

CITY OF TORONTO

TORONTO WATER

SEWER REHABILITATION SPECIFICATION

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1.0 EXISTING VIDEO INSPECTION RECORDS

All Tenderers must view video tapes/CD's of the camera inspections and contract drawings undertaken by Works and Emergency Services, prior to the submission of Tenders. Arrangements for viewing these inspection records can be made by contacting Contract Administrator.

Sewer inspection reports, for some of the sections to be rehabilitated in this Contract, may be available upon request for the information of the Tenderers.

If any Tenderer is of the opinion further inspection is required in order to properly assess the work to be undertaken, they will be responsible to perform such additional inspection.

Permission to enter the City's sewer system for inspection purposes must be obtained from Contract Administrator.

2.0 INFORMATION TO BE SUBMITTED WITH TENDER

As part of their Tender submission, Tenderers shall provide a detailed method statement for the proposed work. The method statement shall include:

- 2.1 An engineered design summary for the proposed lining clearly showing the proposed thickness for each section of lining (SL), designed in accordance with the requirements of Clause 11.0, CIPP Sewer Liner. The summary shall include the lining material strengths and modulus, showing the short term and long term values used in the design. Independent test data shall be provided to support the material strengths and moduli used in design. The engineering design, including the design summary shall be certified and stamped by a professional engineer licensed in the Province of Ontario
- 2.2 Material specifications and structural details of the proposed sewer liner in sufficient detail to enable confirmation that the design and materials proposed will meet the design requirements of Clause 11.0, CIPP Sewer Liner.
- 2.3 A summary of the Manufacturer's proposed installation procedure including an example of the design process wet-out plan and curing cycle summary sheet to be submitted for each line and method for maintaining flows during construction.
- 2.4 The Contractor shall supply with the tender submission a certified original copy (complete with supporting literature) from their resin supplier of the Infrared Spectrograph of the *catalyzed* resin mixture they intend to employ on this Contract.

3.0 CCTV TRUCKS

Proper seating accommodation must be provided by the Contractor to enable two people, in addition to the Operator, to clearly view the screen of the on-site monitor, which displays the work in the sewer as such work proceeds. No equipment utilized within the sewer shall be allowed to be stored in the viewing area.

4.0 SERVICE CONNECTION INVESTIGATION

Where required, the Contractor shall carry out testing to confirm whether or not each service connection is live as per the Special Specifications.

Where service investigation is required in the Contractor's opinion, the Contractor shall carry out the testing at the Contractor's expense. **However, the Contractor is required to complete "Service Connection Statement" attached in Appendix "II" for all locations where no service investigation is performed as part of the video inspection.**

The Tenderer's attention is directed to Section "GC 6.0 – Insurance, Protection and Damage" of the General Condition with respect to Contractor's liability.

5.0 SEWER REAMING, CUTTING, GRINDING

- 5.1 The sewer section shall be reamed to remove deposits and protrusions using an approved reaming method. Deposits and protrusions may include (but are not limited to), calcite build up and roots. An acceptable TV camera must monitor reaming operations. Reaming shall include reaming, cutting or grinding as required.
- 5.2 Protruding Service Connections – Service Connections that protrude into the sewer section must be cut or ground back prior to reaming of the sewer. If the drain piping or service connection is damaged or broken by the Contractor, then the Contractor shall repair the damage (by using excavation if necessary) to the approval of the Commissioner at no additional cost to the City. The Contractor shall submit for approval, the proposed method of repair and reinstatement for damaged drain piping or service connections.
- 5.3 Precaution to Prevent Damage to the Sewer Section - the Contractor shall plan and execute the reaming operation to prevent damage to the sewer section and any service connections in the sewer section. Proper precautions shall be taken by the Contractor to ensure that the reaming operation does not cut into the sewer itself, to ensure that the reaming tools do not become jammed in the sewer and that any areas of the sewer that are structurally unsound are not further damaged. Any extraction of reaming tools (or other equipment), including extraction by excavation, is the responsibility of the Contractor and shall be done at no additional cost to the City.
- 5.4 If it is necessary to excavate for any reason, including retrieval of lodged equipment, repair of defective liner, reinstatement of service connections, by-pass of flow, etc., the Contractor shall undertake such excavation, repair, backfill and restoration at their own expense unless other arrangements are agreed with the City in advance. All such work shall be performed by an approved sub-contractor and shall be completed in accordance with the current City of Toronto specifications.
- 5.5 Reaming Tolerances - all protrusions, deposits and build-ups in the sewer section shall be removed such that the internal diameter of the sewer pipe is not reduced by more than 13 mm.

6.0 SEWER CLEANING

- 6.1 The sewer section shall be cleaned to remove foreign materials prior to lining by means of a controlled hydro pressure sewer cleaner. Precautions shall be taken to ensure that no

flooding of public or private property occurs during any phase of the cleaning and/or reaming operations. Satisfactory precautions shall be taken to protect the sewer lines from damage that might be inflicted by the use of cleaning equipment.

- 6.2 All sludge, dirt, sand, rocks, grease and other solid or semi-solid material resulting from the cleaning operations shall be removed at the downstream maintenance hole of the section being cleaned. Passing material from maintenance hole section to maintenance hole section shall not be permitted.

The contractor shall also install a screen in the downstream maintenance hole in order to catch any material, including cut outs from service connection openings, which might migrate downstream. Such material from the maintenance hole shall be removed and properly disposed.

7.0 FIRE HYDRANTS

Prior to the use of any hydrant, a hydrant use permit must be obtained from The City of Toronto Operations and Maintenance Section, Water and Wastewater Services. When water from fire hydrants is used, care shall be taken to ensure water is conserved and not used unnecessarily. No fire hydrant shall be obstructed in case of a fire in the area served by the hydrant. At all times backflow preventers must be employed when drawing water from any hydrant and proper ramps must be employed for all vehicular and pedestrian traffic.

8.0 FILLING OF VOIDS

Where filling of voids is necessary to ensure structural integrity of the sewer and prevent bridging of the liner, the Contractor must submit for the approval of the Commissioner a detailed method statement outlining the procedures and materials to be used in filling the voids. The accepted void fill method shall be as per the Sewer Section Lining Summary.

Costs associated with the filling of voids specifically identified shall be as per the Form of Tender. Payment for the filling of additional voids identified in the Preliminary Video Inspection (V1 Video) shall be made on a force account basis.

No payment will be made for the filling of voids occurring as a result of the contractor's operations.

9.0 FLOW CONTROL

When interruption of sewer line flows is necessary to properly conduct the inspection and rehabilitation operations, acceptable methods of flow control shall be used. The Contractor is to make all necessary arrangements with the owners of each building. The Contractor shall contact all property owners and/or tenants to co-ordinate the repair work to the sewer and minimize any impact on residents and/or businesses.

During the inspection and rehabilitation, sewer flows shall be shut off in order to enable proper inspection of the pipe invert. After the work is completed, flows shall be restored to

normal. Excess sewage flows shall be transported through a closed, leak tight pipeline or by tank trucks to the nearest or most economical disposal area.

On all liner installation dates, the Contractor must maintain on site both a primary and stand-by by-pass pump and pump power supply. Sufficient power supply and hoses must be on site in order to allow the pump to discharge into the next downstream sewer section. The stand-by by-pass pump and power supply shall be of an equal or better capability than the primary by-pass pump and power supply. No by-pass pumps or related equipment shall be disconnected or removed from the sewer or job site until after all service connections have been reinstated and the Contractor has recorded the post-installation video.

All by-pass pumping shall be in place and operation prior to the final pre-installation inspection. All by-pass pumping capacities and configurations must be approved by the Commissioner prior to the actual liner installation date. The minimum size for all by-pass pumps shall not be less than 75 mm and all by-pass pumps and related equipment must be silenced equipment or contained within an acceptable sound reduction structure.

No additional payment will be made for costs associated with the control of flow.

10.0 VIDEO INSPECTION

10.1 For each sewer section, the Contractor shall submit three video inspection records of the work for the review and approval by the Commissioner. All video inspections and recordings shall be made in accordance with the requirements for video inspection and recording.

- V1 Preliminary Video Inspection
- V2 Post Preparation Video Inspection
- V3 Post Lining Final Video Inspection of Complete Rehabilitation.

10.2 Preliminary Video Inspection (V1 Video)

After the preliminary cleaning, a video inspection shall be made of the entire sewer section for the purpose of investigating the sewer section and the service connections. The inspection shall identify the service connections with visible plugs. The Contractor shall deliver to the City the original video recording clearly identified.

The video recordings will be retained by the City and will be made available to the Contractor if required.

Neither service connection investigation nor reaming may proceed without the approval of the Commissioner.

10.3 Post Preparation Video Inspection (V2 Video)

After completion of the pipe preparation (reaming, etc.) of the sewer section, a video inspection of the full length of the sewer section shall be made. The original video inspection shall be submitted to the City. The Commissioner must approve the preparation of the sewer section prior to any lining installation taking place and delivery of the 48 hour Service Interruption Notice.

10.4 Post Lining Final Video Inspection of Complete Rehabilitation (V3 Video)

After completion of all work including lining of the sewer section, reinstatement of service connections, trimming and parging of the liner and any benching adjustments in the MH's and any required remedial work, a video inspection of the full length of the sewer section shall be made. This inspection shall be made immediately on completion of this work. The original of this video inspection shall be submitted to the City for approval of the lining work and service connection reinstatements.

In addition to video recordings, sewer reports shall also be submitted as per the Third Edition of the WRC (Water Resource Centre) Manual of Sewer Condition Classifications, August 1993, as per Appendix "II". The sewer inspection reports shall be in the format identified as adopted from the Manual of Sewer Classification NWC/DOE Standing Technical Committee Report No. 24 NWC, May 1980, Third Edition, August, 1993. The report shall identify the chainage and defect code for all defects and construction features as established from the classification definitions. **Alternative classification systems will not be accepted.**

The final video tape shall be submitted to the City, for the approval of the Commissioner, no more than 48 hours after the lining installation in each section.

10.5 Video Recording and Video Cassette Requirements for Preliminary & Post Preparation Video Recordings

Each individual video inspection recording must be a continuous recording and must be recorded in its entirety on a single VHS video cassette. Recording media shall be Sony T120 PR recording tape or approved equal. Only new tapes shall be used. Reuse of tapes is not permitted.

Upon completion of each sewer section a CD-ROM shall be provided to the City containing the V1, V2 and V3 video recordings in their entirety. Recording media shall be 80 minutes MAXELL CD-R or approved equal and in a format compatible with the City of Toronto (MPEG-1). Each individual video recording (MPEG file) shall have the appropriate file name (Street, MH to MH run, V1, V2 or V3) to match the type of inspection performed and permitting the video footage to be opened and viewed separately.

The cassette/CD labels for each inspection video must be clearly typed and clearly indicate the Contract number, sewer section number, type of inspection (preliminary, post prep, etc.), date of the inspection and Contractor's name.

10.6 Video inspection equipment and tapes shall be as follows:

- (a) The cameras, transmission cables and recording equipment utilized shall produce SVHS or VHS colour recordings.
- (b) The colour CCD cameras and related equipment used in the inspections shall be of a type capable of radial rotation of 360°, lateral rotation of 180°, and of producing a continuous picture resolution of not less than 400 lines at the periphery of the picture. Picture resolutions shall, at the discretion of the Commissioner, be confirmed using a Resolution Chart (Retna Type).

The picture resolution of the inspection videotape recordings shall not be less than 250 lines at the periphery of the picture. The specified resolution chart must be recorded for a minimum of thirty seconds immediately prior to the recording of each inspection video.

- (c) The adjustment of focus and iris must allow optimum picture quality to be achieved and must be remotely operated.

The cameras shall be equipped with a self-contained, adjustable, directed light source compatible with the lens angle and dispersed such that shadows and/or "hot spots" are not created.

- (d) The camera may be self propelled or skid mounted and must be transported in a stable condition through the sewer under inspection. The mounting of the camera must be adjustable such that the central axis of the camera lies at a point equidistant between the invert and obvert of the pipe during inspection of the sewer. In the case of egg shaped sewers the camera lens must be positioned vertically above the invert at a height two-thirds of the vertical dimension of the sewer. In all instances, when transporting the camera through the sewer the camera lens must be positioned on, and looking along, the central axis of the sewer.
- (e) The equipment and cables utilized shall be capable of inspecting each sewer section, without reversal.

10.7 All inspections of the sewer shall be carried out in accordance with the following procedure :

- (a) Prior to commencing an inspection, the Contractor shall dewater the sewer section to ensure that the full diameter of the pipe is visible.
- (b) The maximum speed of the camera during the inspection shall be 5 metres/minute.
- (c) The camera must stop and look directly up and into each service connection for a minimum of five seconds. If any service connection is missed during the video recording then the entire sewer section must be recorded again on a new cassette. If the specified vertical height of the camera lens does not permit a proper view looking directly up and into each service connection then, at no additional cost to the City, the Contractor must record another video inspection with the camera lens so positioned as to allow such proper view looking directly up and into each service connection. All voids shall be similarly inspected. No video inspections will be accepted if the camera lighting system, iris and focus adjustments do not provide satisfactory illumination and focus up and into each service connection.
- (d) The camera lens shall be kept clean at all times. No inspection of a sewer shall proceed while the camera lens is dirty.
- (e) The sewer section shall be kept clear of fog during the inspection. No inspection of a sewer shall proceed while fog is present in the pipe.
- (f) All recordings shall be made at the SP or normal speed. Tapes recorded at a slower speed will not be accepted.

- (g) The inspection videotape shall have a continuous chainage indicated on the screen. The chainage shall commence at the inside wall of the starting MH and shall be accurate to within 1.0 percent of the length of the sewer as compared to the steel tape measurement.
- (h) The inside wall of the maintenance hole at each end of the sewer section shall be clearly visible on the inspection video tape.

10.8 The sewer inspection video tapes shall include a sewer information screen in the format indicated, attached in *Appendix III*, clearly displayed for a minimum of 30 seconds at the start of all video inspection recordings. Inspection of the sewer shall not proceed while the information screen is being displayed.

11.0 CIPP SEWER LINER

11.1 Type of Lining

The lining shall be cured-in-place in accordance with the requirements of ASTM F 1216 with exceptions made to: (1) include non-inverted cured-in-place liners and (2) require the use of a resin containment method. The inner layer of the finished liner shall have an impermeable plastic coating which is required for enhancement of corrosion, flow and abrasion properties.

11.2 Resin Containment

The cured-in-place lining installation method may incorporate provision to ensure that there is no migration of resin out of the medium containing the resin. The method of achieving resin containment must be acceptable to the City and approved by the Commissioner and may include use of a pre-liner.

Payment for the resin containment system will be as per the appropriate item in the Form of Tender.

11.3 Design of Sewer Lining

The lining system shall be capable of receiving Ontario Ministry of Environment and Energy approval and of carrying effluent within the limits of the current City of Toronto Sewerage Use Bylaw, without adverse effect on the lining or the effluent.

The City reserves the right to reject the design method used.

The lining shall be designed, including the lining wall thickness, for the fully deteriorated pipe condition as defined in ASTM F 1216-93, Appendix X1, Design Considerations. The following design parameters shall be used.

11.4 Design Parameters and Requirements of Sewer Lining

Parameter	Minimum Requirement
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External Hydrostatic Pressure:	Depth of ground water table is assumed to be 2.0m below grade.
Earth Load:	2.0 meters over top of pipe or the height of cover that exists at the liner location, whichever is greater. Load calculations shall be based on a soil density 1920 Kg per cubic meter.
Soil Modulus:	700 psi
<i>Live Load</i>	AASHTO HS-20
Minimum Design Ovality	3%
Ovality:	As determined from video inspection records. See Sewer Section Lining Summary at the end of this specification. Ovality as defined in ASTM F 1216-03.
Design Condition:	The liners shall be designed to withstand earth, live and hydrostatic loads without contribution from the existing sewer pipe. This condition is referred to as "Fully Deteriorated" as in ASTM F 1216-03, Appendix X1, Design Considerations. The design method shall be in accordance with ASTM F1216-03, Appendix X1.
Safety Factors:	The safety factor employed in the design for external load shall be a minimum of 2.
Structural Design Life:	50 years
Lining Material Flexural Modulus & Flexural Strength:	The flexural modulus and flexural strength used in the design shall be the values as rated for the design life. Independent third party test data is required as substantiation of the values used in design.

11.5 Minimum Allowable Liner Wall Thickness

The liner shall have the lower of a Dimension Ratio (DR) of fifty five (55) or the DR as determined by the design.

11.6 Fit and Finish

11.6.1 Liner Fit to Existing Sewer

The outside surface of the finished liner shall be in contact with the inside surface of the existing sewer subject to the contact tolerance. The inside surface of the existing sewer is the surface after the sewer has been prepared for lining in accordance with the preparation requirements. The contact tolerance is 1.0 mm. Where any space of gap between the outside surface of the liner and the inside surface of the existing sewer exceeds 1.0 mm, the liner fit will be deficient, subject to exceptions noted below.

11.6.2 Exception to Liner Fit at Existing Sewer Irregularities

Existing sewer irregularities include off set joints, protrusions, bumps or other similar situations in the existing sewer that remain after the sewer has been prepared in accordance with the preparation requirements. Neither ovalisation of the existing sewer nor curves made by joint deflection are irregularities in this context. Where an irregularity exists, exception to the liner contact tolerance requirements will be allowed in the irregularity zone. The irregularity zone is defined as a zone extending a distance of up to ¼ of the liner inside diameter in any direction from the irregularity as measured along the inside surface of the liner.

A liner fit exception at an existing sewer irregularity shall not present an obstruction to sewage flow whether or not it complies with the allowed exceptions.

11.6.3 Liner Shape

The liner shape will be as defined by liner fit to existing sewer. In general the liner shape shall conform to the shape of the existing sewer inside surface after its preparation in accordance with the preparation requirements. However, where the existing sewer shape is not defined (missing pieces of sewer) the liner may either bridge the missing wall section or indent into the missing wall section. Where the liner bridges, the shape of the liner shall match the shape of adjacent sewer and the inside diameter of the liner shall be as required for Contact Tolerance for the adjacent sewer. Where the liner indents, the depth of the indent shall not reduce the liner wall thickness below the Wall Thickness Tolerance.

11.6.4 Liner Wall Thickness Tolerance

The liner's finished wall thickness shall be as specified in the engineered design summary submitted with the Tender, meeting the requirements of the Contract and as approved by the Commissioner, subject to the following tolerances:

Liner Wall Thickness minus Tolerance: 0%

Liner Wall Thickness plus Tolerance: 25%

11.6.5 Finished Liner Installation

The liner shall be free of any interior bulges, ribs, ripples, folds or other irregularities except where these irregularities comply with the Liner Wall Thickness Tolerance, fit, shape and wall thickness given above.

11.6.6 Liner Termination At and Through Maintenance Holes

At maintenance hole entrances and exits, the interface between the exterior surface of the liner and the maintenance hole shall be watertight to the requirements for external hydrostatic pressure. The finished ends of the liner shall be neat and smoothly cut. The benching in the maintenance holes shall be modified where required to conform to liner dimensions and the requirements for benching.

In the case where the liner is installed through an existing maintenance hole, the liner shall be trimmed neatly and parged at the spring line of the liner and at the interface between the liner and any other existing sewers or service connections entering into the maintenance hole.

11.6.7 Liner Wall

The wall of the liner shall be free of any voids, cavities or bubbles.

11.6.8 Sizing of the Liners

The Contractor shall confirm the internal diameters of each sewer section to be lined. A record of the internal diameter measurements shall be available to the City for review. The Contractor shall immediately notify the City of any discrepancy between any internal diameter measurement and the diameter identified in this Contract.

11.6.9 Installation Procedure

The actual lining installation procedure shall be in accordance with the submission with Tender. Any proposed deviation from the submitted procedure shall be submitted, with explanation, to the City for approval and the submission shall include the approval of the lining manufacturer or senior licenser.

11.6.10 Equipment Ready for Lining

The Contractor shall ensure that all required equipment (including as required by the Contract) is on site and in satisfactory working order prior to commencing the installation of a lining section.

11.6.11 Other Requirements

Prior to the lining of each sewer section the contractor shall submit to the Commissioner a standard certificate of analysis, identifying the batch no. and product name, confirming that the liner design complies with the product specification.

The contractor shall also provide the Commissioner with copies of the wet out information sheet itemizing the dimensions of the liner and the quantity of each material to be used in the lining of the sewer section.

Following installation of the liner the contractor shall provide the Commissioner with copies of the boiler and thermocouple log in a format that will enable direct comparison with the process curing cycle submitted with the tender submission.

11.6.12 Field Samples

(a) Finished Liner

For each section of lining, the Contractor shall furnish to the City a cylindrical sample of the lining at least 200-300 mm in length. The sample shall be taken from lining that extends into any maintenance hole on the section and shall be an extension of the lining installed for that section. A suitable form shall be used to create the sample so that the conditions of making the sample are as close as possible to the installation and curing conditions for the corresponding section of lining.

(b) Resin

The City of Toronto, with the Contractor's assistance, may sample resin from each liner supplied for this Contract and will conduct Infrared Spectrophotometric analysis on each resin sample. The Spectrograph shall be generated by the same test method as employed by the supplier and shall include all components that will be incorporated into the final mix design. The certified copy of the IR Spectrograph shall be the reference IR Spectrograph. All field samples supplied for this Contract shall produce IR Spectrographs that correspond to the reference IR Spectrograph when tested under the same conditions.

11.6.13 Odour Control

(a) Cool Down

Prior to releasing the water used for curing the liner, the water shall be cooled to the ambient temperature of the sewer into which it will drain

(b) Exhaust Fan

During the entire curing process a ventilation fan with a minimum capacity of 2,100 cfm shall be used to exhaust air from the MH.

12.0 REINSTATEMENT OF SERVICE CONNECTIONS

Reinstatement of the service connections shall be carried out in accordance with the approved method statement.

All live service connections shall be reopened to their full diameter, and the interface between the liner made leak tight by remote means.

Service connections must be reinstated to the entire opening of the service connection or service connection pipe, whichever is the greater. No sleeve or liner protrusions, sealer, grout or other foreign material is permitted into such area.

Immediately following any installation that covers a live service connection the Contractor must open each service connection to **a minimum of 75% within 18 hours**. All service connections must be entirely opened by no later than the next day.

At all times when live service connections are to be covered the Contractor must provide a **48-hour Service Disruption Notice** to all affected parties. Such notice must be typed on the Contractor's letterhead and clearly indicate both daytime and after hours local contact telephone numbers. The Contractor must schedule the liner installation accordingly. No service disruption will be allowed without such 48-hour notification. In the event that the Contractor is unable to install the liner on the date stated in the Service Disruption Notice the Contractor must immediately provide written notification of the change of date including the new date for the liner installation. After the service connection has been reinstated the Contractor must provide written notification to all affected parties that their service connection is again in service. The notification format must be submitted to the City for approval prior to the commencement of work on this Contract.

The 48-hour Service Disruption Notice shall contemplate providing residents, upon request of the resident, the supply of a clean, properly functioning portable chemical toilet for the

entire time that such resident's service connection is blocked at the sewer. Such toilets shall be delivered prior to any service connections being blocked in the sewer and shall be promptly retrieved by the Contractor upon service connection reinstatement.

The Contractor shall maintain a detailed record of the time at which the reinstatement of each service connection is completed.

13.0 PAYMENT

Payment for sewer cleaning and reaming, control of water, Preliminary Video Inspection (V1 Video) and Post Preparation Video Inspection (V2 Video) recordings, reports and visible plug survey, and all other work necessary to complete such work shall be at the unit rate price in the Form of Tender.

Payment for service connection investigations, including all other work necessary to investigate service connections, shall be at the lump sum price in the Form of Tender.

Payment for the filling of voids identified in the Sewer Section Lining Summary, including supply of material and all other work necessary to fill such voids, shall be at the lump sum price in the Form of Tender.

Payment for the filling of additional voids identified in the Preliminary Video Inspection (V1 Video) recording shall be made on a force account basis in accordance with the general conditions.

Payment for supply and installation of the resin containment system, including all other work necessary to supply and install such system, shall be based on the actual length of sewer section lined and shall be at the unit rate price in the Form of Tender.

Payment for lining of sewers shall be based on the actual length of sewer section lined, as determined by steel tape measurement of the distance from the inside walls of the maintenance holes at the end of each sewer section. The unit price for the lining of sewers shall include all work necessary for the supply and installation of the liner including traffic control, the provision of the required safety equipment, communication systems, stand-by equipment, control and maintenance, including by-passing, of existing flows, lining of the sewer, filling of voids occurring as a result of the contractor's operations, grouting of the sewer, video inspections of the sewer including, but not limited to, pre-installation, post-installation, and Post Lining Final Video Inspection of the Complete Rehabilitation (V3 Video) inspections, recordings, field samples, installation curing logs and all other documentation.

The unit price for service connection reinstatement shall include all work and material necessary to open, seal and reinstate each live service connection.

Payment for the supply and maintenance of the Commissioner's Site Office shall be at the lump sum price in the Form of Tender.

Sewer Section Lining Summary – Contract No.

SL No	Street/Lane	MH #	Depth (m)	MH #	Depth (m)	Length (m)	Dia. (mm)	Approx . No S/Cs	Min. Ovality	Voids	Void Fill	CCTV Contract DVD/CD #	Comment
1													
2													
3													

SUMMARY:

Total ... mm diameter sewer (m) :

Total ... mm diameter sewer (m) :

Total ... mm diameter sewer (m) :

Total number of service connection (each):

EXCAVATION:

In a case that is necessary to excavate to repair a broken sewer/drain pipe, prior to commencing work in the section, the Contractor shall confirm the exact location of broken pipe via steel tape measurement at appropriate chainage from designated MH's. Contractor to remove and replace the broken pipe in open cut, using DR35 PVC gravity sewer pipe or approved equivalent as per drawing SE-575 (see Appendix "II"). Upon completion of backfill operation with **unshrinkable fill** material in roadways and granular "B" in unpaved areas, the Contractor shall supply and compact in place 150 mm of granular 'A' and 50 mm of H.L.3 hot mix asphalt. See appropriate item in the Form of Tender for payment.

NOTES:

APPENDIX “I”

Contract Drawings

APPENDIX “II”

WRC Sewer Defect Classification Table

Definitions

Clock References

Clock references must be given clockwise, i.e., from 10 o'clock to 2 o'clock = 1002. Thus, the upper half of a pipe is 0903 and the lower half 0309.

Structural Condition - Pipe Sewers

Cracked	Crack lines visible on the pipe wall, pieces all still in place.
Fractured	Cracks visibly open on the pipe wall, pieces all still in place.
Broken	Pipe cracked with pieces of pipe visible displaced, some pieces could be missing.

Cracked, fractured and broken can be further described as:

Longitudinal	Defect runs approximately along axis of sewer.
Circumferential	Defect runs approximately at right angles to axis of sewer.
Multiple	Combinations of both longitudinal and circumferential defects.
Deformed	Original cross-section of sewer altered, pipe probably extensively broken.
Collapsed	Complete loss of structural integrity. Most of cross-sectional area lost.
Joint Displaced	The spigot of a pipe is not concentric with the socket of the adjacent pipe.
Open Joint	Adjacent pipes are longitudinally displaced at the joint.
Dropped Invert	Invert section of pipe 'dropped' relative to sewer walls, with a pronounced gap between invert and wall.

Structural Condition - Brick Sewers

Mortar Missing	Mortar between brickwork missing to a degree varying from surface loss to medium or total loss. Bricks still in place.
Cracked	Crack lines visible in brickwork and/or mortar. Bricks still in place.
Fractured	Cracks visibly open in brickwork and/or mortar. Bricks have moved apart from one another.

It is often difficult to distinguish between mortar missing, cracked and fractured. Where possible, take a photograph of medium or total mortar loss, or where brickwork cracks or fractures are suspected.

Cracked and fractured can be further described as longitudinal, circumferential or multiple, as defined under pipe sewers.

Displaced Bricks	Single bricks, or areas of bricks, have moved from their original position.
Missing Bricks	Single bricks, or areas of bricks, are missing. (More than one ring may be affected).
Surface Damage	
- spalling	Surface splintered off.
- wear	Surface worn, e.g., by cleaning tools.
Deformed Sewer	
- vertical	Reduction in vertical dimension of sewer.
- horizontal	Reduction in horizontal dimension of sewer.
Collapsed	Complete loss of structural integrity. Most of cross-sectional area lost.
Dropped Invert	Invert section of brickwork 'dropped' relative to sewer walls, with a pronounced gap between invert and wall.

Service Condition - Pipe and Brick Sewers

Roots	The ingress of roots through defects in the sewer, connections or maintenance holes. Described as fine, mass or tap roots depending on severity. (See photographs) 'Tap' means that individual roots are over 10 mm thick.
Infiltration	The ingress of groundwater into the sewer through defects, joints or MH's. The four terms used in describing this are:
- Seeper	The slow ingress of water. The usual indication of this type of infiltration is that the joint or crack 'glistens' in the lights of the CCTV camera.
- Dripper	Water dripping in through a crack or faulty joint.
- Runner	Water running in through a crack or faulty joint.
- Gusher	Water entering pipe under pressure through crack or joint.
Encrustation	Deposits left by the partial evaporation of infiltrating groundwater containing dissolved salts. Classified into light, medium or heavy by percentage diameter lost.
Scale	Hard deposits, which cannot be, identified as encrustation, e.g., deposits resulting from corrosion of iron pipes, or hardened grout downstream of a ready-mixed concrete plant.
Debris	Grease, organic or silty materials deposited in a sewer, which cause flow turbulence and a reduction in hydraulic efficiency. Examples of this are road grit, fatty deposits and soil washed in by infiltrating groundwater.
Obstruction	Solid material in a sewer, which impedes the inspection and/or causes a reduction in hydraulic efficiency., e.g., bricks rods or displaced sealing rings.
Water Level	The level of water at the observed point in the sewer.
Line	A visible divergence in the sewer alignment, left, front, up, down.

Construction Features - Pipe and Brick Sewers

Junction	A purpose made or preformed junction built in to the sewer during construction.
Connection	A lateral pipe which has been added to the sewer. Includes all 'saddle' connections.
Major Branch	(Applies only to sewers of diameter 900 mm and above.) Branch or similar feature of comparable size to the main sewer, e.g., drop shaft, air vent, and overflow.
Maintenance Hole	Any access point. May be direct or side entrance shaft, or lamphole. May be 'buried', i.e., covered over at some time since construction.
Defective Junction	The junction or the adjacent sewer have become damaged during or after construction, or the connection is incorrectly positioned or of poor workmanship.
Intruding Connection	The connection intrudes into the water.
Continuous Defect	
- Pipe Sewers	A defect, which extends or is repeated over two or more consecutive pipe lengths.
- Brick Sewers	A defect, which extends beyond the first metre visible in the TV monitor or photograph.

APPENDIX B
WRC Sewer Defect Classification Table

CLASS	CODE	TYPE	CODE	DESCRIPTION	CODE	J	%	CLOCK		SEE NOTE	
								1	2		
Pipe	P	Cracked Fractured	C	Longitudinal	L	*	*	*			
			F	Circumferential	C	*		*			
			M	Multiple	M	*		*			
		Broken Deformed Collapsed	B			*		*			
			D								
			X								
		Joint Displaced Open Joint	JD	Slight under 't'	S)
			OJ	Medium 1-1 ½ x't'	M) 1
				Large over 1 ½ 't'	L)
				't' = pipe wall thickness							
Dropped Invert	DI										
Brick	K	Mortar Missing	M	Surface (1-15mm)	S			*			
				Medium(15-50mm)	M		*				
				Total (over 50mm)	T		*				
		Cracked Fractured	C	Longitudinal	L		*				
			F	Circumferential	C		*				
			M	Multiple	M		*				
		Displaced Bricks Missing Bricks	DB				* or t*				
			MB				* or *				
			S	Spalling	S		* or *				
		Surface Damage		Wear	W		* or *				
D	Vertical		V		*	2					
	Horizontal		H			3					
Deformed Sewer	X						4				
Collapsed Sewer Dropped Invert	DI										

KEY TO ADDITIONAL DETAILS	NOTES
<p>An asterisk (*) in any column means further details should be given, if available, as follows:</p> <p>J if defect is at joint, add J to code</p> <p>% give percentage of diameter lost - to nearest 5%</p> <p>Clock 1 give one clock reference, e.g., 3 o'clock</p> <p>Clock 2 give two clock references, e.g., from 10 to 4</p> <p>additional illustrations occur incidentally throughout</p> <p>in these cases give one clock reference, or two, depending on circumstances.</p>	<ol style="list-style-type: none"> 1. S, M, and L measure degree of displacement 2. Give % height loss 3. Give % width loss 4. Give wall, floor gap in mm 5. Depth of water, as % of height 6. Give junction diameter in mm 7. Give connection diameter in mm 8. Give length of intrusion in mm 9. Give pipe diameter in mm

APPENDIX “III”

**Video Title Screen
Service Connection Statement**

SEWER REHABILITATION VIDEO TITLE SCREEN

Line
Number

1 **CITY OF TORONTO CONTRACT # 12345**

2 **SL - 9 STREET : NIAGARA ST.**

3 **PRELIMINARY / POST-PREPARATION VIDEO**

4 **DATE : 21 MAR/99 TIME : 11:55 AM**

5 **SURFACE DISTANCE : 112.0 M**

6 **START MH # : 23 2ND S/O WELLINGTON**

7 **END MH # : 22 1ST S/O WELLINGTON**

8 **WEATHER : DRY / RAIN / MELTING SNOW / etc.**

9 **FLOW DIRECTION : N TO S**

10 **CAMERA DIRECTION : S TO N**

11 **START & S/C REFERENCE POINT : CAMERA PANNED 90°**

12 **SIZE : 305 mm TYPE : CLAY DUTY: COMBINED**

13 **CONTRACTOR : ACME LINERS INC.**

