To: All Plan Holders of Record

From: Verdantas LLC
For the Owner

Re: ***Addendum No. 1***
Lakeshore Boulevard Trunk Sewer West Rehabilitation
City of Willowick

Date: September 15, 2025

This Addendum forms a part of the contract documents and modifies the original bidding documents dated September 2025 and all previous addenda, if any. Acknowledge receipt of this addendum in the space provided in the bid forms. Failure to do so may subject the bidder to disqualification.

SPECIFICATIONS

REPLACE Specification Section 330130.73 – SPRAY APPLIED PIPE LINING with the enclosed Revised Section.

Changes made to Part 2 – Materials, subsection F to read:

A. Approved SAPL system are listed below. Alternative products may be accepted if they are considered equivalent and meet or exceed the specifications detailed in this section.
   1. Quadex Lining System with Geokrete Geopolymer by Vortex Companies
   2. Geospray by Geotree
   3. Raven 405 Epoxy by PPG Industries
   4. SprayRoq Spraywall
   5. PERMACAST PL-8,000 by Centripipe
   6. Approved Equivalent

TM/JB:mep

Enclosure

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SECTION 330130.73 – SPRAY APPLIED PIPE LINING (SAPL)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

B. Other Sections Referenced:
   1. Section 330130.01 - Sewer Collection System Rehabilitation Definitions
   2. Section 330130.02 - Sewer Line Cleaning
   3. Section 330130.03 - Sewer Flow Control
   4. Section 330130.17 - Television Inspection

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. ASTM - F1216 Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin-Impregnated Tube
   2. ASTM C31 - Standard Practice for Making and Curing Concrete Test Specimens in the Field
   3. ASTM C39 – Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
   4. ASTM C78 – Flexural Strength of Concrete
   5. ASTM C109 – Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50 mm] Cube Specimens)
   6. ASTM C469 – Static Modulus of Elasticity & Poisson's Ratio of Concrete Compression
   7. ASTM C496 – Splitting Tensile Strength of Cylindrical Concrete Specimens
   8. ASTM C666 – Freeze Thaw Durability
   9. ASTM C807 – Set Time of Hydraulic Cement Mortar
   10. ASTM C 868 – Standard Test Method for Chemical Resistance of Protective Linings
   11. ASTM C882 – Bond Strength of Epoxy-Resin Systems Used with Concrete by Slant Shear
   12. ASTM C1090 – Shrinkage Test
   13. ASTM C1138 - Standard Test Method for Abrasion Resistance of Concrete (Underwater Method)
   14. ASTM C 1583/1583M – Standard Test Method for Tensile Strength of Concrete Surfaces and the Bond Strength or Tensile Strength of Concrete Repair and Overlay Materials by Direct Tension (Pull-off Method
   15. ASTM C1898 – Standard Test Methods for Determining the Chemical Resistance of Concrete Products to Acid Attack
   16. ASTM C1904 – Standard Test Methods for Determination of the Effects of Biogenic Acidification on Concrete Antimicrobial Additives and/or Concrete Products
   17. ASTM D 4060 – Standard Test Method for Abrasion Resistance of Organic Linings by the Taber Abraser

18. ASTM D4414 – Standard Practice for Measurement of Wet Film Thickness by Notch Gages
19. ASTM D7682 – Standard Test Method for Replication and Measurement of Concrete Surface Profiles Using Replica Putty
20. ASTM F2304 – Standard Practice for Rehabilitation of Sewers Using Chemical Grouting
21. ASTM F2414 – Practice for Sealing Sewer Manhole Using Chemical Grouting
22. ASTM F2551 – Practice for Installing a Protective Cementitious Liner System in Sanitary Sewer Manholes

B. NACE International, (NACE)
1. NACE SP0188 – Standard Practice for Discontinuity (Holiday) Testing of Protective Linings
2. NACE No. 6/SSPC-SP13 – Surface Preparation of Concrete

C. Occupational Safety and health Administration, (OSHA)
1. Safety and health Standards (29 CFR 1910/1926)

D. The Society for Protective Coatings, (SSPC)
1. SSPC-SP13/NACE No. 6 – Surface Preparation of Concrete
2. SSPC-Guide 12 – Guide for Illumination of Industrial Painting Projects

1.3 DESCRIPTION OF WORK

A. The product furnished shall be a complete spray-applied-pipe-liner (SAPL) system including materials, equipment, and installation procedures. Submitted SAPL or multi-component products for consideration shall be required to meet the submittal requirements as contained herein.

B. The Contractor shall provide materials, labor, equipment, and design services necessary for traffic control (if required), bypass pumping and/or diversion of flows, cleaning, measurement and television inspection of sewers to be rehabilitated, SAPL installation, reconnection of service connections, quality controls, provide samples for performance of required material tests, final television inspection, testing of the rehabilitated pipe system, warranty work and other work, as specified herein.

C. The intent of SAPL is to rehabilitate sewer lines by installing mortar-based, single-component, or multi-component spray applied liner which, once cured, shall be continuous and tight-fitting in a constrained condition with a shear interface with the host throughout the entire length of the original pipeline. The SAPL shall extend the full length of the original pipeline and provide a structurally sound, jointless rehabilitation-solution with no annular space and permanent adhesion between the SAPL and the original pipeline (host pipe). The Contractor is responsible for proper, accurate and complete installation of the SAPL using the system selected by the Contractor meeting the Owners requirements and these specifications. Deficiencies which will be corrected by the finished product include:

1. Cracked and broken pipe caused by poor construction, unstable soil, earth movement, infiltration, roots, destructive loadings, cleaning tool damage, etc.

2. Corrosion of pipe caused by acid attack above the flow line.
3. Erosion of pipe caused by abrasion below the flow level.
4. Degradation of brick pipe caused by loss of masonry.
5. Infiltration of groundwater and soil through leaking pipe joints and structural defects.
6. Exfiltration of transported fluid through leaking pipe joints and structural defects.
7. Inflow of surface water and infiltration of groundwater through unused or illegal connections.

D. The SAPL system shall be designed for a life of 50 years or greater and an equal service life unless specifically specified otherwise by the Owner.

E. The installed SAPL system shall withstand all applicable surcharge loads (soil overburden, live loads, etc.) and external hydrostatic (groundwater) pressure, if present, for each specific installation location.

F. The installed SAPL system shall have a long term (50 year or greater) corrosion resistance to the typical chemicals found in stormwater runoff and defined in the referenced and applicable ASTM standards.

G. Neither the SAPL product, system, nor its installation, shall cause adverse effects to any of the Owner's processes or facilities. The installation pressure for the product shall not damage the system in any way, and the use of the product shall not result in the formation or production of any detrimental compounds or by-products at the wastewater treatment plant or to local receiving waters. The Contractor shall notify the Owner and identify any by-products produced as a result of the installation operations, test and monitor the levels, and comply with any and all local waste discharge requirements. The Contractor shall cleanup, restore existing surface conditions and structures, and repair any of the SAPL system determined to be defective. The Contractor shall conduct installation operations and schedule cleanup in a manner to cause the least possible obstruction and inconvenience to traffic, pedestrians, businesses and property owners or tenants.

1.4 QUALITY ASSURANCE

A. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for work.

B. Installer's Qualifications: Firms with at least 5 successfully completed projects having installed an aggregate total of 5,000 linear feet of the submitted manufacturer's SAPL.

C. Contractor shall submit a written plan with means and methos for installing specified SAPL system. Plan shall be called Performance Work Plan (PWP). This will be made available to the Engineer prior to approval of work and shall identify quality checks to be performed and installation crew qualifications.

D. The Contractor shall outline specific repair or replacement procedures for potential defects that may occur in the installed SAPL.Repair/replacement procedures shall be as recommended by the SAPL system manufacturer and shall be submitted as part of the PWP

E. Defects in the installed SAPL that will not affect the operation and service life of the product shall be identified and defined.

1.5 SUBMITTALS

A. Comply with all provisions of Section 013323 – Shop Drawings and Submittals

B. Manufacturer-certified copies of all test reports on each product used, including:
   1. Test results indicating the product conforms to and is suitable for its intended use per these specifications. Test reports shall be performed at the Licensed Applicator's expense and shall be carried out by an approved independent third-party testing laboratory or by a reputable independent testing body. As a minimum, the test reports should include properties listed in Paragraph 2.5 of this specification.

C. Submit Material Safety Data Sheet(s) for the materials, any other chemical additives, and any other chemicals used in the SAPL system.

D. Minimum Thickness Calculations with approvable design calculations as required in along with proposed plan for ensuring that the installed SAPL meets the minimum thickness.

E. If not submitting the specified SAPL thickness, submit approvable design calculations for the SAPL material thickness for each section of the pipe to be rehabilitated.

1.6 SAFETY

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

B. The Contractor shall perform all of the work in accordance with applicable OSHA standards. Emphasis shall be placed upon the requirements for entering confined spaces and with the equipment being utilized for pipe renewal.

C. The Contractor shall submit a proposed Safety Plan to the Owner, prior to beginning any work, identifying all competent persons. The plan shall include a description of a daily safety program for the job site and all emergency procedures to be implemented in the event of a safety incident. All work shall be conducted in accordance with the Contractor's submitted Safety Plan.
   1. Safety plan shall include a notification of work flyer that will be distributed to all properties connected to the sewer that will be worked on. Notification shall include details of work, dates for expected installation of SAPL, and best measures for preventing fumes from SAPL curing from entering through connected laterals.

D. Compensation for all work required for the submittal of the Safety Plan shall be included in the various pipelining items contained in the bid proposal.

1.7 STORAGE OF MATERIALS

A. Deliver materials in original containers with seals unbroken and labels intact and free of moisture. Do not use materials that have been directly exposed to moisture or if there is visible damage to the packaging.

B. Project materials shall be inspected by the Contractor upon receipt and the Bill of Lading reviewed to confirm it properly documents amount(s) and type(s) of material(s) received, date and time of delivery as well as the shipping company delivering the material. Contractor shall log and make available for review Bill of Lading and material batch numbers upon receipt of the material(s). Receipt of material should also be noted in daily activity logs.

C. Materials may be stored offsite, such as in a yard, for a period prior to use on the project. Upon delivery to the project, Contractor shall designate a specific protected space at the project site for staging and mixing materials. Do not store kerosene, gasoline, or other flammable liquids in this space. Remove oily rags at the end of each day's work. Regardless of storage location, materials used for rehabilitation are to be kept dry, protected from weather, and stored under cover within the temperature ranges recommended by the Manufacturer. Products are to be stored and handled according to their SDSs or appropriate classification. Damaged or unsuitable products shall be promptly

1.8 AS-BUILT DRAWINGS/RECORDS

A. Digital copies of As-Built drawings/records and pre & post inspection videotapes shall be submitted to the Owner via a USB or email, by the Contractor, within 2 weeks of final acceptance of said work or as specified by the Owner. As-Built drawings/records will include the identification of the work completed by the Contractor and shall be prepared on one set of Contract Drawings/Records provided to the Contractor at the onset of the project.

1.9 WARRANTY

A. The materials used for the project shall be certified by the manufacturer for the specified purpose. The Contractor shall warrant the SAPL material and installation for a period of one (1) year. During the Contractor warranty period, any defect which may materially affect the integrity, strength, function and/or operation of the pipe, shall be repaired at the Contractor's expense in accordance with procedures as recommended by the manufacturer.

B. After a pipe section has been rehabilitated and for a period of time up to one (1) year following completion of the project, the Owner may inspect all or portions of the rehabilitated system. The specific locations will be selected at random by the Owner's inspector and should include all sizes of SAPL from this project. If it is found that any of the SAPL has developed abnormalities since the time of "Post Construction Television Inspection," the abnormalities shall be repaired and/or replaced in accordance with plans, specifications, and Owner standards.

C. On any work completed by the contractor that is defective and/or has been repaired, the contractor shall warrant this work for (1) year in addition to the warranty required by the contract.

1.10 GENERAL

A. All equipment and material shall be of a type that has been generally been in use for a period of five (5) years. Work performed with experimental equipment or material will not be permitted without prior written consent of the Owner.

PART 2 - MATERIALS

2.1 MATERIALS

A. The SAPL system must meet the physical performance requirements of these contract documents.

B. All materials used in the installation of SAPL system shall be equal to or exceed the manufacturer's standards.

C. Minimum Design Properties
   1. The Contractor shall provide a detailed calculation using the appropriate methods and standards to determine the thickness of the SAPL system so that it meets minimum design criteria listed below:
      1) All pipe shall be considered fully deteriorated.
      2) All pipe shall be subjected to soil loads of 120 pounds per cubic foot.
      3) All pipe shall be subject to AASHTO HS-20 highway loading.
      4) The water table shall be assumed to one foot (1 ft) above the top of pipe
      5) All pipe shall be assumed to have five percent (5%) ovality.
      6) Creep Retention Factor 50%.
      7) Constrained Soil Modulus per AASHTO LRFD Section 12 and AWWA Manual M45.
      8) Minimum Service Life 50 years.
      9) Design Safety Factor of 2.0 (1.5 for pipes 36” or larger)

D. Minimum Thickness
   1. Design thickness for cementitious or geopolymer liner shall at a minimum be the following unless otherwise specified on drawings or submitted by the Contractor and approved by the Engineer:

Diameter/Span of Pipe	Min. Liner Thickness
54 inch or less	1.0 inch
54 inch < D < 96 inch	1.5 inch
96 inch or greater	2.0 inch

   2. Design thickness for polyurea and polyurethane liners shall at a minimum be the following unless otherwise specified on drawings or submitted by the Contractor and approved by the Engineer:

Condition	Min Liner Thickness
Non-Structural	0.125 inch (125 mils)
Structural	0.250 inch (250 mils)

   3. Design thickness for epoxy liners shall at a minimum be the following unless otherwise specified on drawings or submitted by the Contractor and approved by the

Pipe Material	DFT Thickness
New/Smooth Concrete:	80-250 mils (2030-6350 µm)
Rough Concrete:	100-250 mils (2540-6350 µm)
Resurfaced Concrete:	80-250 mils (2030-6350 µm)
Masonry/Brick:	125-250 mils (3175-6350 µm)
Resurfaced Masonry/Brick:	80-250 mils (2030-6350 µm)
Steel (Carbon):	30-80 mils (762-2030 µm)
Non-Ferrous Metals:	30-80 mils (762-2030 µm)

4. For non-corrugated host pipe materials, conduit materials, the minimum design thickness shall be measured from the interior face of the host conduit wall
5. For corrugated host pipe materials, the minimum thickness shall be measured from the peaks/crests of the corrugation. The corrugations shall be filled to create a flush, smooth pipe surface.
6. If the minimum thickness exceeds that of the calculated thickness provided by the Contractor, the minimum thickness for shall govern as the design thickness for the SAPL system.

E. Physical Properties

1. The cured pipe material shall conform to the minimum structural standards as listed below. Evidence shall be presented to demonstrate that the long-term modulus of elasticity of the cured product is no less than fifty percent (50%) of the herein specified Modulus of Elasticity (Short-term).

CEMENTIOUS AND GEOPOLYMER MINIMUMAL PHYSICAL PROPERTIES

Cured Pipe Material Test	Test Method	Performance Value
Compressive Strength	ASTM C39	Min. 8,000 psi @ 28 days
Flexural Strength	ASTM C78	Min. 800 psi @ 28 days
Modulus of Elasticity	ASTM C469	Min. $3.9x10^6$ psi @ 28 days
Split Tensile Strength	ASTM C496	Min. 700 psi @ 28 days
Freeze Thaw Durability	ASTM C666	Max 0.5% loss @ 300 cycles
Bond Strength to Concrete	ASTM C882	Min. 2,500 psi @ 28 days
Shrinkage Test	ASTM C1090	Max 0.02% loss @ 28 days
Abrasion Resistance	ASTM C1138	Max 36.3 in^3 total vol. loss @ 6 cycles on 28-day sample

POLYURETHANE PHYSICAL PROPERTIES

Cured Pipe Material Test	Test Method	Performance Value
Compressive Strength	ASTM D695	Min. 18,000 psi
Tensile Strength	ASTM D638	Min. 7,500 psi
Bond (Concrete)	ASTM D7234	Min. 200 psi
Bond (Steel)	ASTM D4541	Min. 1,000 psi
Flex. Modulus (Initial)	ASTM D 790	Min. 735,000 psi
Chemical Resistance	ASTM D543	Manufacturer Certified

EPOXY PHYSICAL PROPERTIES

Cured Pipe Material Test	Test Method	Performance Value
Compressive Strength	ASTM D695	Min. 18,000 psi
Tensile Strength	ASTM D638	Min. 9,000 psi
Bond (Concrete)	ASTM D7234	To substrate failure
Flex. Modulus (Initial)	ASTM D 790	Min. 15,000 psi
Chemical Resistance	ASTM D543	Manufacturer Certified

POLYUREA PHYSICAL PROPERTIES

Cured Pipe Material Test	Test Method	Performance Value
Compressive Strength	ASTM D695	Min. 18,000 psi
Tensile Strength	ASTM D412	Min. 4,000 psi
Bond (Concrete)	ASTM D7234	Min. 350 psi
Bond (Steel)	ASTM D4541	Min. 2,000 psi
Flex. Modulus (Initial)	ASTM D790	Min. 95,000 psi
Chemical Resistance	ASTM D543	Manufacturer Certified

F. Approved SAPL system are listed below. Alternative products may be accepted if they are considered equivalent and meet or exceed the specifications detailed in this section.
   1. Quadex Lining System with Geokrete Geopolymer by Vortex Companies
   2. Geospray by Geotree
   3. Raven 405 Epoxy by PPG Industries
   4. SprayRoq Spraywall
   5. PERMACAST PL-8,000 by Centripipe
   6. Approved Equivalent

PART 3 - EXECUTION

3.1 PREPARATORY PROCEDURES

A. The Contractor shall notify all homeowners on the manhole section to be lined forty-eight (48) hours in advance of the work to be done. The Contractor shall inform the homeowner of precautions necessary to prevent backup of sewage into the house. Notification shall include language that the work may extend beyond normal permitted working hours, if necessary to reinstate service laterals

B. The following preparatory procedures shall be adhered to unless otherwise approved by the Engineer:

   1. Cleaning of Sewer Line: Before ordering liner materials for the project, the Contractor shall remove all internal debris from the pipeline that will interfere with the installation as detailed in specification section 330130.02 and the final product delivery of the SAPL materials, as required in these specifications, and accurately measure and document the exact size of the existing pipeline to be rehabilitated. Solid debris and deposits shall be removed from the system and disposed of properly by the Contractor. Moving material from manhole section to manhole section shall not be allowed. As applicable, the contractor shall either plug or install a flow bypass pumping system to properly clean the pipelines. Precaution shall be taken by the Contractor in the use of cleaning equipment to avoid damage to the existing pipe. The repair of any damage, caused by the cleaning equipment, shall be the responsibility of the Contractor. The Owner will designate a site for the disposal of all debris removed from the Owner's sewer system as a direct result of the cleaning

operation. Unless otherwise specified by the Owner, the Contractor shall dispose of all debris at no charge. Should any dumping fees apply, the Contractor shall be compensated at the respective unit price bid in the Proposal for cleaning.

2. Inspection of Sewer Line: In accordance with the Television Inspection requirements, the Contractor shall televise the pipe with PACP certified personnel specially trained in locating breaks, obstacles, and service connections. The interior of the sewer line shall be carefully inspected to determine the location and extent of any structural failures. The location of any conditions which may prevent proper installation of the SAPL shall be noted so that such conditions can be corrected. The Contractor shall provide the Owner a copy of the pre-cleaning and post-cleaning video and suitable log, and/or in digital format, for review prior to installation of the SAPL and for later reference by the Owner.
3. Connections: While televising the mainline sewer, the Contractor shall accurately measure and record the locations and positions of service connections using a fiberglass or other tape approved by the Engineer. Additionally, the Contractor shall utilize the pan and tilt capabilities of the televising equipment to determine which connections are live (active) and which are not in use. If required by the Contract documents, each connection will be dye tested to determine whether the connection is live or abandoned.
4. Bypassing Sewage: The Contractor shall provide for the flow of existing mainline and service connection effluent around the section or sections of pipe designated for SAPL installation. With most small diameter pipelines, particularly on terminal sewers, plugging will be adequate but must be monitored on a regular basis to prevent backup of sewage into adjacent homes. Service connection effluent may be plugged only after proper notification to the affected residence and may not remain plugged overnight. Installation of the liner shall not begin until the Contractor has installed the required plugs or a sewage bypass system and all pumping facilities have been installed and tested under full operating conditions including the bypass of mainline and side sewer flows. Once the installation has begun, existing flows shall be maintained, until the resin/tube composite is fully cured, cooled down, full televised and the SAPL ends finished. The Contractor shall coordinate sewer bypass and flow interruptions with the Owner at least 14 days in advance and with the property owners and businesses at least 1 business day in advance. The pump and bypass lines shall be of adequate capacity and size to handle peak flows. The Contractor shall submit a detail of the bypass plan and design to the Owner before proceeding with any SAPL installation. Compensation for bypass pumping and all associated plans and approvals shall be at the price bid in the Proposal. All bypassing of flow shall be performed as specified under 330130.03 - SEWER FLOW CONTROL.
5. Line Obstructions: It shall be the responsibility of the Contractor to clear the line of obstructions such as solids, dropped joints, protruding service connections, or collapsed pipe that will prevent installation. If the obstruction(s) could have been removed by bucket machines or by using conventional cleaning methods, no compensation will be granted.

    a. Internal repairs are protruding service connections, dropped portions of pipe which can be removed or pushed back in place, and other obstructions which cannot be cleared using conventional cleaning methods, but which can be cleared from within the pipe. Such internal repairs shall be approved in writing

by the Engineer prior to the commencement of the work and shall be considered as a pay item.

b. Point repairs are obstructions that cannot be removed by either conventional sewer cleaning equipment or by internal equipment. The Contractor shall make an excavation to expose and remove or repair the obstruction. Such excavation shall be approved in writing by the Engineer prior to the commencement of the work, shall be performed as specified under Point Repairs, and shall be considered as a pay item.

c. Patching shall be performed at locations where holes or soil are visible within the pipe, but the pipe is otherwise in a condition that it is able to have the SAPL system applied. The Contractor shall apply patching material that is able to properly fill any holes and voids, be smoothened to match the existing pipe surface once cured, and properly adhere to the SAPL. Such work shall be approved in writing by the Engineer prior to the commencement of the work and shall be specified under Patching or Joint Repair, and shall be considered its own pay item(s).

6. Pre-Insertion Television Inspection: The Contractor shall televise and record the sewer pipe immediately before installing SAPL. This televising is to assure that the pipe is clean and existing pipe conditions are acceptable for lining. Should additional cleaning be required, it shall be provided at no additional cost to the Owner. The cost of this televising shall be included in the cost of SAPL.

3.2 INSTALLATION PROCEDURES

A. The liner shall be mixed, installed, and cured (as applicable) in the host pipe per the manufacturer's specifications as described and submitted in the PWP. For non-water based SAPL, materials shall be mixed (when applicable) with the SAPL manufacturer's recommendations component ratio, mix time, temperature, dispersion, and other requirements. Appropriate documentation shall be kept in a Daily Application Log throughout the installation process. The mixing and preparation operations must be performed so that the minimum amount of dust is released into the surrounding environment.

B. The SAPL installation shall be in accordance with the applicable ASTM/ACI standards and manufacturer's instructions.

C. The SAPL material may be spray applied and/or centrifugally spin-cast to the inside of an existing pipeline or structure depending on size of pipe and manufacturer application requirements. The necessary equipment and application methods to apply the liner materials shall be only as provided by the SAPL material manufacturer. Material shall be mixed in accordance with manufacturer's recommendations to proper consistency, then the materials shall be pumped through a high-pressure material hose for delivery to the appropriate and / or selected application device.

D. The Manufacturer's recommended cure instructions (as applicable) shall be strictly adhered to and reviewed with Engineer prior to application.

3.3 FINISH

A. The installed SAPL shall be continuous over the entire length of a lined section (unless specified) and be free from visual defects such as foreign inclusions, infiltration) major surface profile deviation and delamination. The SAPL shall be impervious and free of any leakage through the SAPL wall.

B. Defects that affect the structural integrity or strength of the SAPL shall be repaired at the Contractor's expense in accordance with the procedures submitted under Section 1.4

C. Using the records from the pre-construction inspections, the Contractor shall ensure that connections are properly reinstated and service restored. Excess SAPL material at the connection shall be removed and disposed to an approved waste facility by the Contractor. The Contractor shall ensure that no infiltration is originating at the point of connection by sealing any leaks with appropriate product(s). The laterals and pipe connections shall then be completed by hand, applying the SAPL to the outer surface of the connection to the pipe and smoothly tapering it into the lateral or connecting pipe. No rough edges or abrupt transitions that could catch debris or hinder the flow shall remain.

D. Termination of the SAPL at the end of a pipe or manhole shall be completed by hand applying the SAPL to the outer surface of the pipe or into the interior of the manhole.

3.4 TESTING OF INSTALLED SAPL

A. The physical properties of the installed SAPL shall be verified through field sampling and laboratory testing. Mixed materials for testing shall be furnished by the Contractor to the testing laboratory for sample preparation at the job site, transport to the lab and testing. Sample preparation, transport and materials testing shall be performed at the Contractor's expense by an independent third-party laboratory selected by the Contractor as recommended by the SAPL manufacturer. All tests shall be in accordance with applicable ASTM test methods to confirm compliance with the requirements specified in these contract documents.

B. The Contractor shall provide mixed material samples from the actual installed SAPL for sample preparation to the testing laboratory. Samples shall be provided from the first and last day of installation and every 42,000 lbs | 19,050 kg of material during application of SAPL or as required by the Owner. The sample shall be collected from the mixer/hopper or if appropriate, the end of the application hose. Sample collection and testing hold times will be per manufacturer's recommendations.

C. For ASTM C39 Compressive samples, it is recommended that nine (9) four (4) by eight (8) inch | 100 x 200 mm test cylinders be prepared following ASTM C 31. Alternatively, ASTM C109 Compressive samples in the form of two (2) by two (2) by two (2) | 50 x 50 x 50 mm test cubes can be prepared. It is recommended that three (3) samples be tested at 7 days, three (3) at 28 days and three (3) retained as directed by the Contractor

D. The laboratory results shall identify the project, the test sample date, location as referenced to the nearest manhole and station, product batch and mix information. Final payment for the

project shall be withheld pending receipt and approval of the test results. If properties tested do not meet the minimum physical and thickness requirements, the SAPL shall be repaired or replaced by the Contractor unless the actual physical properties and the thickness of the sample tested meet the design requirements as required in the contract.

E. The installed SAPL thickness shall be confirmed during application through the visual observation and monitoring of the permanent depth gauges and use of a handheld depth gauge by the installer. Pre- and Post-installation video should show the presence of the depth gauge (pre) and coverage of the depth gauge indicated by it no longer being visible (post).

F. Visual inspection of the installed SAPL lining for installation defect to include cracks, infiltration, surface texture and spray defects.

G. Adhesion testing shall be performed for SAPL systems that have been applied to steel or concrete hose pipes. Testing shall be in accordance with ASTM D4541 or ASTM D7234 and performed based on manufacturer guidelines for quality assurance.

H. All costs to the Contractor associated with providing mixed SAPL material to an independent third-party testing laboratory for sample preparation, transport, curing and testing shall be included in the Lump Sum price bid for Mobilization.

3.5 FINAL ACCEPTANCE SAPL.

A. A visual inspection should be made by Owner and Contractor periodically throughout the progression of construction, prior to the completion of a lining stage. Any deficiencies in the finished lining shall be marked and repaired by the Contractor according to the procedures set forth herein.

B. SAPL sample testing and repairs for the installed SAPL, as applicable, shall be completed before final acceptance, meeting the requirements of these specifications, and documented in written form.

C. The Contractor shall perform an internal pipe inspection per PACP requirements in the presence of the Engineer after installation of the SAPL and reconnection of the side sewers. Unedited digital documentation of the inspection shall be provided to the Owner within ten (10) working days of the SAPL installation acceptance.

D. Flow control from the upstream manhole shall be utilized to minimize sewage or stormwater from entering the line during the inspection. In the case of bellies in the line, the pipe shall be cleared of any standing water to provide continuous visibility during the inspection.

E. After the installation work has been completed and all testing acceptable, the Contractor shall clean up the entire project area. All excess material and debris not incorporated into the permanent installation shall be disposed of by the Contractor. Any leaks through the wall of the pipe shall be repaired.

END OF SECTION 330130.73