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**SECTION 5B****SANITARY SEWER - INSTALLATION****5B.1 SCOPE**

This section shall govern the installation of all sanitary sewer mains and their appurtenances within the Municipality.

**5B.2 GENERAL**

5B.2.1 Provision shall be made to maintain the flow of all drains, ditches, watercourses and service connection that may be encountered during the progress of the work. Where existing systems are anticipated or located during construction, the existing system shall be connected to the new installation or replaced. In every case the contractor and/or Consulting Engineer shall notify the Municipality when previously unidentified systems are found. The contents of any sewer, drain or service connection shall not be allowed to flow into the trench or into the main.

5B.2.2 The Contractor shall ensure debris and mortar droppings do not enter any part of the sanitary sewer system and shall leave all pipe lines, manholes, cleanouts, and other appurtenances in a thoroughly clean condition.

5B.2.3 Any connection or modification to existing works shall be by Municipal crews at the Developer's expense, unless specifically approved otherwise.

**5B.3 PIPE INSTALLATION**

5B.3.1 Standards for excavation, bedding, backfilling and restoration shall be in accordance with Section 3.

5B.3.2 Pipe shall be checked before being lowered into the trench to ensure that no foreign material, manufacturer's defects, or cracks exist that might prevent the proper jointing of the pipe or its operation.

5B.3.3 Pipes shall be handled, stored and laid in accordance with the recommendations of the pipe manufacturer and in all cases gaskets shall be installed. Particular care shall be taken to ensure that before each joint is made the pipe is cleaned out and all dirt and other debris removed.

5B.3.4 Pipe laying shall commence at the lowest point of the length being laid and the pipes shall be placed with spigot ends pointing in the direction of flow.

5B.3.5 The open end of the pipe in the trench shall be suitably covered to prevent entrance of trench water and other material during periods when pipe is not being installed.

5B.3.6 Precautions shall be taken to ensure that displacement of the pipe in the trench does not occur through soil displacement or floatation due to the presence of trench water. Pipe that has been displaced shall be removed from the trench and re-laid.

5B.3.7 Pipe shall not be backfilled until the bedding, grade and alignment has been approved by the Consulting Engineer.

5B.3.8 The pipe shall be laid on the alignment and grade in accordance with the construction drawings. Methods to maintain pipe alignment and grade must be approved by the Engineer. Each pipe shall be checked for line and grade as it is installed.

5B.3.9 Unless otherwise directed by the Engineer, tolerances for pipe alignment and grade shall be:

Alignment	=	" 50 mm
Grade	=	" 10 mm

5B.3.10 Where a sanitary sewer is being constructed as an extension to an existing Municipal system, gravel traps must be installed by contractor. Alternatively, the Engineer may require that the existing pipe remain sealed until the sewer extension is completed, flushed, tested and accepted by the Municipality. Upon acceptance, the seal may be removed and one length of pipe installed to connect the extension to the existing system.

5B.3.11 Where storm drains and sanitary sewers are installed in a common trench, there shall be a minimum 300 mm lateral clearance between the walls of adjacent pipes.

5B.3.12 Where deflections are required to accommodate manholes or other works only the storm drain shall be deflected from the approved alignment.

#### 5B.4 MANHOLE AND CLEANOUT INSTALLATION

Unless otherwise approved by the Engineer, all manhole bases shall be precast concrete.

##### 5B.4.1 Manhole Concrete Bases

- (a) All water shall be removed from the excavation prior to placing base concrete. The base shall be constructed such that the first section of a precast section can be set plumb with uniform bearing throughout its full circumference.
- (b) If material in the bottom of the trench is unsuitable for support, the bottom shall be over excavated to firm base as determined by the Consulting Engineer and backfilled to the required grade with thoroughly compacted base gravel as specified for unstable sub-grade in Section 3 Trenching, Backfilling and Restoration.
- (c) Concrete manhole bases shall be constructed as shown on the drawings. Pipes and fittings through the manhole shall be supported on concrete blocks and the concrete base poured around the pipe to a depth of at least 150 mm below the bottom of the pipe and up to the spring line of the pipe. Install rubber manhole adapter rings on all plastic pipe installed in the manhole base.
- (d) Invert elevations of pipes at the manhole shall be checked by the Contractor prior to and following placement of base concrete around the pipe. Variations in manhole inverts from

established grade or elevation shall be corrected.

5.B.4.2 Precast Manhole Bases

- (a) Installation of precast manhole bases shall conform to Section 5B.4.1.
- (b) Precast manhole based shall be placed on 150 mm thick base of 40 mm drain rock.

5B.4.3 Manhole Channeling

- (a) Manhole channeling shall be constructed as shown on the standard drawings. The channeling shall be shaped and finished to provide smooth passage for the sewage in order to minimize head losses and deposits at bends and at junctions. The drop from inlet to outlet must be provided as shown on the drawings.
- (b) Channels shall be accurately formed. The practice of forming channels roughly to shape and finishing with mortar cement will not be permitted. The channels must be steel trowel finished.
- (c) Benching in manholes shall be sloped to drain as specified on the standard drawings. Prior to curing, the concrete benching shall be given a broom finish to produce a non-skid surface.
- (d) Where connecting to an existing main, the concrete channeling and benching may be formed around the existing pipe. The new channel shall then be cut out of the existing pipe and the concrete finished to conform to a standard manhole.
- (e) Branch lines entering the manhole shall be channeled to join the main sewer at an angle with the flow that is less than 90 degrees.

5B.4.4 Precast Manhole Sections

- (a) Manholes must be constructed so as to ensure that there is no infiltration or exfiltration.
- (b) All pipes entering manholes must be sealed using approved water stop gaskets installed in accordance with manufacturer's recommendations.
- (c) Manholes and other precast sections shall be joined and sealed using cement mortar, mastic sealer or rubber gaskets to produce a watertight joint.
- (d) Where cement mortar is used a layer of mortar shall be placed on the tongue of each section prior to lowering the following section into place. All lifting holes shall be lugged with cement mortar and finished flush with the manhole wall. The outside surface of the joint shall be sealed with an asphalt emulsion treatment or approval equal. The interior joints are to be grouted.
- (e) Where rubber gaskets or mastic sealers are used, installation must be in strict accordance

with manufacturer's recommendations to ensure that a watertight joint is achieved. The interior joints are to be grouted.

#### 5B.4.5 Manhole Steps

- (a) Manhole steps shall be installed in manhole sections by the manufacturer unless circumstance dictates otherwise in which case approval must be received from the Consulting Engineer.
- (b) The distance from the top of the casting and lid, to the first manhole step shall conform to Workers Compensation Board requirements.

#### 5B.4.6 Frames and Covers

- (a) Set manhole frames by firmly embedding in mortar on a minimum of 1, maximum of 3 courses of bricks or precast concrete riser rings, or cast-in-place form system with due regard to maximum distance to first step.
- (b) The contractor may use precast concrete rings instead of concrete bricks to bring the manhole frames up to grade. The rings shall be laid in common bond with raked mortar joints and shall be faced with mortar at the entrance of the manhole.
- (c) Heavy duty frames and covers, as specified on the standard drawings, shall be installed on manholes and cleanouts. Low profile frames and covers shall only be used in special circumstances as approved by the Engineer.

#### 5B.4.7 Drop Structures

Manhole drop structures shall be constructed as shown on Standard Drawings.

#### 5B.4.8 Stubs

Blind stub sections for connection of future sewers and service connections to the manholes shall be installed where shown on the construction drawings and as directed by the Consulting Engineer. Stubs shall be as long as determined by the Engineer. Each stub shall be plugged with a removable, watertight plug as shown on the construction drawings. Where stubs are installed, the bottom of the manhole shall be channeled to the stub entrance.

#### 5B.4.9 Cleanouts

Cleanouts shall be installed using the above specifications and information as shown on the standard drawings.

### 5B.5 SERVICE CONNECTION INSTALLATION

- 5B.5.1 Service connections shall be installed in accordance with Standard Drawing S5.

- 5B.5.2 Standards for excavation, bedding and backfilling of service connections shall be in accordance with Section 3.
- 5B.5.3 Service connection installations shall conform to the specific sizes, locations and grades indicated on the design drawings and the general requirements noted below:
- (a) Minimum grade for a 100 mm service shall be two percent; minimum grade for a 150 mm service shall be one percent.
  - (b) Minimum cover on service shall be 1.0 m unless otherwise approved by the Engineer.
  - (c) Where horizontal bends are required in the service pipe these shall be made with long radius bends.
  - (d) Where a horizontal bend greater than 45 degrees is required, a cleanout shall be constructed.
- 5B.5.4 Services shall be extended 2.0 m into the lot in order to prevent undermining of the boulevard and to protect cleanout when connecting to service.
- 5B.5.5 Cleanouts shall be installed at property line on all sanitary sewer connections. Cleanout riser, complete with rubber ring joint cap shall be left 600 mm above ground at time of installation. Risers shall be adjusted by lot owner to suit finished grade.
- 5B.5.6 The ends of the service pipes shall be marked with a 50 mm x 100 mm (2 x 4) stakes with the depth to invert indicated on the stakes. Sanitary sewer connections shall be identified by painting the stakes red.
- 5B.5.7 The connection to the main shall be made with 45 degree "Y" branches installed during construction of the main sewer. Connections onto existing sewer mains will be done by municipal personnel unless otherwise approved by the Engineer.

5B.6 **NOTIFICATION TO TOWN OF LADYSMITH**

- 5B.6.1 The Engineer shall be given 48 hours notice of all tests and flushing.
- 5B.6.2 All testing and flushing shall be performed in the presence of the Consulting Engineer and a Municipal Inspector.

5B.7 **CLEANING AND FLUSHING**

- 5B.7.1 On completion of the sewer pipe installation, the pipes shall be cleaned to the satisfaction of the Engineer by power flushing with water to remove all foreign matter.
- 5B.7.2 A silt trap shall be provided at the downstream manhole for removal of the foreign material.

5B.8 **LEAKAGE TESTING OF GRAVITY SEWERS**

5B.8.1 Leakage tests shall be performed by the Contractor on all sanitary sewers and sewer service connections, manholes and appurtenances.

5B.8.2 Type of Test

- (a) Tests on gravity sewers and manholes shall be either exfiltration or infiltration water tests as directed by the Engineer. Manholes shall be tested separately from gravity sewers.
- (b) In lieu of leakage testing with water, the Engineer may permit testing with low pressure compressed air.
- (c) Testing shall only be carried out after all underground work is complete.
- (d) Copies of all test results must be forwarded to the Engineer.

5B.8.3 Testing Equipment

- (a) The Contractor shall furnish all the necessary testing equipment, including suitable removable watertight plugs and test balls and shall perform the tests in a manner satisfactory to the Engineer. Testing equipment must provide readily observable and reasonably accurate measurements of leakage under the specified conditions. The Contractor must comply with all WCB regulations covering the use of air testing, and ensure that safe working practices are used in the application of the test.

5B.8.4 Water Exfiltration Test

- (a) On an exfiltration test, the test section shall be sealed at its lower extremity by means of a watertight plug. The test section shall be filled with water such that a minimum hydrostatic head of 600 mm is placed on the pipe at its upper extremity. The head of water on the pipe shall be taken as the distance from the top of the pipe being tested to water surface at the point of measurement. The test pressure shall be maintained above the 600 mm minimum head for a period of not less than one hour, and unless excess exfiltration requires further testing, not greater than 8 hours. Pressures in excess of 3 metres water head are not recommended. Damage resulting to pipe as a result of testing shall be repaired by the Contractor at no cost to the owner.
- (b) In areas where the groundwater table is above the sewer invert level, the test shall be increased by a height equal to the distance from the sewer invert level to the water table elevations.
- (c) Exfiltration test sections shall normally have a manhole at both extremities. If, however, sewer grades are such that a test section cannot be terminated at a manhole without placing excess pressure on the pipe or joints, apparatus shall be provided to enable testing without having manholes at the upper and lower ends of a test section.
- (d) Gravity sewers, service connections and appurtenant structures thereon shall be constructed such that leakage as evidenced by exfiltration tests is less than that calculated using the



following formula:

$$\text{Allowable leakage in litres} = \frac{\text{HDL}}{5200}$$

Where H = duration of test in hours  
D = inside diameter of the pipe in millimetres, and  
L = length of pipe in the test section in metres.

- (e) The above leakage limit will constitute the total maximum allowable leakage of any test section of gravity sewer. Where service connections exist along the test section, the allowable leakage from service pipe calculated by the use of the formula in Section 5B.8.4(d) will be added to that of the main sewer to arrive at the total allowable leakage unless the elevation of the service connection pipe is greater than the maximum water elevation. No additional leakage allowance will be made for manholes existing along the test section.
- (f) The maximum allowable leakage for an exfiltration test will be that calculated by the formula in Section 5B.8.4(d) regardless of the test head of water employed. Where a section of sewer is found to have leakage exceeding the allowable limit, replacement or repairs shall be made to reduce the amount of leakage to or below the allowable limit. Repaired sections shall be retested until they meet the allowable limit.
- (g) All point sources of leakage exceeding 1.2 litres per minute (from poor joints, improper connections, etc.) shall be made watertight by the Contractor to the satisfaction of the Engineer.
- (h) The Contractor shall dispose of the water used for testing in a manner approved by the Engineer.

#### 5B.8.5 Manhole Exfiltration Test

Manholes shall be tested independent of the sewer pipe for leakage by filling the chamber to the underside of the roof slab with water. The test duration shall be a minimum of three hours. No leakage shall be permitted in manholes.

#### 5B.8.5 Water Infiltration Tests

In areas of high groundwater table, the Contractor shall, if instructed by the Engineer, measure the amount of infiltration into the sewer over a period of 8 hours. The infiltration rate shall not exceed the leakage as calculated for exfiltration testing.

#### 5B.8.6 Air Test

- (a) Air test shall not be used with concrete sewers.
- (b) On an air test, the section to be tested shall be plugged at each end and all service laterals, stubs and fittings properly capped or plugged.

- (c) Air shall be supplied to the test section slowly, filling the line to a constant pressure of 24.0 kilopascal (kPa)(3.5 psi). The air pressure inside the pipe shall not exceed 28 kPa( 4.0 psi) except in the case where the groundwater level is above the sewer line being tested. In the event of the groundwater level being above the invert, the air test pressure must be increased by 1.0 kPa (0.145 psi) for each 100 mm of groundwater above the invert.
- (d) The air supply is throttled to maintain the internal pressure above 20 kPa (2.9 psi) for a minimum of 5 minute to stabilize the temperature in the pipe. After stabilization, the air pressure is adjusted to 24.0 kPa (3.5 psi) and the air supply shut off or disconnected. Timing commences and the time required for the line pressure to drop to 20.5 kPa (3.0 psi) is noted.
- (e) If the time required to drop from 24.0 to 20.5 kPa (3.5 to 3.0 psi) is greater than allowable, the test section shall have passed.
- (f) For the air test the minimum time allowable is calculated from the following tables:

Time Requirements for Air Testing

PIPE SIZE (Millimetres)	TIME	
	Min	Sec
100	2	32
150	3	50
200	5	6
250	6	22
300	7	39
375	9	35
450	11	34
525	13	30
600	15	24

- (g) Where multi pipe sizes are to undergo the air test, the average size shall be used.

5B.9 **VIDEO INSPECTING MAINS**

- 5B.9.1 For gravity sewers, other than service connections, the contractor shall arrange for video inspection to check alignment, grade and condition of the main sewer pipe. Inspection shall be carried out by pulling or pushing a video camera through the sewer pipe in the presence of a Municipal Inspector.
- 5B.9.2 The inspection shall include the preparation of a VHS tape record and a pipe condition report. The pipe condition report shall be in accordance with Section 5B.11. The contractor shall submit the VHS tape and pipe condition report to the Consulting Engineer.

- 5B.9.3 The Consulting Engineer shall review the VHS tape and pipe condition report and provide certification that the condition of the installed pipe is accurately recorded and the pipe installation meets the Town of Ladysmith Standards and Specifications.
- 5B.9.4 The VHS tape, pipe condition report and certification shall become the property of the Town of Ladysmith.
- 5B.9.5 Variations in line or grade of pipe, from that established by the Consulting Engineer prior to installation, and any jointing, pipe cleaning, or other deficiencies discovered during the inspection, shall be rectified. Re-inspection of the pipe may be required by the Engineer.
- 5B.9.6 During this test, manhole construction and invert elevations shall be checked and any variations from the established grade, drawings or specifications shall be rectified.
- 5B.9.7 If directed by the Engineer, the contractor shall arrange for a re-inspection of the pipe for the warranty inspection one month prior to the end of the maintenance period.

5B.10 **SMOKE TESTING**

- 5B.10.1 If required by the Engineer, the Consulting Engineer shall arrange for smoke testing of all installed gravity sanitary mains in the presence of a Municipal Inspector.
- 5B.10.2 The Consulting Engineer shall provide as-built service location information prior to smoke testing.
- 5B.10.3 Cross-connections noted during the smoke testing shall be corrected and the as-built service location information revised.

5B.11 **PIPE CONDITION REPORT FORMAT**

- 5B.11.1 Reference plans shall accompany reports with manholes labeled, and inspected sections highlighted. Manhole numbering shall conform to the construction drawings, or if available, Town of Ladysmith manhole numbers.
- 5B.11.2 All sewer defects shall be photographed and included with the report.
- 5B.11.3 The following information shall be included with the report:
- (a) Date of Survey
  - (b) Report number and tape number
  - (c) Pipe diameter, material and use
  - (d) Manhole numbers and length of section
  - (e) Direction of camera travel
  - (f) Street name
  - (g) Location of all service wyes to the nearest 0.1 metre
  - (h) Pipeline data including:
  - (i) Cleanliness, general condition and damaged areas

- (ii) Alignment, grade, pipe profile and areas of water ponding
- (iii) Infiltration, leaking or separated joints, root intrusion or pipe blockages
- (iv) Protruding or damaged services, and type of service connection
- (v) Other comments and observed conditions not suitable for acceptance by the Town of Ladysmith.
- (i) Location of all unacceptable conditions by stationing from manhole to the nearest 0.1 metre and position as per a clock face in the direction of the camera view. Photographs shall be coordinated to the report by reference numbers.