live Load: AASHTO HS20-44
14. Safety Factor: 2 minimum
15. Min. Thickness(= $<10''$): 6 mm
16. Min. Thickness ($>10''$): 7.5 mm
17. If calculations require thicker wall round to the next higher multiple of 0.5 mm.

- B. Any layers of the tube that are not saturated with resin prior to insertion into the existing pipe shall not be included in the required design structural CIPP wall thickness.

2.03 EQUIPMENT

- A. The basic equipment shall consist of a CCTV system, necessary liner materials, stand pipes, pumps, regulators, valves, hoses, boilers, blowers, winches, etc. The equipment shall be capable of performing the specified operations required to install the sewer liner material.

2.04 CLEANING, ROOT REMOVAL, PROTRUDING GASKET REMOVAL, AND INSPECTION

- A. Contractor shall notify the Engineer prior to beginning cleaning activities and preconstruction CCTV inspection.
- B. It shall be the responsibility of the Contractor to remove all loose debris that is located within the sewer pipe. This cleaning will be incidental to the cost of sewer pipe lining. If an obstruction is encountered that cannot be cleared with conventional sewer cleaning equipment, the Engineer should be notified immediately.
- C. Any roots and/or protruding gaskets in the existing sewer pipe shall be cut and removed from the sewer pipe prior to the sewer liner installation. This root and/or protruding gasket cutting and removal shall be incidental to the cost of the sewer pipe lining, and there shall be no direct payment to the Contractor.
- D. Experienced personnel trained in locating breaks, obstacles, and service connections by CCTV will perform CCTV of pipe. The interior of the pipe should be carefully inspected to determine the location of any conditions that may prevent proper installation of the impregnated tube, such as protruding service taps, collapsed or crushed pipe, and reductions in the cross sectional pipe area of more than 10%. The Contractor will notify the Engineer immediately if the inspection reveals an obstruction that cannot be removed by conventional sewer cleaning equipment. CCTV to be included in pipe CIPP lining unit price.

2.05 PROTRUDING SERVICE CONNECTIONS

- A. When service connections protrude into the existing pipe more than 1/2" as measured from the inside pipe wall, then the Contractor shall remove the protruding portion of the service connection to within 1/2" of the inside pipe wall. Removal of the protruding portion of the service connection shall be accomplished using a television camera and internal cutting device, which shall not damage the collection line or the portion of the service line to remain in place. This work shall be accomplished prior to the installation of the liner pipe.

2.06 RESIN IMPREGNATION

- A. The tube shall be vacuum-impregnated with resin (wet out) under controlled conditions. The volume of resin used should be sufficient to fill all voids in the tube material at nominal thickness and diameter. The volume should be adjusted by adding excess resin for the change in resin volume because of polymerization and to allow for any migration of resin into the cracks and joints in the original pipe. A roller system shall be used to uniformly distribute the resin throughout the tube.
- B. The Contractor shall designate a location where the CIPP will be vacuum impregnated prior to installation. The Contractor shall allow the Engineer to inspect the materials and procedures used to vacuum impregnate the tube if desired.
- C. Delivery, storage and handling of approved products are the responsibility of the Contractor. The Contractor shall keep them safe from damage and stored with the proper environmental containment as outlined by the manufacturer. No products should be used that have exceeded the designated shelf life as outlined by the manufacturer. Remove damaged products from Site. Promptly replace damaged products with new products at no additional cost to the Owner.
- D. Maintain resin-impregnated tubes in refrigerated truck trailers at a temperature below 45-degrees F to prevent premature curing. Prior to beginning inversion, no portion of the resin-impregnated tubes liner shall be subjected to sunlight or ultraviolet radiation. Resin-impregnated tubes with signs of premature curing shall not be installed and shall be removed from the Project Site.
- E. The liquid thermosetting resin used to impregnate the felt tube shall produce a properly cured tube that will be resistant to abrasion and corrosion due to solids, grit, sand, acids, and gases such as hydrogen sulfide, methane, and carbon monoxide. The resin selected shall have proven resistance to normal municipal sewage, especially sulfuric acid corrosion from hydrogen sulfide gas.
- F. The resin system to be used shall be manufactured by approved company(ies) selected by the "Cured-in-Place" process manufacturer.
- G. The Engineer shall be informed in advance, for verification and inspection of the resin material at the "wet out" of the felt tube. The inspection shall be at the discretion of the Engineer, which shall not relieve the Contractor of his responsibilities. Heating shall continue uninterrupted until the desired temperature is achieved. Temperatures shall be

measured at both ends by sensitive and accurate measuring devices, and the initials of the Engineer or his representative shall be obtained, if he is present at the site.

- H. Copies of curing temperature/time log sheet on approval format shall be submitted to the Engineer immediately after the curing is completed. This report shall be attached to the daily report. The Contractor shall follow the process manufacturer's criteria, guidelines and recommendations. A copy of the Manufacturer's data shall be made available to the Engineer. Any changes in guidelines after the contract date will require the Engineer's approval prior to implementing any changes.
- I. Correction of failed liner deemed unacceptable, as a result of the post video inspection and/or test reports for structural values, thickness, etc. shall be repaired at no extra cost to the Owner. Method of repair shall be approved by the Engineer, which may require field or workshop demonstration.

2.07 FLOW CONTROL PRECAUTIONS

- A. The Contractor shall be completely responsible for preventing service line backups during the liner installation and curing period.
- B. The Contractor shall follow the additional flow control precautions in accordance with Section 02961 including notification to homeowners.

2.08 TESTING

- A. At the discretion of the Owner/Engineer, one CIPP sample shall be cut from a section of cured CIPP at an intermediate manhole and/or at the termination point that has been inverted through a like diameter pipe. (Note: In areas with limited space and larger diameter pipes, other sampling techniques may be required at the discretion of the Engineer.) Each sample shall be marked identifying information (i.e. manhole, pipe size, nominal thickness, project number) and retained for testing during the project. The samples at an approved laboratory will be paid by the Owner. Any samples not passing the minimum established requirements will be paid for by the Contractor. If the test results fail to exceed the minimum established values for flexural strength, flexural modulus or required thickness, the mean value obtained through testing will be used to re-evaluate the required thickness. If the in-place thickness fails to meet the design requirements, the Contractor will be allowed to remove and test a sample from within the host pipe at his own expense. The results of this test will be evaluated as stated above. Should this sample also fail, the Contractor will have the option to re-line the pipe segment or receive no pay for lining the existing pipe segment. In either case, the Contractor will be paid for service restoration work completed under separate payment items.
- B. Specimen Parameters

The sample should be large enough to provide a minimum of three specimens and a recommended five specimens for flexural testing. For specimens greater than 1/2 in (12.70mm) in thickness, the width-to-depth ratio of the specimen shall be increased to a minimum of 1:1 and shall not exceed 4:1.

C. Test Procedure

Test specimens shall be oriented of the testing machine with the interior surface of the CIPP tension. The following test procedure should be followed after the sample is cured and removed.

Short-Term Flexural (Bending) Properties – This initial flexural modulus of elasticity and flexural stress should be measured for specific gravity in accordance with Test Method D 790, Test Method I Procedure A, as modified for curved samples.

D. Gravity Pipe Leaking Testing

Leakage testing of the CIPP shall be conducted during cure while under hydrostatic pressure.

PART 3 - EXECUTION

3.02 PRE-INSTALLATION

- A. The following preparation/steps shall be completed, unless approved otherwise by the Engineer. Prior to commencement of the actual liner installation process, the Contractor will plan his work after review of previous television inspection tapes and reports. All point repairs must be satisfactorily completed, equipment and material mobilized, and the Engineer shall be informed of the impending work schedules for liner installations.
1. Pre-Inversion Cleaning – The Contractor shall rewash and reclean the existing sewer pipe immediately before the pre-installation television (TV) inspection, at a cost incidental to the insertion of liners.
 2. Pre-Installation Television (TV) Inspection – The Contractor shall video (TV) inspect the sewer pipe immediately before the installation of the resin impregnated tube, to assure that the pipe is clean and pipe conditions have not changed. This inspection as well as the video (TV) inspection after the inversion, shall be incidental to the installation of the liner.
 3. Diversion Pumping – The Contractor shall provide for continuous sewage flow around the section or sections of pipe designated for the liner process when required. The pump and bypass lines shall have adequate capacity and size to handle the flow as per provisions of relevant items in these contract documents. The bypassing of sewage and pumping costs, equipment, etc., shall be incidental to the cost for lining the sewer segment.
 4. Line Obstructions – If Per-Installation video (TV) inspection reveals an obstruction in the existing pipe that cannot be removed by conventional sewer cleaning equipment, (such as heavy solids, dropped joints, or collapsed pipe which will prevent completion of the liner process), then the Owner may elect to either have the point repair completed by others at no charge to the Contractor or will issue a Change Order.

3.02 INSTALLATION OF CIPP

- A. The wet out tube shall be inserted through an existing manhole or approved access point by means of an inversion process and the application of a hydrostatic head sufficient to extend it to the next designated manhole or termination point.
- B. Alternately, the tube can be pulled into place and expanded with an inflation bladder.
- C. Once the installation has begun, the pressure shall be maintained between the minimum and maximum pressures until the installation has been completed.
- D. The existing host pipe shall be dewatered for any CIPP installation that does not use an inversion method to expand the tube against the pipe wall.
- E. The area/equipment used for this process shall be securely protected, and all damaged yards, driveways, walks, etc. shall be repaired, at no cost to the Owner.

3.03 USE OF LUBRICANT

- A. Lubricant shall be used to reduce friction between the host pipe and the liner during the inversion or pulled-in process. This lubricant should be poured into the water in the downtube or applied directly to the tube or inflation bladder. The lubricant used should be a nontoxic, oil-based product that has no detrimental effects on the tube, heating source and pump system, will not support the growth of bacteria, and will not adversely affect the fluid to be transported. Lubricant shall be used in processes with permeable coatings.

3.04 CURING WITH WATER

- A. After installation is completed, suitable heat source is required to circulate heated water throughout the pipe. The equipment should be capable of delivering hot water throughout the section to uniformly raise the water temperature above the temperature required to affect a cure of the resin. Temperature gauges shall be installed in the following areas: incoming water supply; outgoing water supply and between the impregnated tube and the pipe invert at the lining termination point.
- B. All water used shall be metered and paid for by the Contractor with the prior approval of the appropriate utility, and utilizing approved backflow prevention devices. The curing temperature shall be recommended by the resin/catalyst system or the process manufacturer. The heat source shall be fitted with suitable monitors to gauge the temperature of the incoming and outgoing water supply. Another such gauge shall be placed between the impregnated tube and the invert of the original pipe at the manhole(s) to monitor the outside liner temperatures during the resin curing process. Initial cure may be considered completed when the exposed portions of the felt tube pipe appear to be hard, and the remote sensing device indicated the temperatures to be adequate, as recommended by the resin/catalyst system manufacture, and approved by the Engineer. Curing temperatures and duration shall comply with submitted data and information.

3.05 CURING WITH STEAM (ALTERNATE METHOD)

- A. After installation is completed, suitable heat source is required to circulate steam throughout the pipe. The equipment should be capable of delivering steam throughout the section to uniformly raise the steam temperature above the temperature required to affect a cure of the resin. Temperature gauges shall be installed in the following areas: incoming steam supply; outgoing steam supply and between the impregnated tube and the pipe invert at the lining termination point.
- B. Curing Time: 2 hours minimum
- C. Minimum interface temperature between liner and tube shall be 120 degrees F.
- D. Steam Temperature: 230 degrees F minimum.
- E. Pressure required to keep tube inflated while curing 5 psi.

3.06 COOL-DOWN

- A. Water cured CIPP should be cooled to a temperature below 90 F before relieving the hydrostatic head. Cool-down may be accomplished by the introduction of cool water into the CIPP to replace water being drained from the small hole made in the downstream end. Care should be taken in the release of the static head to prevent a vacuum that could damage the newly installed CIPP. Coupon samples shall be obtained for testing as stated previously.
- B. Steam cured CIPP: Send air through the liner until it cools down to 120 F interface temperature. Once 120 F has been reached water may be introduced to finish cooling the line down to 90 F. Care should be taken in the release of the water to prevent a vacuum that could damage the newly installed CIPP. Coupon samples shall be obtained for testing as stated previously.

3.07 INFLATION BLADDER REMOVAL

- A. For pulled-in place installation techniques where the inflation bladder is designed not to bond to the CIPP, all portions of the bladder material must be removed from the CIPP.

3.08 FINISHED CIPP

- A. Be continuous over entire length from manhole to manhole and be free from visual defects such as foreign inclusions, dry spots, keel, boat hull, fins, pinholes, wrinkles, delamination, and other deformities. Such defects and deformities may (at the discretion of the Owner) be cause for rejection of the entire liner, in which case the lined pipe will be removed and replaced at no additional cost to the Owner.
- B. When passing through or terminating in a manhole shall be carefully cut out in a shape and manner approved by Engineer.
- C. Each pipe opening into manhole, a hydrophilic rubber joint seal shall be bonded with adhesive to the manhole and CIPP.
- D. Meet gravity sewer leakage test requirements.

3.09 SERVICE LINE CONNECTION RESTORATION

- A. After the liner has properly cured, the service line connections shall be cut without excavation using an internal cutting device and a television camera. All coupon materials from this action shall be collected at the next downstream manhole and submitted to the Engineer if required.

3.10 INSPECTION AND TESTING

- A. GRAVITY PIPE LEAKAGE TESTING: For 24-inch diameter or less CIPP low pressure air test as specified in Section 802 shall be required after liner has been installed in existing pipe.
- B. PROPERTIES TEST: The following test requirements apply to all CIPP installations, regardless of installation method, for each setup: One (minimum) 12 inch long restrained pipe section shall be cut from the cured liner and labeled with upstream and downstream manholes numbers for that setup. Contractor shall submit the sample to the Owner and measurements of sample thickness will be taken by the Owner from four locations on each section. The average thickness of the measurements shall be equal to or greater than the required minimum or design thickness (whichever is greater). In addition, Contractor shall collect the coupons from the service line connection restoration for each setup, label with upstream and downstream manhole numbers, and submit to the Owner. These coupons may also be used for testing. Failure of the thickness test shall be grounds for rejection of the CIPP liner.
- C. "Wet-out" facility resin mixing equipment shall have a valve downstream of the mixing functions and immediately upstream of the application of the mixed resin to the tube where the Owner can draw resin samples. Contractor's batch mix facilities, if any, shall provide for sampling of the mixed batch. Submitted "wet-out" schedule cannot be modified without 24-hour notice to Owner. Resin samples shall be drawn at times determined by Owner. The Owner representative drawing the samples will arrive unannounced and shall be afforded immediate access to the equipment.
- D. Post Installation CCTV: The Contractor shall inspect each installation visually by CCTV. Variations from true line and grade may be inherent because of the conditions of the original piping. No infiltration of groundwater should be observed. All service entrances should be accounted for and be fully functional unless otherwise directed by the Engineer in writing. No visible leak around liner at manhole connection will be allowed. The pre- and post-installation documentation in DVD format will become the property of the Owner. The post-inversion televising shall be performed after all service reconnections have been completed. The video shall be taken by a 360 degree radial view camera for close up view showing the completed work, including the condition of the restored taps prior to requesting payment. Post-installation televising of the installation shall be performed at no additional cost to the Owner. CCTV price shall be included in unit price for CIPP.
- E. Contractor shall correct failed liner or liner deemed unacceptable by the Owner as a result of the post-video inspection, leakage test results, and/or thickness test. Remedy for failed thickness test shall be defined as shown in the following table. Where pipe removal and replacement is required, it shall be for the entire segment length from manhole to manhole and payment shall be made in full for the cured-in-place pipe. No payment will be made to construct a new sewer segment (i.e. pipe replacement).

3.11 SEALING AT MANHOLES

- A. The cured-in-place- liner shall make a tight seal at the manhole opening with no annular gaps. Should an annular space occur, an approved hydrophylic sealant, shall be applied all around for a proper seal, unless designated otherwise. All large annular space shall be sealed by using activated Oakum soaked in Scotchseal 5600 or equal, and later covered with a cementitious mortar. This procedure shall be completed before proceeding to the next manhole section unless directed otherwise by the Engineer.

3.12 POST INSTALLATION CLEANING

- A. At the conclusion of the work, the Contractor shall thoroughly clean the entire new pipe by flushing with water or other means to remove all dirt, stones, and pieces of wood or other material that may have entered during the construction period. Debris cleaned from the lines shall be removed from the job site. If, after this cleaning, any obstructions remain, they shall be removed.
- B. Upon acceptance of the installation work and testing, the Contractor shall reinstate the project area affected by his operations.

3.13 PATENTS

- A. The Contractor shall warrant and hold harmless the Owner against all claims of patent infringement and any loss thereof for any type of sewer pipe lining process used in the work.

3.14 MANUFACTURER'S SERVICES

- A. Provide the service of a qualified technical representative of the manufacture for three eight-hour days. Two days shall be supervision of the initial installation efforts, and the third day shall be approval of the completed facilities. The Contractor shall provide the CCTV tapes to the manufacturer prior to his final site visit, so the manufacturer may review these tapes. The manufacturer is required to submit a letter to the Engineer approving the completed installation based on his review of the tapes and his field visit.

END OF SECTION

SECTION 02957

SMOKE TESTING

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. Sanitary sewer line sections, at locations designated by the Owner or his authorized representative, shall be smoke tested to locate significant defects which are causing or could cause infiltration/inflow, soil erosion and degradation to the existing sanitary sewer system or other underground utilities and surface structures.
- B. The Owner will field determine which pipe segments are to be smoke tested.

1.02 SHOP DRAWINGS

- A. Submit a copy of the proposed smoke testing log form for review and approval by the Engineer.
- B. Submit a copy of the proposed public notification land-bill for review and approval by the Engineer.

PART 2 - MATERIALS

- A. Nontoxic, odorless, nonhazardous and non-staining smoke generators (bombs) shall be used to produce smoke used for testing.
- B. Smoke shall be blown by a gasoline powered "squirrel cage" or other approved blower located on top of a central manhole. Blower pressure should be adequate to force smoke throughout the isolated line section and to the ground surface through cracks, channels, improper jointing, etc. Minimum blower free fan delivery is 1,500 cfm.
- C. Sand bags and/or plugs shall be placed at each end of the test section to prevent smoke from escaping through the manholes and adjacent sewer pipes.
- D. Color Polaroid or digital photographs shall be taken of all test sections where smoke is observed coming out. The camera shall be equipped with a date and time generator which can record this data directly onto the photo. The photographs will provide permanent documentation of the infiltration/inflow sources and will be used to locate the leak for further evaluation.
- E. All data pertinent to the smoke testing shall be recorded on a smoke testing log form as supplied by the Contractor and approved by the Owner. Each form shall be turned over to and remain in the possession of the Owner after a section of line has been tested.

PART 3 - EXECUTION

3.01 PROCEDURE

- A. Only pipe segments on either side of the blower shall be tested on a single set-up.

- B. Smoke shall be introduced into a manhole and then blown into the connecting sewer lines.
- C. All visible leaks including those from collection lines, service laterals and manholes shall be recorded on the smoke testing log form. The information listed below shall be included on the log form:
 - 1. Upstream and downstream manhole numbers
 - 2. Manhole depths
 - 3. Direction of flows
 - 4. Location of sandbags and plugs
 - 5. Sketch showing leak location and distance and offset from the upstream manhole
 - 6. Street address nearest the detected leak
 - 7. Leak type which clearly describes the leak (i.e. yard drain, roof connection, x-connection with storm drain, drainage channel, soil fissure, etc.)
 - 8. Smoke quantification (i.e. light, medium, heavy)
 - 9. Surface cover (i.e. concrete pavement, drive, grass, etc.)
 - 10. Properly identified color photograph of inflow source shall be attached to reporting form.
- D. Public notification and coordination with the City's Police and Fire Departments shall be accomplished according to the following:
 - 1. A minimum of 24 hours prior to the test of any pipe segment, the Contractor shall go door-to-door to announce that a test is to be performed shortly and distribute a handbill describing the smoke testing.
 - 2. Contractor shall notify the appropriate authorities a minimum of 24 hours prior to the beginning of any smoke testing and shall be responsible for maintaining close coordination with the local Police and Fire Departments regarding the smoke tests.
- E. Smoke tests shall not be performed when the smoke coming out of the ground may be blown away so quickly as to escape visual detection.
- F. The Engineer is to be contacted after any rainfall greater than ½ inch. The Engineer will make the decision on whether to continue with smoke testing, or to delay this testing until groundwater levels are known to have dropped to an extent where accurate results can be realized.
- G. The Contractor shall be totally responsible and held liable for the adequacy of the testing program, public notification and coordination with the City Police and Fire Departments.

3.02 INSPECTION

- A. The Owner or his duly authorized representative shall witness all smoke testing, and smoke testing log forms shall be submitted to the Owner on the work day following the performance of the test.

3.03 MANUFACTURER'S SERVICES

- A. Provide the services of a qualified technical representative of the manufacture for three eight-hour days. Two days shall be for supervision of the initial installation efforts, and the third day shall be for approval of the completed facilities. The Contractor shall provide the CCTV tapes to the manufacturer prior to his final site visit, so the manufacturer may review these tapes. The manufacturer is required to submit a letter to the Engineer approving the completed installation, based on his review of the tapes and his field visit.

END OF SECTION

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SECTION 02958

SEWER LINE CLEANING

PART 1 – GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall provide all labor, materials, equipment and incidentals necessary to perform the cleaning of sanitary and storm sewer lines as specified in this section. Sewer line cleaning shall include preparatory cleaning prior to television inspection and heavy cleaning.
- B. The work shall consist of cleaning sanitary sewer lines of all excess sand, debris and grease.
- C. No separate payment shall be made for preparatory cleaning. Internal inspection reports which may be available and which were made prior to the Contract will be made available to the Contractor upon request to the Engineer.
- D. Heavy cleaning of sanitary sewers shall be conducted on lines at the direction of the Engineer. Heavy cleaning shall be conducted using bucket machines and mechanical cleaning equipment as specified herein.
- E. Heavy cleaning shall remove all foreign materials from the lines. The Contractor shall not be responsible for removing mortar or other similar material which is permanently attached to the pipe walls.
- F. Comply with the methods established by NASCO, unless those requirements are superceded by this specification.

1.02 ACCEPTABLE METHODS

- A. Sewer line cleaning shall be performed by hydraulically propelled or mechanically operated cleaning equipment as described in Part 3 of this section. Selection of equipment shall be made by the Contractor with the concurrent of the Engineer and shall be based on field conditions such as availability of access to manholes, type of debris to be removed, and depth of sewer flow.

1.03 LIMITATIONS

- A. Satisfactory precautions shall be taken to protect the sewer lines from damage that might be inflicted by improper use of the cleaning equipment. Whenever hydraulically propelled cleaning tools, which depend upon water pressure to provide their cleaning force, or any tools which retard the flow of water in the sewer line are used, precautions shall be taken to ensure that the water does not cause damage or flooding to public or private property being serviced by the sewer line section involved.

1.04 SHOP DRAWING SUBMITTALS

- A. Submit technical data on sewer cleaning equipment to be used for review and approval by the Engineer.

- B. Submit a copy of correspondence with the local utility (water) supplier for the Engineer's records.

PART 2 – MATERIALS (NOT USED)

PART 3 - EXECUTION

3.01 SEWER CLEANING

- A. Sanitary sewer line sections shall be cleaned using mechanically powered, hydraulically propelled or high velocity sewer cleaning equipment. Selection of the equipment used shall be based on the conditions of the lines at the time the work commences. The equipment and methods selected shall be satisfactory to the Engineer. The equipment selected for cleaning shall be capable of removing dirt, grease, rocks, sand, and other deleterious materials and obstructions from the sewer lines and manholes. If cleaning of an entire section cannot be successfully performed from one manhole, the equipment shall be re-setup at the manhole on the opposite end of the pipe segment being cleaned and cleaning shall be re-attempted.
- B. Water for sewer cleaning shall be purchased by the Contractor and obtained at locations in accordance with the utility owner's direction. If the water is obtained from the potable supply, adequate backflow prevention devices shall be provided to protect the potable system from cross connections and contamination. Coordination with the utility agency is the responsibility of the Contractor.

3.02 CLEANING EQUIPMENT

- A. Hydraulic Cleaning Equipment: The equipment used shall be of a movable dam type and be constructed in such a way that a portion of the dam may be collapsed at any time during the cleaning operation to allow the sewer flow past the cleaning head to protect against flooding of the sewer. The movable dam shall be equal in diameter to the pipe being cleaned and shall provide a flexible scraper around the outer periphery to ensure total removal of grease. If cleaning balls or other such equipment which cannot be collapsed instantly are used, special precautions against flooding of the sewers and causing damage to public or private property shall be taken.
- B. High Velocity Jet (Hydro-Cleaning) Equipment: All high velocity sewer cleaning equipment shall be designed for ease and safety of operation. The equipment shall have a selection of two or more high velocity nozzles. The nozzles shall be capable of producing a scouring action from 15 degrees to 45 degrees in all size lines designated to be cleaned. Cleaning shall be accomplished by using a pump capable of delivering water at 800 to 1000 psi to the self-propelled nozzles. Equipment shall also include a high velocity gun for washing and scouring manhole walls and floor. The gun shall be capable of producing flows from a fine spray. The equipment shall carry its own water tank, auxiliary engines, pumps, and hydraulically driven hose reel. All controls shall be located so that the equipment can be operated above ground.

3.03 MATERIAL REMOVAL

- A. All sanitary sewers to be cleaned shall be plugged at the discharge end prior to cleaning.

- B. All sludge, dirt, sand, rocks, grease, and other solid or semi-solid material resulting from the cleaning operation shall be removed at the downstream manhole of the section being cleaned. Passing material from one sewer line section to another sewer line section, or from manhole section to manhole section, shall not be permitted except when using high velocity jet equipment.

3.04 DISPOSAL OF MATERIAL

- A. All solids or semi-solids resulting from the cleaning operations shall be removed from the site and disposed of at an approved landfill. All materials shall be removed from the site no less often than at the end of each workday. Under no circumstances will the Contractor be allowed to accumulate debris, etc., on the site of work beyond the stated time, except in totally enclosed containers and as approved by the Engineer.

3.05 CLEANING PRECAUTIONS

- A. During all sewer cleaning operations, satisfactory precautions shall be taken to protect the sewer lines from damage that might be inflicted by the improper use of cleaning equipment. Whenever hydraulically propelled cleaning tools or tools which retard the flow in the sewer line are used, precautions shall be taken to ensure that the water pressure created does not cause any damage or flooding to public or private property being served by the sewer line section. The flow of sewage in the sewer lines shall be utilized to provide necessary pressures for hydraulic cleaning devices whenever possible. When additional water from fire hydrants is necessary to avoid delay in normal working procedures, the water shall be conserved and not used unnecessarily. No fire hydrant shall be obstructed in case of a fire in the area served by the hydrant nor shall a hydrant be used for the purpose described unless a backflow preventer is provided.

3.06 INSPECTION

- A. Inspection of all cleaning operations will be made on a daily basis by the Engineer.

3.07 ACCEPTANCE

- A. All sewer cleaning shall be performed to the satisfaction of the Engineer. In areas where television inspection is not performed, a double squeegee, with each squeegee the same size as the sewer, shall be pulled through each sewer line section as evidence of being adequately cleaned, If inspection shows the cleaning to be unsatisfactory, the Contractor shall be required to reclean and reinspect the sewer line section until the cleaning is acceptable to the Engineer.

END OF SECTION

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SECTION 02959

SEWER TELEVISION INSPECTION

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. This section describes the closed circuit television (CCTV) and video taping of existing line sections. The interior of the line sections and service line connections at the main line shall be carefully inspected to determine the location and extent of any breaks or obstacles, the quantities of infiltration/inflow, and the location of service connections on the post inspection condition of rehabilitated segments.
- B. Comply with the recommendations of NASCO, unless these recommendations are superceded by this specification.

1.02 SHOP DRAWINGS

- A. Submit the proposed Television Inspection Report Form for review and approval by the Engineer.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 METHODS

- A. The television camera used for the inspection shall become specifically designed and constructed for such inspection. Lighting for the camera shall be suitable to allow a clear picture of the entire periphery of the pipe. The camera shall be operative in 100% humidity conditions. The camera, television monitor, and other components of the video system shall produce a "color" picture quality to the reasonable satisfaction of the Engineer; and if unsatisfactory, the equipment shall be replaced with satisfactory quality producing equipment. A television camera with radial view capabilities (in order to view the service line connections at the main line) shall be made available upon request of the Owner.
- B. The camera shall be moved through the line section in either direction at a moderate rate, stopping when necessary to permit proper documentation of the sewer's condition. In no case will the television camera be pulled at a speed greater than 30 feet per minute. Manual winches, power winches, TV cable, powered rewinds or other devices that do not obstruct the camera view or interfere with proper documentation of the sewer conditions shall be used to move the camera through the sewer line. If, during the inspection operation, the television camera will not pass through the entire line section, the Contractor shall set up his equipment so that the inspection can be performed from the opposite manhole. If, again the camera fails to pass through the entire line section because of an obstruction, the inspection shall be considered complete and no additional inspection work will be required.
- C. When manually operated winches are used to pull the television camera through the line section, telephones or other suitable means of communication shall be set up between the

two manholes of the line section being inspected to insure good communication between members of the crew.

- D. Measurement for location of defects shall be above ground by means of a meter device. Marking on the cable, or the like, which would require interpolation for depth of manhole, will not be allowed. Accuracy of the distance meter shall be checked by use of a walking meter, roll-a-tape, or other suitable device, and the accuracy shall be satisfactory to the Engineer or his Authorized Representative.

3.02 VIDEO TAPE RECORD

- A. A videotape recording of each line section shall be made by the Contractor and this recording shall provide a complete "color" video and audio record of the entire inspection. The TV unit shall have the capability of displaying on video tape written information concerning the pipe inspected.
- B. All visual observations shall be recorded by the Contractor on a "Television Inspection Report" form. The report produced shall indicate the internal condition of the line section, the deviation in line and grade abnormal condition of the pipe barrel and joints, building sewer connection locations, the location and estimated quantity of each source of infiltration and inflow.
- C. Measurement: The work will be measured from the center of the upstream manhole to the center of the downstream manhole. Should root cutting be required, the Contractor shall so inform the Engineer or his authorized representative. Obtain the approval of the Engineer or his authorized representative prior to commencing any root cutting. The cost of any and all root cutting required to perform the television inspection shall be in accordance with the unit quantities bid.
- D. Payment: All work performed and measured as provided under "Measurement" will be paid for at the unit price bid, which price shall be full compensation for television inspection as specified, and for furnishing all labor, tools, equipment and incidentals necessary to complete the work.

END OF SECTION

SECTION 02960

SERVICE RECONNECTIONS

PART 1 – GENERAL

1.01 SCOPE OF SERVICES

- A. The Contractor shall reconnect all service connections, including those that go to unoccupied or abandoned buildings or houses or vacant lots, unless otherwise directed by the Engineer. Contractor shall be required to begin reconnection of service lines within 24 hours after pipe rehabilitation. All services which are reconnected to the rehabilitated sanitary sewer shall be properly shown on the record drawings with the exact distances from the nearest downstream manhole. All existing connections shall be properly disconnected from the existing sewer and then reconnected to the liner as directed below or as approved by the Engineer. The exact location and number of service connections shall be determined from T.V. inspection tapes, and/or in the field. It shall be the Contractor's responsibility to accurately field locate all existing service connections, whether in service or not, along the sanitary sewer main which has been rehabilitated.

PART 2 – MATERIALS (NOT USED)

PART 3 - EXECUTION

3.01 EXCAVATION FOR RECONNECTIONS

- A. Some repairs may be in easements or right-of-ways where machine operated equipment cannot be employed due to accessibility, locations of buildings adjacent to or over easements, etc. When excavation for a service line repair cannot be done with power equipment, excavation shall be done by hand.

3.02 HOUSE OR BUILDING SERVICE CONNECTIONS

- A. Saddle Method

After the liner has been put into place and allowed to normalize to ambient temperature as well as recover from any imposed stretch, each existing service connection shall be reconnected to the new liner. A portion of the existing sanitary sewer main, or "carrier pipe", around each service connection shall be removed to expose the liner pipe and to provide sufficient working space for installing a pre-fabricated polyethylene saddle or an approved alternate. The polyethylene saddle shall be a one-piece saddle equipped with a neoprene gasket so that a complete seal is accomplished with the strap-on saddle is tightened with two (2) stainless steel bands; one on each side. The stub-out attached to the saddle must protrude into the liner a distance equal to the wall thickness of the liner in place. The new 4", 6", or 8" stub-out, or lateral, shall be connected to the existing service line with a flexible PVC coupling, "Fernco" or an approved equal. A service reconnection shall consist of the removal and replacement of any cracked, offset or leaking existing service up to a distance of eight (8) feet from the center of the new liner, measured horizontally.

The flexible coupling shall be secured to the existing service lateral, and new stub and/or stack, with stainless steel bands.

B. Remote Cutting Method

Service connections (for cured-in-place method) made by remote cutting tools shall be done carefully and no blind holes shall be allowed. All service connections made by remote cutting shall be restored to a minimum of 90% of the existing service connection capacity. Post TV shall show the locations of all service connections. The Contractor shall be responsible for restoring without any delay, all missed or faulty connections, as well as repair the blind drilled hole(s). If a remove cut service connection is later corrected by full excavation with saddle etc., only one payment shall be made as per bid item, whichever is greater.

3.03 PROTRUDING TAPS

- A. Protruding taps or service connections which are to be reconnected and which obstruct the insertion of the liner and shall be removed to allow the liner to proceed and shall be paid for as a Protruding Tap Removal. Abandoned taps/services which are protruding shall be removed to allow the liner to be inserted into the sewer and shall be paid for as a Protruding Tap Removal.

3.04 TESTING

- A. A smoke test shall be performed in each rehabilitated sanitary sewer manhole section to determine if all existing service connections have been reconnected to the rehabilitated sewer and to check the integrity of the connection of the newly replaced service tap, both to the liner and to the existing private service connection. No taps shall be backfilled until completion of this test. Only those taps in one manhole section shall be tested at any one time thus preventing a large number of open excavations which could be a hazard to the public. Smoke testing shall be performed in accordance with the appropriate section of these specifications.
- B. All taps/connections noted as leaking shall be repaired or replaced and then retested. The Contractor will be allowed to leave the tap/connection exposed in only one manhole section at a time to minimize inconvenience and hazard to the residents. If tap/connection repair or replacement, testing or retesting, and backfilling of the excavation is not completed within the work day, the Contractor shall properly barricade and cover each excavation with plywood, steel plates, or some other approved material, to the satisfaction of the Engineer.
- C. On houses where smoke does not issue from the plumbing vent stacks to confirm the reconnection of the sewer service to the newly installed liner pipe, a dye test will be required to confirm the reconnection. Dye shall be introduced into the service line through a plumbing fixture and flushed with water. The Contractor will observe the flow at the service reconnection, or downstream manhole. Detection of the dye shall confirm a reconnection.

END OF SECTION

SECTION 02961

SEWER FLOW CONTROL

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. When sewer line depth of flow at the upstream manhole for any pipe segment is above the maximum allowable for television inspection or joint sealing, the flow shall be reduced to the level shown below by plugging or blocking of the flow as specified. Flows above the maximum shall be by-pass pumped in accordance with the requirements contained herein.
- B. Depth of flow shall not exceed that shown below for the respective pipe sizes as measured in the manhole:
1. Maximum Depth of Flow for Television Inspection

6" - 10" Pipe.....	20% of pipe diameter
12" - 24" Pipe.....	25% of pipe diameter
>24" Pipe.....	30% of pipe diameter
 2. Maximum Depth of Flow for Joint Sealing

6" - 10" Pipe.....	40% of pipe diameter
12" - 24" Pipe.....	45% of pipe diameter
>24" Pipe.....	50% of pipe diameter
- C. No separate payment shall be made for sewer flow control

PART 2 – MATERIALS (NOT USED)

PART 3 - EXECUTION

3.01 PLUGGING OR BLOCKING

- A. A sewer line plug shall be inserted into the line upstream of the pipe segment being inspected or repaired. Where necessary, plugs shall also be installed into the storm sewer pipe. Plugs shall be so designed that all or any portion of the flow can be released. During TV inspection and sealing operations, flow shall be reduced to within the limits specified above. After the Work has been completed, flow shall be restored to normal.

3.02 FLOW ELIMINATION

- A. The sewer flow shall be completely eliminated when required for such operations as pipe replacement repairs, structural concrete repairs to deteriorated manholes and sewers, or installation and curing of sliplining pipe.
- B. Flow elimination shall be by temporary shut-down of pump stations where possible, or by plugging upstream sewers and pumping of flows if required. The method of flow

elimination is at the discretion of the Owner.

- C. All requests of the Owner to eliminate or adjust the flow of sewage within the system shall be made in writing to the Engineer. Owner and Contractor recognize and acknowledge that the elimination and/or adjustment of the flow is a cooperative effort and that the time and effort required to achieve the desired flow varies. Owner and Contractor declare and agree that Contractor shall not be allowed, due or paid any additional compensation, whatsoever, for Contractor's work, effort, time, material, labor, rentals, equipment, expenses, etc., during, as a result of, or arising from the elimination or adjustment of the flow.

3.03 PUMPING AND BYPASSING

- A. Bypass pumping shall be required whenever pump stations are shut down or flow in gravity sewer lines is restricted or blocked. The Contractor shall supply the necessary pumps, conduits, and other equipment to divert the flow of wastewater around the pump station, restriction, blockage, or other structure in which work is to be performed. The bypass system shall be of sufficient capacity to handle existing flows plus additional flow that may occur during periods of a rainstorm. Trailer-mounted electric pumps shall be used. No other type of pump will be acceptable without prior approval of the Owner and the Engineer.
- B. The Contractor shall be responsible for furnishing the necessary equipment, power, labor, and supervision to set up and operate the pumping and bypassing system. If pumping is required on a 24-hour basis, all equipment shall be operated in a manner to keep the pump noise at a minimum.
- C. Bypassing of wastewater to storm drainage systems shall not be allowed.

3.04 FLOW CONTROL PRECAUTIONS

- A. Whenever flows in a sewer line are blocked, plugged, or bypassed, sufficient precautions shall be taken to protect the sewer lines from damage that might be inflicted by excessive sewer surcharging. Further, precautions shall be taken to ensure that sewer flow control operations do not cause flooding or damage to public or private property being served by the sewers involved.

END OF SECTION

SECTION 02962

CURED-IN-PLACE PIPE (CIPP) LATERALS (TOP HAT)

PART 1 – GENERAL

This work consists of installing a cured-in-place pipe (CIPP) liner to stabilize structural defects and construction inadequacies in sanitary sewer service laterals and service/mainline connections.

1.01 SCOPE OF WORK

- A. Contractor shall provide materials, labor, equipment, and services necessary for: sewer flow control, pre-installation cleaning, rehabilitation of existing sanitary sewer service laterals by lining, sealing connections to existing sewer main, pre- and post –construction Closed Circuit Television inspection (CCTV) in accordance with Section 815, and final testing of the CIPP system.
- B. The rehabilitation of service lateral main line connections shall be done by the installation of a resin-impregnated, flexible, felt tube inverted into the existing service lateral, approximately 12 – 24 inches, utilizing a pressure apparatus positioned in the mainline pipe. Curing shall be accomplished by ambient cure or other approved method to cure the resin into a hard impermeable pipe-within-a-pipe. When cured, the service lateral connection repair shall extend over the length of inversion in a tight fitting, watertight pipe-within-a-pipe to effect a watertight seal with the rehabilitated service lateral pipe. In addition, the lateral connection repair shall seal to the mainline pipe by means of a resin-impregnated flexible felt flange integral with the service lateral felt tube portion or by means of a resin-impregnated one-piece main and lateral cured-in-place liner that will have a watertight seal with the mainline.
- C. The Work required by the Contract Documents may include just the installation of a service lateral connection sealing and repair product or the installation of this and a service lateral liner. If the work requires both products, the complete product may either be a one piece liner from the main line seal to the cleanout or a two piece liner consisting of service lateral main line connection overlapped by the service lateral liner. The completed product will be a watertight pipe-within-a-pipe, mechanically bonded to the host pipe from the cleanout to the main line with a watertight seal with the main line pipe. The liner shall be smooth, hard, strong, and chemically inert.

1.02 QUALIFICATIONS

- A. CIPP Contractors shall have a minimum of two (2) years of active continuous experience installing CIPP lateral liners in pipe of similar size, length and configuration as proposed in the project. In addition, Contractor shall have successfully installed CIPP liner product in at least 2,000 laterals in wastewater collection system applications.
- B. Field supervisory personnel employed by the CIPP Contractor will have at least two (2) year's experience in the performance of the work and tasks as stated in the Contract Documents.

PART 2 – MATERIALS

2.01 MATERIALS

- A. The required principal components are based on materials developed by the impregnation or an

absorbent carrier material shaped into a tube of the correct size to fit the host pipe. This sleeve is expanded to the inner wall of the host pipe and cured in place to obtain a hard plastic sleeve mechanically bonded to the host pipe.

- B. The flexible polyester felt top hat is a tube insert that shall be fabricated to the proper size for the lateral and host pipe. The proper fit will allow the top hat to key into the internal surface irregularities of the lateral joint and neatly fit tight to the internal circumference of the lateral. The top hat tube shall be a laminate made of non-woven fiber materials that allows for circumferential stretching and angular alignment with the lateral pipe connection geometry during insertion.
- C. The carrier material for the tubes shall be of fibrous absorbent composition tailored to achieve the following:
 - 1. Allow the migration or resin from its internal structure by compressing to a thickness of less than 90% of its uncompressed thickness under a pressure of 1 psi.
 - 2. The carrier material must consist of non-degradable fibers such as polyester or polypropylene or corrosion resistant fiberglass. The carrier may use stitched or glued joints of material with sufficient strength to comply with the minimum requirement of this specification (Table 1).

Table 1 CIPP Initial Structural Properties (ASTM F1216)		
PROPERTY	ASTM METHOD	MINIMUM VALUE
Tensile Strength	D638	3,000 psi
Flexural Strength	D790	4,500 psi
Modulus of Elasticity	D790	250,000 psi

- 3. The material must have an abrasion resistant, chemically resistant, fully bonded coated surface in the lateral portion to ensure that on curing a smooth surface free from blemished, pinholes or loose non wetted fibers.
- 4. Where fiberglass is used, a surface veil or a layer of felt must be used to prevent osmosis or wicking of the strands.
- 5. The resin used to impregnate the liner must be a resin cured by light, heat or chemicals via the use of accelerators. As an alternative, any other safe energy source, which does not involve the use of electrical current within the main sewer, may be used when evidence can be supplied of the intrinsic safety of the method. PET resins, resin filters, resin additives, and resin enhancement agents are prohibited. Only neat resins are acceptable. Old resins and reworked resins are prohibited, regardless of whether or not they are mixed with new resin.
- 6. Proven resistance to the municipal wastewater environment that may comprise, as a minimum, all of the following factors:
 - i. Immersion in septic sewage at temperatures up to 75 degrees F.
 - ii. Exposure in hydrogen sulfide gas from septic sewage at temperatures up to 75 degrees F.
 - iii. Proven resistance to ultra-violet light (sunlight) at any stage prior to installation.

- iv. Solvent free epoxy, polyester, and vinyl ester resins are acceptable.
- v. Shall not contain silicones, stearates, or natural waxes that would adversely affect the adhesives properties or any other chemical or physical properties of the CIPP liner.

PART 3 – SUBMITTALS

3.01 SUBMITTALS

- A. **Qualifications:** Submit documentation showing that the Contractor and personnel meet the minimum required qualification stated. Include a list of Projects showing Contractor’s experience with the use of the same pipe material, length and diameter (or larger). Information must include, but not be limited to date and duration of work, location, pipe information (i.e. length, diameter, depth of installation, pipe material, etc.), project owner information (i.e. name, address, telephone number, contact person), and the contents handled by the pipeline (water, wastewater, etc.).
- B. The Standard Dimension Ratio (SDR) is the ratio of the outside diameter (OD) of the pipe to its minimum wall thickness. All CIPP wall thicknesses, SDR’s by diameters, and depth ranges corresponding to the requirements of the Contract Documents, must be submitted to the Engineer for approval prior to installation.
- C. Prior to installation, the manufacturer shall provide the inversion pressures necessary for proper insertion and tube installation. The tube manufacturer shall provide the minimum pressure required to hold the tube tight against the existing host pipe, and the maximum allowable pressure that will not damage the tube. Forces or pressures shall be limited so the tube is not stretched longitudinally by more than 5% of the original length.
- D. The proposed bypassing system shall be approved in advance by the Engineer. The acceptance of the bypassing system in advance by the Engineer shall, in no way, relieve the Contractor of responsibility or public liability.
- E. Traffic control shall be the responsibility of the Contractor. Any necessary lane closures shall require a permit from the Traffic Division of the DPW or the LA DOTD. Copies of the permits shall be submitted to the Engineer prior to commencing the Work.
- F. Post-construction CCTV inspection videos.

PART 4 – DESIGN PARAMETERS

4.01 DESIGN PARAMETERS

- A. The CIPP system felt or fiberglass and resin composite shall have the minimum physical properties given below and in accordance with the guidelines in the appendix of ASTM F1216.
 - 1. Design Life: 50 years
 - 2. Pipe Diameters: Per Contract Documents
 - 3. Ovality: 2%
 - 4. Pipe Condition: Fully deteriorated
 - 5. External Water: ground surface
 - 6. Flexural Strength: 4,500 psi
 - 7. Short Term Flexural Modulus: 250,000 psi
 - 8. Reduction Factor: 50%
 - 9. Long Term Flexuarl Modulus: 125,000 psi

- | | |
|--|----------------|
| 10. K (enhancement Factor): | 7 |
| 11. Soil Modules: | 1,000 psi |
| 12. Soil Density: | 120 pcc |
| 13. Highway Live Load: | AASHTO HS20-44 |
| 14. Safety Factor: | 2 minimum |
| 15. Min. Thickness | 3 mm |
| 16. If calculations require thicker wall, round to the next higher multiple of 0.5 mm. | |

- B. Any layers of the tube that are not saturated with resin prior to insertion into the existing host pipe shall not be included in the required design structural CIPP wall thickness.

PART 5 – PREPARATIONS

5.01 PREPARATIONS

- A. Temporary flow control shall be carried out in accordance with Spec 02952. Prior to shutdown of private service laterals, provide notification and comply with the requirements as specified in Spec 02952. Contractor shall provide for the transfer of flow, through or around the section or sections of host pipe that are to be repaired.
- B. Delivery, storage and handling of approved products are the responsibility of the Contractor. The Contractor shall keep them safe from damage and stored with the proper environmental containment as outlined by the manufacturer. No products should be used that have exceeded the designated shelf life as outlined by the manufacturer. Remove damaged products from site. Promptly replace damaged products with new products at no additional cost to the Owner.
- C. Contractor shall video inspect the service lateral immediately prior to the repairs of the lateral and connection. The Contractor shall use a self-leveling camera to determine the structural condition of the service lateral in accordance with Spec 02959. The Contractor will notify the Engineer immediately if the inspection reveals an obstruction or other condition exists that will interfere with the proper installation an acceptable lateral liner or lateral connection sealing and repair product.
- D. The section or lateral pipe to be lined must be free of debris, obstructions, scale or any other material that reduces the effective diameter of the pipe.
- E. All necessary work to repair the lateral-main joint shall be completed prior to commencing any service lateral pipe lining operation described herein.
- F. If the service lateral lining process requires the installation of a cleanout, the Engineer must approve the Work before it is done.

PART 6 – TOP HATS

6.01 LATERAL CONNECTION SEALING AND REPAIR PRODUCTION INSTALLATION

Specified service lateral connections along a mainline to be CIPP lined shall receive a lateral connection sealing and repair product after installation of the mainline liner, unless the lateral has been recently replaced by a point repair or remove and replacement resulting in a new connection. After suitable cleaning and video inspection, introduce the fiberglass connection sealing and repair product (top hat) from the mainline into the lateral as follows:

- A. A flexible resin impregnated top hat tube that is sized to the service laterals will be inserted into the service lateral by means of a robotic manipulator device. The robotic device, together with a

television camera, will be used to align the repair product with the service lateral connection opening. Air pressure, supplied to the applicator through an air hose, shall be used to insert the top hat into the service lateral pipe. The insertion pressure will be adjusted to fully deploy the top hat into the service lateral connection and hold it tight to the main and lateral pipe walls.

- B. A resin-impregnated sample shall be retained by the installer for each installation to provide verification of the curing process taking place in the host pipe. This sample shall be hung in the entry manhole to simulate ambient conditions of the host pipe.
- C. The inserted product will be inspected using CCTV camera to confirm the product is correctly positioned and/or centered in the lateral opening prior to cutting.
- D. The pressure apparatus shall include a bladder of sufficient length in both the main and service lateral lines to extend beyond the ends of both the lateral tube and main line brim segments. A smooth transition from top hat to the pipe diameters without a step, ridge or gap between the product and the inner diameters of the service laterals and mainline host pipes must be achieved.
- E. After insertion is completed, the manufacturer's recommended pressure must be maintained on the impregnated product for the duration of the curing process. The liner is chemically cured at ambient temperatures or by a suitable heat source. The heating equipment shall be capable of delivering a mixture of steam and air throughout the liner bladder assembly to uniformly raise the temperature above the temperature required to cure the resin. The curing of the CIPP must take into account the existing pipe material, the resin system, and ground conditions (temperature, moisture level, and thermal conductivity of the soil). The heat source temperatures shall be monitored and logged during the cure and cool down cycles. Once the sample piece in the manhole has cured, the bladder is deflated, removed from connection and returned to the manhole to repeat the cycle. Contractor shall recover the sample piece and label with upstream and downstream, manhole numbers and footage from upstream to service connection. Sample shall be submitted for testing.
- F. The top hat insert shall seal to the inside wall of the mainline at least 2.5 – 3 inches around the host lateral opening and to the lateral wall 12-24 inches into the lateral pipe from the main host pipe. This bond seal shall be created by the resin cure and aided with the use of hydrophilic gaskets or hydrophilic caulk. The cured top hat must attain the cured physical strength of the lateral liner.
- G. The Contractor shall install the top hat into the service lateral connection within five (5) days of the main line CIPP liner installation.

PART 7 – INSPECTION AND TESTING

7.01 INSPECTION AND TESTING

- A. Finished liner shall be free from visual defects such as foreign inclusions, dry spots, keel, boat hull, fins, pinholes, wrinkles, and other deformities.
- B. All re-established services shall be smoke tested prior to backfill. Failures shall be completely removed and replaced until a successful test is achieved at no additional cost to the Owner.
- C. Testing requirements of Spec 02952 shall also apply to service lateral lining and lateral connection sealing and repair products. The resin-impregnated sample for each installation shall be retained, labeled in accordance with this specification, and submitted to an independent laboratory, approved by the Owner.

- D. The Engineer and the Contractor shall inspect each installation visually by CCTV. No infiltration or groundwater should be observed. The repair sleeve should be monitored for excessive wrinkling, exposed unwetted fibers, pinhole leaks, and infiltration around the terminations. The pre – and post-construction CCTV inspection documentation in DVD format will become the property of the Owner.

7.02 POST INSTALLATION CLEANING

At the conclusion of the Work, the Contractor shall thoroughly clean the entire new lined pipe by flushing with water or other means to remove all debris or other material that may have entered during the construction period.

7.03 PATENTS

The Contractor shall warrant and hold harmless the Owner against all claims of patent infringement and any loss thereof for any type of sewer pipe lining process used in the Work.

END OF SECTION