9 Testing Procedures

9.1 GENERAL

It shall be the responsibility of the Consulting Engineer to ensure that the Contractor properly tests all aspects of each project. A quality control plan shall be provided to the Town of Lamont prior to work commencing.

The Developer shall submit all test data performed by the accredited testing company to the Town on an on-going basis and prior to issue of the Construction Completion Certificate.

Failure to receive test results will be considered sufficient cause for not accepting such work.

9.2 MATERIALS TESTING - ROADWAYS

Subgrades, construction materials and construction standards shall be verified with a representative number of standard tests.

The Developer shall forward copies of such test results on an ongoing basis to the Town and prior to issuing the Construction Completion Certificate.

The Developer shall engage a qualified materials testing consultant to take representative samples of all materials to be incorporated in the pavement structure, prepare mix designs for approval by the Town, and to carry out quality control testing during construction.

9.3 MATERIALS TESTING - TRENCH BACKFILL FOR SHALLOW AND DEEP UTILITIES

9.3.1 Trench More than 15 m in Length

A minimum of two (2) density tests per 600 mm of trench depth per 100 m of length. The tests shall be representative of the entire length, width and depth of trench backfill, including around catch basins, manholes, valves and service connections.

9.3.2 Trench Less than 15 m in Length

A minimum of three (3) density tests evenly spaced through depth of trench. For service connection trenches, at least one (1) additional (fourth, or more) density test shall be taken between the back of curb and separate walk over each service connection line within the uppermost 0.5 m as measured from final finished grade.

9.4 TESTING – SANITARY SEWERS

Testing of installed pipes shall depend on the elevation of existing ground water and shall consist of at least one of the following tests:

9.4.1 Video Inspection Test

A televised inspection of the sewer system shall be carried out by the Developer at the end of construction and prior to the Construction Completion Certificate inspection. Any deficiencies found during this test shall be promptly remedied by the Developer at his own expense. DVD's in colour format only, and of acceptable clarity, quality, along with inspection reports and summaries of the televised inspection, shall be supplied to the Town prior to issuing the Construction Completion Certificate.

The report shall also include the location of all service connections together with a statement of opinion as to whether or not the service connections are leaking.

9.4.2 Testing of Force Mains

Force mains shall be tested as described for watermains in 9.6.1.

9.5 TESTING - STORM SEWERS

Testing of installed pipe shall consist of the following:

- Visual checking between manholes to ensure proper alignment and grade of pipe;
- Visual checking for joint leaks where access is possible;
- Visual checking for pipe cracks where access is possible;
- Video inspection of the entire sewer system by the Developer at the end of construction;
- All testing and repair of deficiencies found during the testing shall be rectified by the Developer at his own expense.

All the results of acceptable tests shall be supplied to the Town.

9.6 TESTING - WATERMAINS

9.6.1 Pressure and Leakage Test

- Test completed mains after services are installed, backfill is complete, and at least five (5) days after placing concrete for thrust blocks and in accordance with AWWA Standards.
- Test in sections containing no more than 500 m.
- Fill the system with water and expel air at services and hydrants. Install temporary taps wherever necessary to expel air and plug after completion.
- Apply test pressure by means of a test pump with a measurable volume container.

- The Town of Lamont shall witness all pressure tests.

9.6.1.1 Pressure Testing PVC Pipe

- Maintain test pressure for a period of two (2) hours. Test pressure shall be the greater of 1035 kPa (150 psi) or 1.5 times the normal operating pressure.
- For testing PVC sanitary forcemains (Section 9.4.2), the pressure shall be the greater of 690kPa or 2.0 times the normal operating pressure.
- Table 9.2 outlines a leakage allowance chart. This chart forms the basis for testing all watermains.

Table 9.2
Leakage Allowance Time
Leakage Allowance in Litres per 100 Joints Per Hour

Pipe Size	*Test Pressure (kPa)*	
	690	*1035*
150 mm	3.10	3.76
200 mm	4.09	5.02
250 mm	5.14	6.27
300 mm	6.14	7.52
350 mm	7.20	8.78
400 mm	8.18	10.00
450 mm	9.24	11.28
500 mm	10.22	12.56

Above leakage allowances have been calculated from the following formula from the AWWA Manual No. M23 (PVC Pipe – Design and Installation):

$$L = \frac{NDP}{128{,}300}$$

where: L = allowable leakage in L/hr
N = total number of joints
D = pipe diameter in mm
P = square root of the test pressure in kPa.

Leakage allowance for new construction of materials other than PVC shall be in accordance with the applicable AWWA standard.

9.6.1.2 Pressure Testing HDPE Pipe

The test procedure consists of two steps. The initial expansion phase and the test period. In order to accommodate the initial expansion of the main under test, the following shall be done:

- Fill the line with water and pressurize to 1.5 times the Standard Pressure Rating of the main. Test pressure shall be 1035 kPa for DR11 HDPE pipe. All air shall be expelled from the line during filling of the test section.
- Add sufficient make-up water to the main at hourly intervals to return the main to the test pressure. The initial expansion shall be done for a three (3) hour period so the main shall be repressurized three (3) times during this phase.
- After the third repressurization, the test period shall begin. No make-up water shall be added to the main until the end of the test period which shall be one (1) to three (3) hours long. At the end of the three (3) hours, a measured quantity of make-up water shall be added to the main to repressurize it to the test pressure. The amount of make-up water shall not exceed the volume allowance for expansion given below.
- Allowance for expansion under test pressure in litres for each 100 m of pipe at 23°C.

Nominal Pipe Diameter in mm	*1 Hour Test*	*2 hour Test*	*3 Hour Test*
75	1.2	1.9	3.1
100	1.6	3.1	5.0
150	3.7	7.5	11.2
200	6.2	12.5	18.7
250	8.7	16.2	26.2
300	13.7	28.7	42.4
350	17.4	33.7	52.4
400	21.2	41.1	62.3
450	27.4	53.6	81.0
500	33.7	68.6	99.7
550	43.6	87.3	130.9
600	56.1	111.0	165.8

The amount of make-up water shown in the table above should be multiplied by the appropriate correction factor taken from below for the pipe temperature at the time of testing.

Temperature (°C)	*Correction Factor*
0	0.22
2	0.24
4	0.28
6	0.32
8	0.36
10	0.42
12	0.47
14	0.53
16	0.59
18	0.66
20	0.74
22	0.87
23	1.00
24	1.20

- Under no circumstances should the total time under test exceed eight (8) hours at 1.5 times the pressure rating. If the test is not completed due to leakage, equipment failure or any other reason with this time period, the test section shall be permitted to "relax" for an additional eight (8) hour period prior to starting the next testing sequence.
- Locate and repair defects if leakage is greater than amount specified. Repeat test until leakage is within specified allowance for the test section.

9.6.2 Flushing and Disinfection

- Flushing and Disinfection is the responsibility of the Developer;
- Boundary valves are only to be operated by Town of Lamont personnel;
- The method of disinfection shall conform to AWAA Standard C651-05- Disinfecting Water Mains;
- Chlorine products must be NSF/ANSI 61 certified products for potable water use.