SPECIFICATIONS FOR SUBDIVISION

2021

PROJECT LUNENBURG

Navigating the Future, Together.

TOWN OF LUNENBURG SPECIFICATIONS FOR SUBDIVISIONS, 2021

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1 Definitions

1.1.1 Whenever the following terms are used in any part of these specifications the intent and meaning shall be interpreted as follows:

ACT means the *Municipal Government Act.*

APPROVAL means the approval of the Town Engineer. The Town Engineer's decision shall be final and binding in matters of design and construction.

BOARD means the Nova Scotia Utility and Review Board

DEVELOPMENT OFFICER means the officer of the Town of Lunenburg charged from time to time by Council with the administration of the Subdivision By-law.

FORCEMAIN means a section of sanitary sewer through which sewage is either pumped or flows by gravity under a low pressure head.

PUBLIC STREET means any street or road owned and maintained by the Town, a municipality or the Province excluding designated controlled access highways pursuant to section 21 of the *Public Highways Act*.

INSPECTION means a field inspection by the Town Engineer at various stages of construction.

LATERAL means a service pipe for either sanitary sewage, storm water or potable water that extends from the main to the property line.

MAIN LINE means the primary pipeline in a water or sewer system. In the case of a sewer line a main line includes both collection and trunk lines, and in the case of a water main includes both distribution and transmission lines.

MAINTENANCE PERIOD means one year from the date of final approval of a subdivision.

NATURAL WATERCOURSE means the bed and shore of every river, stream, lake, creek, pond, spring, lagoon or other natural body of water, and the water therein, whether it contains water or not.

PROFESSIONAL ENGINEER means a Professional Engineer who is a member of the Association of Professional Engineers of Nova Scotia.

RUNOFF means overland flow that occurs when the rainfall rate exceeds the soil's capacity to absorb water.

SANITARY SEWAGE means wastewater from residential, industrial, institutional, and commercial buildings, excluding storm water runoff and ground water.

SETBACK means the minimum setback requirements as defined by the Land Use By-law or the Subdivision By-law of the Town.

SERVICES means all of the sanitary sewer, storm sewer, and water systems.

STORM SEWER means a buried drain for conveyance of storm water that includes the storm sewer main, manholes, laterals, catch basins, and catch basin leads.

SUB-BASE COURSE means the crushed rock or aggregate which is placed immediately upon the subgrade.

SUBDIVSION means the division of any area of land into two or more parcels, and includes a re-subdivision or a consolidation of two or more parcels.

SUBGRADE means that portion of the roadbed upon which the sub-base course is to be placed.

TOWN means the Town of Lunenburg.

TOWN ENGINEER means the engineer of the Town of Lunenburg and includes a person acting under the supervision and direction of the engineer.

TRAFFIC STUDY means a study carried out by a professional engineer specializing in traffic, paid for by the Town, and shall include, at the discretion of the Town Engineer, information regarding:

(a) existing traffic patterns; and

(b) estimate of future traffic patterns and volumes; and

(c) ability of existing adjacent streets to support the anticipated traffic volumes; and

(d) sight distances; and

(e) recommendations regarding traffic safety improvements; and

(f) recommendations regarding upgrades to existing streets affected by the proposed subdivision; and

(g) recommendations regarding upgrades to pedestrian and active transportation infrastructure affected by the proposed subdivision.

TRIBUTARY AREA means the area that contributes runoff flow to an inlet or given point immediately downstream of the contributing area.

2 Submission Requirements

2.1 General

2.1.1 This Part is intended to assist the applicant for subdivision approval in preparing a submission for the approval of municipal services. This Part must be read in conjunction with the Subdivision By-Law.

2.2 Tentative Approval

2.2.1 Three (3) copies of the information in this Section shall be submitted with an application for tentative approval of subdivision.

Permit to Construct

2.2.2 A copy of the Certificate of Approval from Nova Scotia Department of Environment and Climate Change shall be required prior to approval of the Tentative Plan.

General Service Plan

2.2.3 A copy of the plan indicating proposed street layout, tributary areas for servicing, existing and proposed services; including pipe sizes, valves, hydrants, manholes, lift stations, directions of flow, and points of connection to existing systems shall be required prior to approval of the Tentative Plan.

Drainage Plan

2.2.4 A copy of the plan indicating contributing area, the tributary area for each inlet, natural watercourse, and existing and proposed storm drainage systems; including run-off rates at each inlet and outlet, pipe/culvert size, and other relevant features shall be required prior to approval of the Tentative Plan. Lot grading plans and minimum basement elevations may be required for areas prone to flooding.

Survey Plan

2.2.5 A tentative plan of subdivision in accordance with the Subdivision By-law, showing proposed lot layout and all proposed public streets, street reserves, and easements to be transferred to the Town shall be required prior to approval of the Tentative Plan.

2.2.6 Proposed streets shall be identified with preferred street names.

Detailed Design Drawings

2.2.7 The following material is required prior to approval of the Tentative Plan:

(a) Plan and profile drawings (1 :40 horizontal, 1 :4 vertical), drawing size D (24" x 36" overall dimensions) indicating lot layout, manhole locations, main and lateral locations, valves, hydrants, pipe size, material, and slope, horizontal and vertical street alignment data, existing and proposed street center line profiles, and cross sections; and

(b) All streets, water, storm and sewer systems shall be designed in accordance with the specifications included in this document. These specifications shall be read in conjunction with the latest edition of "Standard Specifications for Municipal Services" which may be obtained from the Joint Committee on Contract Documents c/o Spectech Ltd. , Halifax, NS. The design shall also be in compliance with the latest edition of the "Nova Scotia Standards and Guidelines Manual for the Collection, Treatment and Disposal of Sanitary Sewage" prepared by the Nova Scotia Department of Environment and Labour; and

(c) The Town's specifications shall govern over other specifications referred to in this document; and

(d) In the case where the developer proposes to substitute an equivalent product or procedure departing from these specifications a description of the proposed substitute with sufficient supporting documentation shall be submitted to the Town Engineer for approval; and

(e) All engineering work must be undertaken and stamped by a Professional Engineer registered in the Province of Nova Scotia; and

(f) The developer shall notify the Town of work or tests a minimum of two (2) working days in advance of such work or test taking place. Work or tests completed without prior notice may not be accepted by the Town; and

(g) Details for lift stations indicating pump data, invert elevations for gravity inlet, overflow, and forcemain, float elevations, base elevation, top elevation, wet well size, bypass piping arrangement, and other relevant details; and

(h) Details for environmental control measures, and other relevant details as required or as requested by the Town Engineer.

Design Submission

2.2.8 Depending on the size of the proposed subdivision development, the following information may be required by the Town Engineer:

(a) Design summary for the sewer system in tabular form giving population density peak flow, design flow, pipe size, slope, minimum and maximum velocity, and depth of flow; and

(b) Design summary for the water system in tabular form giving population density, domestic demand, fire flow requirements, maximum and minimum static pressures under normal operating conditions, and residual pressures under fire flow conditions; and

(c) Design information for the storm drainage system in tabular form giving runoff rates at each inlet and outlet, design flow, pipe, culvert, or channel size, and depth of flow; and.

(d) Design information in tabular form for lift stations and forcemains giving minimum, maximum, and peak flow rates, pipe size, velocity in forcemain, and pump cycle time, system and pump curves for lift stations and forcemains; and

(e) Erosion and sedimentation control plan.

Traffic Study

2.2.9 The Town may commission a traffic study by a qualified consultant to determine the impact of the prosed subdivision on adjacent streets, pedestrian networks, and active transportation facilities. The cost of the traffic study shall be paid by the Town, and the cost of improvements required by the study shall be paid for by the developer.

2.3 Final Approval

2.3.1 The information in this Section shall be required for final approval of municipal streets and services.

Record Drawings

2.3.2 Reproducible record drawings stamped by a Professional Engineer. Plan and profile, detail drawings and a drainage plan similar to those submitted for tentative approval are required.

2.3.3 Record drawings prepared on a CAD system must be submitted in both hard and electronic format. Hard copies must be on a high-quality bond paper (1 set) and mylar (1 set). Electronic copies are to be submitted on compact disc or USB drive and be saved in AutoCAD "dwg" or "dxf" format. Record drawings prepared manually must be submitted on both high-quality bond paper (1 set) and mylar (1 set).

Deeds and Easement Documentation

2.3.4 The following shall be submitted by the developer:

(a) Warranty Deed for all street rights-of-way and street reserves; and

(b) Easement agreements for water, sanitary sewer, and storm drainage systems located outside of the proposed street right-of-way; and

(c) Title certificate by developer's solicitor for land and easements being transferred. A copy shall be provided to the Town Solicitor for approval; and

(d) Information and documentation sufficient to record the deeds in either the Traditional Registry or Land Registry, as applicable. Title to streets shall be migrated if required under the Act; and

(e) Plan of subdivision submitted for final approval.

Maintenance Deposit

2.3.5 The following shall be submitted by the developer:

(a) Statement of construction costs which must be reviewed and approved by the Town Engineer; and

(b) Statutory declaration from the developer indicating that all accounts for labor and material used in the construction of the subdivision and all statutory liens have been paid in full; and

(c) Maintenance deposit in accordance with Subdivision By-law.

Street Completion Agreement and Bond for Street Completion

2.3.6 The street completion agreement and bond shall be provided in accordance with the Subdivision By-law.

Operation and Maintenance Manuals

2.3.7 Operation and Maintenance Manuals shall be provided for pumps and other similar equipment.

Certificate of Compliance

2.3.8 A Certificate of Compliance shall be provided by the developer from a Professional Engineer stating that the streets and services have been constructed in accordance with the approved plans and specifications.

Inspection and Testing Reports

2.3.9 The following inspection and testing results as applicable, shall be provided:

(a) video inspection file and report for sanitary and storm sewer; and

(b) test results for allowable leakage testing of the sanitary and storm sewer, stamped by a Professional Engineer; and

(c) test results for hydrostatic and leakage tests for water lines, stamped by a Professional Engineer; and

(d) bacteriological test results for water lines; and

(e) sieve analysis for base and sub-base gravel; and

(f) compaction test results on trench compaction, subgrade, sub-base and base courses; and

(g) test results for asphaltic concrete paving shall be required after completion and prior to release of standby letter of credit.

2.4 Listing Procedure for Subdivision Streets

2.4.1 Before the constructed streets and services are accepted, the Town must receive confirmation from the Nova Scotia Environment and Climate Change that all its requirements have been met.

2.4.2 When the preceding information has been submitted and approved, the developer may then officially request the Town take over the street system in the subdivision. The request shall be accompanied by four (4) copies of a final plan showing the entire subdivision, its boundaries and street layout. The Town Engineer may then recommend that the Town officially accept the deeds for the streets in the subdivision.

3 Sanitary Sewer System Specifications

3.1 General

3.1.1 This Part specifies the requirements for a central sanitary sewer collection system. A sanitary sewer consists of main lines, laterals, forcemains and appurtenances (including manholes and lift stations).

3.2 References

3.2.1 In cases where this document requires expansion or clarification, the latest revision of the following documents may be used for reference:

(a) Standard Specifications for Municipal Services prepared by the Nova Scotia Road Builders Association and the Nova Scotia Consulting Engineers Association; and

(b) Sanitary sewage systems shall conform to the Nova Scotia Department of the Environment and Climate Change Standard and Guidelines Manual for the Collection, Treatment and Disposal of Sanitary Sewage. No systems shall be constructed until the design has been approved by the Town Engineer and by the Nova Scotia Department of Environment and Climate Change.

3.2.2 In addition, please note that any discharge into a sanitary sewer must comply with the Town of Lunenburg's *Sewer Discharge By-law*.

3.3 Design Criteria

General

3.3.1 The sanitary sewage system shall be designed for flows generated from all lands within the serviceable area which are naturally tributary to the drainage area as determined from topographic plans. In addition, lands within the serviceable area which are tributary by pumping or regrading which are at present or anticipated to flow through the design area are to be included.

3.3.2 Design shall be based on an appropriate population density according to land use and zoning.

Design Flows

3.3.3 Sewer collection mains shall be sized for the domestic peak hourly water demand. Unless data is supplied by flow metering, the design sewage flow shall be calculated as follows:

(a) Average Dry Weather Flow (Q_A) shall be calculated on the basis of an allowance of 75 Imperial Gallons per person per day (340 liters per person per day).

(b) Design Peak Flow (Q_P) shall be based on the peak wet weather flow according to the following:

$$Q_P = M*Q_A + I*A$$

where:

M = Peaking Factor, determined using the Harmon formula:

$M = (1 + 14)/(4 + P^{0.5})$, where P = design population in thousands;

I = a minimum of 1080 Imperial Gallons per acre per day (12,096 liters per hectare per day); and

A = tributary area in Acres (Hectares) as defined in Section 1, Definitions.

3.3.4 The Town Engineer shall have the right to request flow and other engineering calculations including impact on the downstream systems prior to approval to install a sewer system.

3.4 Gravity Systems

Pipe Material

3.4.1 Polyvinyl Chloride (PVC), SOR 35 shall be used for sanitary sewer main installations within the Town, unless otherwise approved by the Town Engineer.

Hydraulic Design

3.4.2 Sanitary sewer mains shall be designed to convey the calculated Design Peak Flows. The Designer shall ensure that surcharging of the system does not occur during such peak flow conditions by taking into consideration such factors as energy loss at manholes. The capacity of the sanitary sewer mains shall be calculated using the "Manning Formula" or an appropriate nomograph. A Manning roughness coefficient (n) equal to 0.011 shall be used for PVC pipe.

3.4.3 Sewers shall be designed to maintain a minimum velocity of 2 feet per second (0.6 meters per second) and a maximum velocity of 15 feet per second (4.6 meters per second) when operating under Design Peak Flow conditions from the tributary area when fully developed.

Minimum Pipe Size

3.4.4 No sanitary sewer main shall be less than 8 inches (200 mm) in diameter.

Minimum Slope

3.4.5 Sanitary sewer mains shall have a minimum slope of 1 percent. Slopes less than 1 percent may be considered where the depth of flow will be at least 30 percent of the diameter of the pipe for Design Peak Flow. In no case shall the slope be reduced to less than 0.75 percent.

3.4.6 Calculations shall be presented in a tabular form to indicate depths and velocities at minimum, average and maximum daily wastewater flow for the different sizes of sewer proposed.

High Velocity Protection

3.4.7 Where velocities greater than 15 feet per second (4.5 meters per second) are attained, special provision shall be made to protect against displacement of pipe and structures by erosion and shock.

Depth

3.4.8 The sanitary sewer shall be installed at a sufficient depth to provide service by gravity flow from all proposed lots within the proposed subdivision and to provide service to adjoining lands.

3.4.9 The minimum depth of sanitary sewer mains shall not be less than 5 feet (1.5 meters).

3.4.10 The depth of sanitary sewer mains shall not normally exceed a maximum of 14 feet (4.3 meters). However, under special conditions, if full and justifiable reasons are given (such as elimination of a pumping station), the maximum depth of sanitary sewer mains may be increased to 18 feet (5.5 meters).

Location

3.4.11 Where possible, all sanitary sewer pipe and appurtenances shall be located within a street owned by the Town. If approved by the Town Engineer, sanitary sewer mains may be installed within an easement granted in favor of the Town. The actual width of the easement shall depend upon the depth of any pipe lines contained within the easement. The minimum width of any such easement shall be 20 feet (6.1 meters).

3.4.12 Depending upon the length and location of the easement, the Town Engineer may require a suitable surface to provide vehicle access within the easement for maintenance purposes.

3.4.13 Where a need is identified by the Town Engineer to accommodate future upstream lands which are naturally tributary areas to the drainage area, an easement shall be provided from the edge of the street right-of-way to the upstream limit of the subdivision.

Joints

3.4.14 All joints on gravity lines shall be bell and spigot as recommended by the manufacturer.

Alignment

3.4.15 All sanitary sewer mains shall be laid with a straight alignment between manholes.

3.5 Gravity System Manholes

General

3.5.1 A manhole shall be provided on a sanitary sewer at the end of each line, at any change in pipe size, vertical or horizontal alignment and at all pipe intersections. All manholes shall be watertight.

Hydraulic Loses

3.5.2 The following criteria shall be used for pipe elevation and alignment in sanitary sewer manholes to account for hydraulic losses through the manhole:

(a) minimum drop across manholes of similar diameters shall be:

i. straight run - 0.10 feet (30 mm); and
ii. deflections up to 45 Degrees - 0.10 feet (30 mm); and
iii. deflections 45 to 90 Degrees - 0.20 feet (60 mm); and

(b) the crown of a downstream pipe shall not be higher than the crown of an upstream pipe.

Minimum Diameter

3.5.3 The minimum internal diameter of a manhole shall be 42 inches (1050 mm).

Maximum Spacing

3.5.4 The distance between manholes shall not exceed 400 feet (120 m) for sewer main diameter of 24 inches (600 mm) or less. For sewer mains greater than 24 inches (600 mm) in diameter, the maximum spacing shall be 500 feet (150 m).

Location

3.5.5 All sanitary sewer manholes shall be positioned so as to minimize the inflow of surface water or ground water. Manholes shall not be located at or near drainage ditches or roadway low points.

3.5.6 In some situations where manholes cannot be easily located to minimize inflow, the use of berms and/or water-tight frames and covers may be permitted by the Town Engineer.

Drop Manholes

3.5.7 Where the difference between invert elevations of any two pipes entering and leaving a manhole is greater than 3 feet, either an internal or external drop chamber shall be provided. Drop manholes will only be approved when there are no other means of installing the pipe near the base of the manhole.

Frames & Covers

3.5.8 The following manhole frames and covers are approved for use:

(a) IMP Type R60 for manholes within a public street allowance; and

(b) IMP R12 bolt down frame and cover for manholes in easements, parks or wet wells.

Lateral Connections at Manholes

3.5.9 If services must be designed to enter a manhole then the maximum number entering any manhole shall be limited to three (3). All entrances shall be cast into the manhole by the manufacturer and be complete with watertight gasketed joints.

3.6 Gravity System Laterals

General

3.6.1 In any subdivision for which tentative or final approval is being sought, a single sanitary sewer lateral shall be provided by the developer to each lot at the time of installation of services. The lateral shall extend from the main to the property line.

3.6.2 A single sanitary sewer lateral shall be installed to each existing lot or potential future lot which could be created under the zoning in effect at the time of installation of services, except that duplex or semi-detached unit lots may be serviced by a common service lateral from the main to the street line with individual curb stops for the two units at the street line.

Location

3.6.3 Where possible, service laterals shall not be installed in private driveways, parking areas, or other traveled areas.

Pipe Material

3.6.4 Polyvinyl Chloride (PVC), SOR 28 shall be used for sanitary sewer service laterals. Pipe markers and end caps for sanitary sewer laterals shall be red in color.

Minimum Pipe Size

3.6.5 Minimum pipe size for laterals shall be 4 inches (100 mm) in diameter.

Clean-out

3.6.6 Service laterals with a total length greater than 85 feet (25 metres) shall be installed complete with a wye type clean-out or approved manhole in locations approved by the Town Engineer. A 1 foot (300 mm) by 1 foot (300 mm) x 1/4 inch (6mm) steel plate shall be placed above cleanouts and located 6 inches (150 mm) below the ground surface to allow detection by a metal detector.

Minimum Slope

3.6.7 Sewer laterals shall have a minimum slope of 2 percent.

Depth

3.6.8 The minimum depth of sanitary sewer laterals shall not be less than 5 feet (1.5 metres) below a traveled way (such as a driveway or street) or less than 3 feet (1 meter) below the bottom of a ditch.

3.6.9 To minimize future maintenance costs, all service laterals shall be eliminated from the deep section of the sewer main either by installation of a rider sewer for lateral connections or by the installation of all laterals at manholes.

Connection to Mains

3.6.10 Service connections to an existing main in service shall be made using the approved saddles listed below:

(a) PVC Main - PVC gasketed strap on, in line or wye tee

(b) Concrete or AC main - Daigle 050

3.6.11 All saddles shall be fitted with a gasket and a double stainless steel strap and shall not protrude into the main.

3.6.12 Service connections to any newly constructed main shall be made using a service tee or wye fittings of the same material as the pipe with gaskets.

3.6.13 For laterals greater than 6 inches (150 mm) in diameter the connection to the sewer main shall be made by installing a manhole on the sanitary sewer main.

3.6.14 Any service connection requiring a major change in horizontal or vertical alignment shall be constructed using a maximum of one horizontal and one vertical bend per service lateral unless an approved manhole structure or "wye" type clean-out is provided. All bends shall be long-radius type with a maximum deflection of forty-five degrees.

3.6.15 The center line of any service connection at the main shall be located at an angle of 45 degrees above the horizontal at the main.

Joints

3.6.16 Sewer joints shall be designed to prevent infiltration and to prevent the entrance of roots, and shall be made in accordance with the manufacturer's recommendations.

Repairs

3.6.17 Repairs to pipe damaged after installation will be accepted only if carried out in accordance with the manufacturer's recommendations and after the damaged section has been retested.

Groundwater Movement

3.6.18 The design engineer shall assess the possible change in groundwater movement caused by the use of pervious bedding material and shall be responsible for the design of corrective measures to prevent flooding as a result of this groundwater movement. Clay plugs in service lateral trenches may be required for low lying lots and impervious soils.

3.7 Pumped Systems

General

3.7.1 Pumping stations shall be provided when, in the opinion of the Town Engineer, a gravity system is not possible or is not economically feasible.

3.7.2 Sewage pumping station structures and electrical and mechanical equipment shall be protected from physical damage from the 1 in 100 year flood. Sewage pumping stations shall be designed so that they remain fully operational and accessible during the 1 in 50 year flood.

3.7.3 During preliminary location planning, consideration shall be given to the potential of emergency overflow provisions and the avoidance of health hazards, nuisances and adverse environmental effects.

3.7.4 Unless otherwise approved by the Town Engineer, all pumping stations, pumps, and forcemains shall be designed for the ultimate sanitary sewer peak flows from the tributary area for drainage. In the selection of pumps, both present and future conditions shall be considered, and pump overloading situations shall be avoided.

3.7.5 Design parameters such as the roughness coefficient of pipe and flow volumes can vary over time, and such variances shall be considered in the selection of the pumps.

3.8 Pumped System Pumping Stations

General

3.8.1 All pumping stations shall include above ground self-priming pumps unless approved otherwise by the Town Engineer.

Pump Capacity

3.8.2 All pumping stations shall have a minimum of two pumping assemblies. If only two pumps are provided, each shall be capable of handling the expected Design Peak Flow. Where three or more units are provided, they shall be designed to fit actual flow conditions and must be of such capacity that, with the largest unit out of service, the remaining units will have capacity to handle maximum sewage flows, taking into account head losses with parallel operation. The pump control circuitry shall be designed to automatically alternate pumps for each pump cycle. Run time meters shall be provided to record run time for pumps operation.

Wet Well Size

3.8.3 The wet well shall be designed to allow for a minimum cycle time for each pump of fifteen minutes. For a duplex station, the volume in cubic feet, between pump start and pump stop shall be 0.5 times the pumping rate of one pump, expressed in US gallons per minute. The wet well size and control settings shall be appropriate to avoid heat build-up in the pump motor due to frequent starting and to avoid septic conditions due to excessive detention time.

3.8.4 The wet well shall be designed for a maximum retention time of 30 minutes to avoid septic conditions.

Phased Development

3.8.5 In situations of phased development, the effects of minimum flow conditions shall be investigated to ensure that the retention time in the wet well will not create an odor or septic conditions.

Structural Design

3.8.6 The wet well structure shall be designed for all external loads, including bearing capacity with the wet well full, lateral earth pressure and hydraulic uplift with the wet well empty.

Pump Manufacturers

3.8.7 The following pumps and pump manufacturers may be approved for use in sewage pumping stations in the Town:

(a) submersible pumps manufactured by "ITT Flygt" or "Gorman Rupp"

(b) self priming pumps manufactured by "Gorman Rupp"

3.8.8 All pumps shall be solids-handling type complete with electric motors.

Pump Supplier

3.8.9 The pump supplier shall have as a minimum:

(a) 15 years of continuous sales and repair service in Canada; and

(b) a replacement mechanical seal, a replacement wear plate, and a replacement impellor for the electrical pump in inventory in Nova Scotia; and

(c) factory trained personnel available at all times in Nova Scotia; and

(d) all pumps and motors must carry a minimum 24-month warranty.

Emergency Overflows

3.8.10 Each pumping station shall be provided with an emergency overflow arrangement acceptable to both the Town Engineer and the Nova Scotia Environment and Climate Change. The invert of the overflow pipe at the pumping station shall be lower than the invert of any sanitary sewer laterals at the property line. As well, the invert of the overflow pipe shall be at an elevation high enough to prevent backflow from surface runoff or during extreme high tides.

Safety Precautions

3.8.11 The pumping station and appurtenances shall be designed in such a manner to ensure the safety of Town employees, in accordance with all applicable Municipal, Provincial and Federal regulations including the *Occupational Health and Safety Act.* All moving equipment shall be covered with suitable guards to prevent accidental contact.

3.8.12 Equipment that starts automatically shall be suitably and visibly posted with warning signs to ensure that the Town employees are aware of this condition. Lock-outs on all equipment shall be supplied to ensure that the equipment is completely out of service when maintenance or servicing is being carried out.

Pump Selection

3.8.13 Pumping equipment shall be selected to perform at maximum efficiencies under normal operating conditions. Pumping stations, wet wells and dry wells shall be designed such that all pumps will operate under a continuous positive prime condition during the entire pump cycle. (This criteria will not apply to pumping stations designed to use self-priming pumps). System head calculations and curves shall be provided for the following operating conditions:

(a) C=100 and low water level in the wet well; and

(b) C=120 and medium water level over the normal operating range in the wet well; and

(c) C=130 and overflow water level in the wet well.

Where C is Hazen-Williams flow co-efficient.

Curve (b) shall be used to select the pump and motor since this most closely represents normal operating conditions. The extreme operating ranges will be given by the intersections of curves (a) and (c) with the selected pump curve. The pump and motor shall be capable of operating satisfactorily over the full range of operating conditions.

Surcharge

3.8.14 Pumping stations shall be designed such that the incoming sewers will not surcharge under the peak flow conditions.

Flow Velocity

3.8.15 Suction and header piping shall be sized to carry the anticipated flows. Flow velocities shall be:

(a) minimum cleansing velocity of 2.6 feet per second (0.8 meters per second), and

(b) maximum velocity of 6.6 feet per second (2.0 meters per second).

3.8.16 Regardless of the above conditions, piping less than 4 inches (100 mm) in diameter shall not be acceptable, unless otherwise approved by the Town Engineer.

Piping

3.8.17 Pumping station internal piping shall be either ductile iron Class 54 with coal tar epoxy lining or stainless steel, Type 316 or 316L, 11 Gauge. Regular steel pipe spool pieces will not be permitted.

3.8.18 Threaded flanges or victaulic couplings shall be used for all ductile iron pipe joints, fittings and connections within the station. Pressed or rolled vanstone neck flanges shall be used for all stainless steel pipe joints, fittings and connections. All piping within the pumping station shall be properly supported and shall be designed with appropriate fittings to allow for expansion and contraction, thrust restraint, etc.

Wet Well Inlet

3.8.19 Only one inlet will be permitted into the wet well. If more than one sewer main flows to a pumping station site then a manhole shall be provided near the pumping station to collect the flow from the contributing mains.

Hydraulic Analysis

3.8.20 A hydraulic transient analysis shall be undertaken to ensure that transients (water hammer) resulting from pumps starting, stopping, full load rejection during power failure, etc. do not adversely affect the pipe or valves in the system.

Valves

3.8.21 Hand operated gate or plug valves shall be provided on discharge piping to allow for proper maintenance. A check valves shall be provided on the discharge lines between the isolation gate valve and the pump. Check valves shall be accessible for maintenance.

Ventilation

3.8.22 Forced ventilation shall be provided for pumping station wet wells and dry wells. A ventilation system capable of delivering a complete air change in ten minutes and with automatic operation of the fan at least four times in a 24-hour period is required.

Access & Removal

3.8.23 Access hatchways and doorways shall be provided to allow adequate maintenance and servicing. All pumping stations shall be provided with an acceptable device for the removal of pumps and motors for repair and maintenance. Lift hatches shall have gas assisted cylinders and be able to be "locked in" in the upright position.

3.8.24 Submersible pumps shall be readily removable and replaceable without dewatering the wet well or disconnecting any piping in the wet well. A non-corroding working platform shall be constructed in the wet well of any submersible station. The platform shall be set on a concrete lintel cast integrally with the station walls. Alternatively, a separate valve chamber shall be provided.

3.8.25 All locks shall be keyed to the Town's standard key system.

Electrical / Supervisory Control and Data Acquisition (SCADA) System

3.8.26 Electric motors less than 10 horsepower shall be 208 volt and 3 phase. Electric motors 10 horsepower and larger shall be 600 volt and 3 phase. Single phase pumps will only be permitted if in the opinion of the Town Engineer that three phase power is not feasible. All pumping station control equipment shall be mounted in a CSA Type 3 enclosure that is weather tight, heated and rated NEMA 4. Alternatively, control equipment may be mounted in an aboveground, prepackaged enclosure as manufactured by Gorman Rupp. Control package and wiring shall be CSA approved and the complete package shall meet CSA requirements for the type of equipment.

3.8.27 Run-time meters shall be provided for each pump. The run-time shall be recorded both on SCADA and also locally on meters at the station, mounted in the panel, facing outwards.

3.8.28 Pumping stations shall have ultrasonic echo controls to control pump starts and stops. Mercury float switches may be required in stations where ultrasonic echo control is unsuitable or used as a back-up to the ultrasonic echo controls. The station liquid levels shall be displayed both locally and remotely. Pump controls are to be provided with two over-rides (over-riding the normal function of the station), both of which are to be operated by mercury float switches. One float is to be set to lock-out the pumps if the liquid level drops 3 inches (75 mm) below the normal pump shut-off level. This condition is to provide an alarm but is to be self-resetting. The other float is to be set at the high-level alarm level, both to provide that alarm but also to start both pumps, if they are not already running.

3.8.29 Each panel is to be equipped with a pump controller complete with communications hardware, including but not limited to, radio, radio power supply, antenna and interface cable. Adequate lighting arresters shall be provided. The SCADA system must be compatible with the system presently used by the Town.

3.8.30 The SCADA unit shall have two extra digital points and two extra analog points and shall be capable of transmitting the following signals and alarms to the central monitoring location:

(a) hand off automatic selector switch status; and

(b) output control through SCADA system; and

(c) power generating system (overload, battery status, fuel tank level, running, etc.); and

(d) low level alarm; and

(e) high level alarm; and

(f) panic alarm; and

(g) building fire alarm; and

(h) power failure alarm; and

(i) illegal entry alarm; and

(j) pump information (overload, motor current, pump status, line voltage, pump running hours, pump starts, and phase monitoring); and

(k) dry well alarm - where applicable; and

(l) any other requests of the Town Engineer

3.8.31 The electrical service meter socket is to be mounted on a utility pole and come complete with CEMA 3 weatherproof enclosure and disconnect switch suitable for the service provided.

3.8.32 The service connection shall meet requirements of the Town's electric light utility.

3.8.33 Electrical service from the supply to the control panel and between the control panel and the pumping station shall be through buried conduit. Each pump cable shall be installed in a separate conduit and a spare conduit shall be provided for future use. All conduits entering or leaving shall be adequately sealed to protect against corrosion, water intrusion or harmful gases.

Site Considerations

3.8.34 Whenever possible, all pumping stations and control panels shall be within the street right-of-way in an appropriate area specifically designated for that purpose. Property required for the pumping station shall be deeded to the Town. All pumping station land shall be graded such that ponding of water does not occur. The elevation of the top of the wet well shall be no less than 4 inches (100 mm) and no more than 6 inches (150 mm) above the finished grade of the pumping station lot. Adequate areas for vehicular access and parking areas shall be paved. All other exposed areas shall be sodded. The pumping station shall not be located in areas which may flood. Low maintenance shrubs and foliage are to be planted by the developer to screen the site.

Testing

3.8.35 The wet-well shall be tested for water-tightness by filling to the top cover level with water and after a 24-hour period, being topped up and tested for 4 hours to ensure that there is no more leakage from the station than 5 liters/hour/0.8 m2 surface area/1000 mm of vertical height. Any visible leaks, seepage or weeping shall be repaired regardless of test results.

3.8.36 The capacity of the pumps shall be tested both individually and together by means of a station draw-down test or approved equivalent method. Results shall be submitted to the Town Engineer in order to compare the results obtained with the pump curve and design. Pumps failing to meet the design will be not be accepted.

3.8.37 The pumps shall be tested both individually and together for voltage and current draw. Copies of the manufacturer's start-up report, including capacity test, and certification from the pump manufacturer that the pumps meet the electrical and installation specifications are required.

Operations and Maintenance Manual

3.8.38 Three copies of the pumping station operation and maintenance manual shall be prepared in a form acceptable to the Town Engineer and provided to the Town Engineer prior to acceptance of the pumping station. This manual shall contain the following as a minimum:

(a) system description; and

(b) design parameters, system hydraulics and design calculations (including curves); and

(c) as-constructed civil, mechanical and electrical drawings; and

(d) pump literature, pump curves and operating instructions; and

(e) manufacturer's operation and maintenance instructions of all equipment; and

(f) name, address, and telephone number of all equipment suppliers and installers; and

(g) information on guarantees/warranties for all equipment.

3.8.39 All special tools and standard spare parts for all pumping station equipment shall be provided by the contractor prior to acceptance of the system by the Town Engineer.

3.9 Pumped System Forcemain

Pipe

3.9.1 PVC DR 18 pipe is approved for use for all sanitary sewer forcemains in the Town. Warning tape (150 mm wide polyethylene) shall be placed 6 inches above the top of the pipe's first backfill layer and labeled "Caution, Sewer Line Buried". The minimum pipe diameter shall be 4 inches (100 mm).
The hydraulic losses in the forcemain shall be calculated using the Hazen-Williams formula. Variations in the roughness coefficient (C) through the life of the pipe shall be taken into account.

Limiting Velocities

3.9.2 The forcemain shall be designed such that a minimum cleansing velocity of 2 feet per second (0.6 meters per second) is maintained. The maximum velocity in any forcemain shall not exceed 8 feet per second (2.4 meter per second). Regardless of the above conditions, piping less than 4 inches (100 mm) in diameter is not acceptable, unless otherwise approved by the Town Engineer.

Minimum/Maximum Depth

3.9.3 Forcemains shall have a minimum cover of 5 feet (1.5 m) and a maximum cover of 8 feet (2.4 m). The depth of cover shall be measured from the design grade at finished surface to the crown of the pipe line.

Slope

3.9.4 Forcemains shall be installed at uniform slopes and under no circumstance shall they be installed at zero slope.

Location

3.9.5 Forcemains shall not be located in a common trench with a water main and the soil between them shall be undisturbed. Forcemains crossing water mains shall be laid to provide a minimum vertical distance of 1.5 feet (450 mm) between the outside of the forcemain and the outside of the water main. The water main shall be above the forcemain. At crossings, one full length of water pipe shall be located so that both joints are as far from the forcemain as possible. Special structural support for the water main and forcemain may be required.

Termination

3.9.6 Forcemains shall terminate at a manhole on the gravity sewer system, and at a point not more than 2 feet (0.6 meters) above the flow line of the receiving manhole. A bend may be required to direct the flow down into the barrel of the receiving gravity sewer.

Valves

3.9.7 Where high points in the forcemain profile cannot be avoided, automatic air relief and vacuum valves shall be installed in a manhole to prevent air locks in the pipe or in other locations as determined by the Town Engineer. Drain valves housed in manholes shall be provided at low points in the forcemain system as directed by the Town Engineer.

Air Relief & Vacuum Valves

3.9.8 Heavy duty type cast iron body valves with bronze trim and combination of small orifice and large orifices shall be used. Small orifice size shall be 3.2 mm. Valves shall be suitable for operation at 150 psi (1 MPa) working pressure and shall have flanged ends.

3.9.9 Operation shall be through independent floating stainless steel buoy balls located in both orifices.

3.9.10 Orifices shall be capable of expelling air at a high rate during filling and at a low rate during operation and shall admit air while draining the pipeline. Seats shall be replaceable.

3.9.11 Valves shall have no moving parts except for stainless steel balls which shall remain in the throat area discharging air without blowing shut or collapsing the balls.

3.9.12 Valves shall not leak in the closed position when pipe is being filled.

Changes in Direction

3.9.13 Any change in direction which is in excess of the pipe joint deflection tolerance will require a suitable fitting as approved by the Town Engineer. Thrust blocks shall be provided at any change of direction and shall be designed considering the operating pressure, surge pressure, peak flow velocity and in-situ material which the thrust block bears against. Thrust blocks shall be constructed of "ready mix" concrete and shall have a minimum 28-day compressive strength of 3000 psi (20 MPa). In the case of vertical bends, the thrust block shall be located below the fitting and shall be connected to the forcemain through the use of stainless steel tie rods securely embedded in concrete. The use of restrained joints is not permitted unless used in conjunction with a thrust block and of a design acceptable to the Town Engineer.

Pipe Installation

3.9.14 Repairs to pipe after installation will only be accepted if carried out in accordance with the manufacturer's recommendations and shall be re-tested.

3.10 Inspections and Testing

General

3.10.1 Sewers and forcemains shall be tested in accordance with the requirements of the Standard Specification for Municipal Services prepared by the Nova Scotia Road Builders Association and the Nova Scotia Consulting Engineers Association. The Town Engineer shall be notified at least forty-eight (48) hours in advance of all proposed tests. Tests shall be performed in the presence of the Town Engineer, or their representative.

Manholes

3.10.2 Manholes and valve chambers shall be inspected by the Town upon completion of construction and again prior to the end of the maintenance period.

3.10.3 All manholes and valve chambers shall be tested for leakage using either a hydrostatic or air vacuum method.

3.10.4 Any part of the system failing the above tests or found deficient shall be repaired, retested and inspected to the satisfaction of the Town Engineer.

Deflection

3.10.5 Sewers shall be tested for deflection after trenches are backfilled and compacted.

Testing Leakage

3.10.6 Leakage test shall be done in accordance with the requirement of the Standard Specifications for Municipal Services prepared by the Nova Scotia Road Builders Association and the Nova Scotia Consulting Engineers Association.

Testing Video Inspection

3.10.7 Video inspections shall be carried out at the following times:

(a) at completion of construction and prior to subdivision endorsement of acceptance of the work by the Town; and

(b) two months prior to the end of the maintenance period.

3.10.8 A colour camera shall be used for video inspections. Color digital video files and written reports shall be provided in forms acceptable to the Town Engineer.

4 Water System Specifications

4.1 General

4.1.1 This Part specifies the requirements for a water distribution system. A water distribution system consists of water mains, laterals and appurtenances, including pumping stations, pressure control facilities and reservoirs, which is designed to convey and distribute an adequate supply of potable water for domestic consumption and fire protection.

References

4.1.2 In cases where this document requires expansion or clarification, the latest revision of the following documents may be used for reference:

(a) Standard Specifications for Municipal Services prepared by the Nova Scotia Road Builders Association and the Nova Scotia Consulting Engineers Association.

4.1.3 The following reference standards and organizations are supplementary to these specifications:

(a) "Water Supply For Public Fire Protection" prepared by the Fire Underwriters Survey-Insurer's Advisory Organization (IAO)

(b) National Fire Protection Association (NFPA)

(c) American Water Works Association (AWWA)

(d) Canadian Standards Association (CSA)

(e) National Building Code (NBC)

(f) Canadian Plumbing Code (CPC)

(g) Underwriters Laboratories of Canada (ULC)

Nova Scotia Environment and Climate Change Requirements

4.1.4 Water distribution systems shall conform to any requirements established by the Nova Scotia Department of Environment and Climate Change. No system shall be constructed until the design has been approved by the Town Engineer and by the Nova Scotia Department of Environment and Climate Change.

Quality Assurance

4.1.5 Water quality is monitored and maintained by the Town's Water Utility. The system shall be designed such that water quality is maintained and supplied to water utility customers at an adequate pressure and volume.

4.2 Design Criteria

System Capacity

4.2.1 Water distribution systems shall be designed to supply fire flow demand plus maximum daily demand, or the maximum hourly demand, whichever is greater, unless otherwise approved by the Town Engineer.

4.2.2 Fire flow demand shall be established in accordance with the latest edition of Fire Underwriter's Survey publication, "Water Supply for Public Fire Protection: A Guide to Recommended Practice".

4.2.3 The following domestic demand rates shall be used for water distribution systems design:

(a) average daily demand: 90 Imperial Gallons per capita per day (410 liters per capita per day).

(b) maximum daily demand: 200 Imperial Gallons per capita per day (909 liters per capita per day).

(c) maximum hourly demand: 300 Imperial Gallons per capita per day (1364 liters per capita per day).

Design Population

4.2.4 Water distribution systems shall be designed based upon appropriate population projections. The design population and assumed domestic demand shall be clearly stated in the calculations submitted for review and approval.

Hydraulic Analysis

4.2.5 Hydraulic analysis of the distribution system shall be carried out by the design engineer. Water distribution designs shall be supported by a hydraulic analysis of the system which determines flows, pressures and velocities under maximum day plus fire, maximum hour and minimum hour conditions. The analysis shall be of sufficient scope to identify and describe any impact on the existing system. The analysis shall include a location of known hydraulic grade line determined by the Engineer and include demands on the existing system downstream of the known hydraulic grade line, as well as demands generated by the proposed development. Maximum day plus fire analysis shall include sufficient scenarios to test all extreme conditions, such as high fire flow requirements, fires at locations of high elevations and fire at a location remote from the source or feeder main.

4.2.6 Subject to the Engineer's review, new water system extensions of thirty (30) dwelling units, as defined in the Land Use By-law, or less may not require a hydraulic analysis if it can be demonstrated that minimal or no impact will be created on the existing system.

4.2.7 The Town Engineer shall have the right to request flow and other engineering calculations prior to granting approval to install a water system.

4.3 Water Main

Looping

4.3.1 Water distribution systems shall be designed to exclude any dead-end pipes unless otherwise approved by the Town Engineer.

Limiting Velocities

4.3.2 The water main shall be sized such that the maximum velocity in the pipe shall not exceed 5 feet per second (1.5 meters per second) during maximum hourly domestic flow conditions or 8 feet per second (2.4 meters per second) during fire flow conditions.

Minimum Pipe Size

4.3.3 The pipe size for local distribution mains shall be no smaller than 8 inches (200 mm) in diameter. The pipe size for a main feeder shall be no smaller than 12 inches (300 mm)

Oversizing

4.3.4 Oversizing of water mains to accommodate the water supply requirements of future off-site development may be required by the Town Engineer.

Type of Pipe

4.3.5 Pipe shall be Polyvinyl Chloride (PVC) conforming to AWWA C900, DR18 unless otherwise approved by the Town Engineer.

4.3.6 Fittings shall conform to AWWA C110, with a minimum working pressure rating of 1035 kPa (150 psi).

4.3.7 Joints shall be mechanical or push-on conforming to AWWA C111. Mechanical joint restraints shall be as approved by the Town Engineer.

Cover Over Watermain

4.3.8 All water mains shall be designed with a minimum cover of 5 feet (1.5 m).

4.3.9 In no situation shall the depth of cover over the water main exceed 8 feet (2.4 m). The depth of cover shall be measured from the design grade at finished surface to the crown of the pipe line.

Location

4.3.10 Water lines installed in the same trench as sewer lines shall be installed to one side on a shelf of undisturbed earth, and a minimum horizontal separation of 20 inches (500 mm) and vertical separation of at least 12 inches (300 mm) shall be maintained between the crown of the sewer line and the bottom of the water line. If the vertical separation cannot be maintained, the two lines shall be installed in separate trenches with a minimum horizontal separation of 10 feet (3.0 m), maintaining undisturbed soil between the trenches.

4.3.11 Under no circumstances shall a water main be installed in the same trench as a sewer forcemain. Water mains and sewer forcemains shall be installed with a minimum horizontal separation of 10 feet (3.0 m), maintaining undisturbed soil between the trenches.

4.3.12 Whenever a sewer crosses underneath a watermain a separation of at least 18 inches (450 mm) must be maintained between the top of the sewer and the bottom of the watermain.

4.3.13 All water mains and appurtenances shall be located within a street or within an easement, of minimum 20 feet (6.1 meters) width, granted in favor of the Town. Depending on the length and location of the easement, the Town Engineer may require a suitable surface to provide access within the easement for maintenance purposes. Water mains shall be installed as close as possible to the centerline of the easement.

4.3.14 All watermains shall be installed at a consistent grade to avoid localized high points. The location of watermains and laterals shall also meet the requirements of the Nova Scotia Department of Environment and Climate Change.

4.3.15 Where a need for water mains to accommodate future development on adjacent lands is identified, easements shall be provided from the edge of the street right-of-way to the property boundary of the subdivision.

Changes in Direction

4.3.16 Any change in direction which is in excess of the pipe joint deflection tolerance shall require a suitable fitting as approved by the Town Engineer. Thrust blocks shall be provided at any change in direction and shall be designed considering the operating pressure, surge pressure, peak flow velocity and in-situ material which the thrust block bears against. Thrust blocks shall be constructed of "ready mix" concrete and shall have a minimum 28-day compressive strength of 3000 psi (20 MPa).

4.3.17 In the case of vertical bends, the thrust block shall be located below the fitting and shall be connected to the water main through the use of stainless steel tie rods securely embedded in the concrete. The use of restrained joints shall not be permitted unless used in conjunction with a thrust block and of a design acceptable to the Town Engineer.

Groundwater Movement

4.3.18 The design of the water system shall give consideration to the possible change in ground water movement caused by the use of pervious bedding material. The design shall include corrective measures to prevent flooding as a result of this ground water movement.

4.3.19 Water mains installed in a single pipe trench may require a trench drainage relief system to lower the ground water in the trench. The design of the relief system shall be specific to the situation with consideration for topography, subsurface conditions, ground water conditions and local drainage patterns.

4.3.20 Service lateral trenches that have a trench bed sloping down from the main trench may require the installation of an appropriate clay plug, or similar solution, to prevent the flow of ground water from the trench towards the abutting properties.

Air Relief Valve and Vacuum Valves

4.3.21 Air relief and vacuum valves shall be installed in a manhole at all high points in the distribution system.

Connections to Existing Mains

4.3.22 Tapping sleeves and valves shall be provided for connections to existing water mains where required by the Town Engineer.

4.4 Service Laterals

General

4.4.1 In any subdivision for which tentative or final approval is being sought, a single water service lateral shall be provided by the developer to each lot at the time of installation of services. The lateral shall extend from the main to the property line.

4.4.2 A single water service lateral shall be installed to each existing lot or potential future lot which could be created under the zoning in effect at the time of installation of services except that duplex or semi-detached units lots may be serviced by a common service lateral from the main to the street line with individual curb stops for the two units at the street line.

Location

4.4.3 Where possible, service laterals shall not be installed in private driveways, parking areas, or other traveled areas.

Pipe Material and Size

4.4.4 Water service laterals shall be copper tubing conforming to ASTM 888, Type K annealed, minimum working pressure of 150 psi (1035 kPa).

4.4.5 All water service laterals between the corporation stop and curb stop shall be a minimum of 3/4 inch (19 mm) in diameter.

4.4.6 A single lateral designed to service duplex or semi-detached units shall have a minimum inside diameter of 1 inch (25 mm). Individual service laterals from the curb stop to the street line shall have a minimum inside diameter of 3/4 inch (19 mm).

4.4.7 Where the length of service laterals from the curb stop to the serviced building is longer than the typical setback, a larger diameter service maybe required to avoid excessive pressure loss.

Service Fittings

4.4.8 Corporation and curb stops shall be brass conforming to ASTM B 62 with compression type joints. Threads on corporation stops shall conform to AWWA C800. All service connections on PVC mains shall include a service clamp (saddle) with bronze body, confined "o"-ring seal cemented in place, stainless steel straps suited for the main size, and outlet threads conforming to AWWA C800.

4.4.9 Service connection joints shall be compression type, with a minimum pressure rating of 150 psi (1035 kPa).

4.4.10 For services which are longer than 66 feet (20 m), the number of compression couplings used shall be kept to a minimum.

4.4.11 Service boxes shall be adjustable with cast iron bottom section, cast iron lid with recessed nut, and internal stem to suit the depth of bury.

Minimum Cover

4.4.12 All service laterals shall be installed with a minimum cover of 1.5 meters (5 feet).

4.5 Valves

General

4.5.1 All connections to an existing water system shall be valved so that the system can be isolated from the existing main to facilitate construction and testing. The connection to the existing water system shall be coordinated through the Town Engineer.

Type of Valves

4.5.2 Valves on water mains 12 inches (300 mm) and smaller shall be mechanical joint gate valves conforming to AWWA C509, minimum working pressure rating of 200 psi (1380 kPa), with cast iron body and resilient rubber seat. Cast iron adjustable height valve boxes shall be provided on all valves 12 inches (300 mm) and smaller.

4.5.3 Valves larger than 12 inches (300 mm) shall be gate valves conforming to AWWA C500, minimum working pressure rating of 150 psi (1035) kPa, with cast iron body and bronze mounted mechanism. Butterfly valves conforming to AWWA C504, Class 150B, minimum pressure rating of 150 psi (1035 kPa), with cast iron body and mechanical joint ends may be approved by the Town Engineer.

4.5.4 All meter chambers, air release chambers, and other special works shall be as approved by the Town Engineer.

Valve Locations

4.5.5 Valves shall be provided on water mains at the following locations:

(a) where required to adequately isolate sections of the water system as determined by the Town Engineer; and

(b) four valves for each cross in the watermain - one on each leg of the cross; and

(c) three valves for each tee in the watermain - one on each leg of the tee; and

(d) at intervals of 1,000 feet (300 m) on watermain sections where there are no junctions; and

(e) at the street line for all domestic and sprinkler services.

4.6 Backflow Prevention Devices

General

4.6.1 Backflow prevention devices shall be provided on new water services if in the Town Engineer's opinion there is a risk of contamination of the potable water supply. Premises which require backflow prevention devices include, but are not limited to, the following:

(a) industrial, commercial and institutional buildings; and

(b) dwellings larger than four units; and

(c) sprinkler service lines.

Location

(d) Backflow prevention devices shall be installed downstream of water meters. A water distribution connection shall not be permitted between a water meter and a backflow prevention device.

(e) Where a meter by-pass is required, a backflow prevention device shall be installed on the main service line and on the by-pass line.

Type of Device

4.6.2 Backflow prevention devices shall conform to CSA B64-M88.

4.7 Fire Hydrants

Spacing and Location

4.7.1 Fire hydrants shall be spaced in accordance with the latest revision of the publication "Water Supply for Public Protection". In no case shall the spacing exceed 500 feet (150 m).

4.7.2 The following are desirable hydrant locations:

(a) at high points on the water main profile unless an automatic air release valve is required at that location;

(b) at low points on the water main profile;

(c) at street intersections;

(d) near the middle of long blocks;

(e) at the end of dead-end streets or cul-de-sacs greater than 300 feet (90 m) in length.

4.7.3 Fire hydrant laterals shall have a minimum diameter of 6 inches (150 mm) and shall be provided with a gate valve between the hydrant and the tee on the main. The depth of bury of hydrant laterals shall be 5 feet (1.5 m).

4.7.4 Hydrants shall be provided with adequate drains to prevent freezing.

4.7.5 If dead end mains are permitted by the Town Engineer then a hydrant or blow off is required to permit flushing of the distribution system.

4.7.6 Fire hydrants shall be dry barrel type, conforming to AWWA C502 and shall be two-piece with safety break-away flange and stem. The safety flange shall be installed above the ground but it shall be no higher than 6 inches (150 mm) above finished grade.

4.7.7 Hydrants shall have two (2) two and one-half (2.5) inch hose nozzles Nova Scotia thread and one standard pumper nozzle with a diameter of four inches. The Town Engineer shall consult with the fire department prior to approval. Clow "Brigadier" -67 is an acceptable product.

4.8 Insulation

4.8.1 Insulation shall be placed where, due to special circumstances, the depth of bury is less than 5 feet (1.5 m). Insulation shall conform to CAN/CGSB 51.20M, type 4, expanded polystyrene. Styrofoam HI40 is an acceptable product.

4.8.2 Insulation of a main shall consist of insulation over the top of the pipe, with clean dry sand filling the annular space between the pipe and insulation.

4.9 Pumping and Storage Facilities

4.9.1 Differences in ground elevations or distance from the source of supply may require that the water system pressure be boosted in certain areas to provide adequate pressure and flows to meet domestic and fire flow requirements.

4.9.2 To accomplish this, a pumping station may be required to service a specific and defined area of a water distribution system which is generally isolated from the remainder of the system. All pumps, pump houses and storage facilities shall be designed in consultation with and meet the requirements of the Town Engineer.

4.10 Inspections and Testing

Valve Operation

4.10.1 The operation of any valve not part of the new construction shall only be by the Town.

Operation Notice

4.10.2 The Town shall be notified forty-eight (48) hours in advance of all filling, flushing, or chlorination operations for new construction.

Requirements

4.10.3 Testing shall be carried out with the following additional requirements:

(a) all services, hydrants, mains, and other appurtenances shall be included in the system test; and.

(b) testing shall be performed in presence of the Town Engineer or his representative. Test results shall be verified and submitted to the Town Engineer by a Professional Engineer registered to practice in Nova Scotia; and

(c) all water used for pipe testing shall be the contractor's responsibility and shall be chlorinated potable water.

Hydrostatic Pressure Test

4.10.4 Water lines shall be flushed before testing. The duration of each hydrostatic pressure test shall be at least (2) hours, and the pressure shall be maintained at a minimum of 200 psi (1380 kPa) throughout the test period.

4.10.5 Pressure gauges shall be liquid filled type, minimum 4 inch (100 mm) face diameter, graduated in psi, accuracy 3% at maximum reading.

4.10.6 There shall be no leakage or drop in pressure for the duration of the test.

4.10.7 The test must be conducted with all service laterals installed to the property line.

4.10.8 Should any section of the pipe leak the contractor shall, at their own expense, locate and repair the defects, and re-test the section that failed the pressure test.

Disinfection

4.10.9 Chlorination of any water system may proceed only after the system has been successfully pressure tested, with the test witnessed by the Town Engineer or their representative.

4.10.10 All water mains shall be chlorinated in accordance with AWWA C651.

4.10.11 All water mains shall be flushed before and after chlorination. Dechlorination of the water mains shall be the responsibility of the contractor. Dechlorination procedures shall satisfy the requirements of the Nova Scotia Department of Environment and Climate Change and the Town.

4.10.12 After chlorination and dechlorination are complete, water samples shall be delivered to a facility approved by the Nova Scotia Department of Environment and Climate Change for bacteriological testing. Chlorination shall be repeated if necessary.

4.10.13 Bacteriological test results shall be forwarded to the Town Engineer.

5 Storm Drainage System Specifications

5.1 General

5.1.1 This Part specifies the requirements for a storm drainage system. A storm drainage system is a system which receives, carries and controls discharges from rain and snow which includes overland flow, sub-surface flow, groundwater flow and snow melt. A storm drainage system may consist of ditches, culverts, swales, subsurface interceptor drains, roadways, curb and gutters, catch basins, manholes, pipes or conduits, retention ponds, lateral lines.to the lots from pipes or conduits to street lines, watercourses, floodplains, canals, ravines, gullies, springs and creeks.

5.1.2 The design criteria contained in this Part are included to illustrate the more common aspects encountered in the design of storm drainage systems. Any storm drainage system within the Town shall be designed to achieve all of the following objectives:

(a) prevent loss of life and to protect structures and property from damage due to a major storm event; and

(b) provide safe and convenient use of streets, lots and other land during and following storm events; and

(c) to adequately convey stormwater flow from upstream sources; and

(d) to mitigate the adverse effects of stormwater flow, such as flooding and erosion, on downstream properties; and

(e) to preserve natural water courses and other natural features; and

(f) to minimize the long term effect of development on receiving watercourses and on groundwater.

Nova Scotia Environment and Climate Change Requirements

5.1.3 Storm drainage systems shall conform to any requirements established by Nova Scotia Department of Environment and Climate Change. No system shall be constructed until the design has been approved by the Town Engineer and by Nova Scotia Environment and Climate Change.

5.2 Design Approach

Minor Drainage System

5.2.1 The minor drainage system is the system which is used for initial stormwater flows. The minor drainage system shall be designed to provide safe and convenient use of streets and properties, and reduce street maintenance costs. All pipes within the system shall be designed to carry runoff from a minor storm without surcharge.

Major Drainage System

5.2.2 The major drainage system is the path which stormwater will follow during a major storm, when the capacity of the minor drainage system is exceeded. The minor and major drainage systems together shall be capable of carrying the runoff from the major storm. The designed flow of stormwater in a major storm shall prevent basement flooding and damage to property, streets and structures. Easements may be required for the identification and protection of certain elements of the major drainage system.

Downstream Drainage Systems

5.2.3 All downstream drainage systems must have adequate capacity to receive and carry discharge from the proposed storm drainage system in addition to its natural rate of discharge. An investigation of the downstream system shall be carried out from the outfall location of the proposed storm drainage system to a point sufficiently downstream that will demonstrate no adverse impacts on downstream lands, such as erosion or flooding.

5.2.4 The effect on downstream development will be assessed by the Town Engineer based on design engineer's investigation. Mitigative measures may be required to alleviate any adverse downstream impacts.

Design Storm Frequencies

5.2.5 Piped systems and other minor drainage systems shall be designed based on a design storm frequency of 1 in 10 years.

5.2.6 Roadways, road cross culverts and other major drainage systems shall be designed for the combined capacity of the major drainage system and minor drainage system and shall be based on a design storm frequency of 1 in 100 years. The design capacity of a natural watercourse, including a floodplain, or any drainage system where a minor drainage system is not provided, shall be based on a design storm frequency of 1 in 100 years.

5.3 Meteorological Data

5.3.1 Acceptable rainfall data to calculate runoff flows is to be based on the following intensity-duration-frequency data:

(a) most current information from the Atmospheric Environment Service for area closest to project; and

(b) Rainfall Frequency Atlas for Canada; and

(c) Meteorological Services of Canada (MSC).

5.4 Runoff Methodology

5.4.1 The design engineer shall determine the best runoff calculation method to be used. The design engineer shall also calibrate and verify for local conditions. The designer shall provide for future reference the reason why a certain method is selected. The Town Engineer may request that a second method be used as verification or for checking the results.

5.4.2 The Rational Method may be used for drainage areas less than 50 acres (20 hectares) and for the preliminary design of storm drainage systems servicing larger areas.

5.4.3 Generally, the Rational Method shall not be used for the design of storage facilities, except that the modified Rational Method may be used for the design of storage facilities for highly impervious areas, and shall use the graphical hydrograph method.

5.5 Storm Drainage Report

5.5.1 A storm drainage report shall be prepared and included as part of the submission for any land development to deal with storm water and drainage issues related to the development. The report shall include site engineering analysis to a level consistent with the size of the development, its location within the drainage basin, and the sensitivity of the area's drainage system. The report shall include details of the safety implications of the proposed system, and an examination of the potential for erosion in the downstream receiving streams due to increased peak and total flows and flow velocities as a result of the development.

5.5.2 The storm drainage report shall also include drainage plans and detailed runoff calculations. The calculations shall include input information showing sub-watersheds, rainfall abstraction, antecedent moisture conditions and schematization of the system for pre and post development and all stormwater management alternatives, and output information which shows the main step of the calculations and the peak discharge at key points in the system.

5.5.3 The drainage plans shall show the location of the proposed development within the topographic drainage area, the area tributary to the proposed and existing storm drainage system(s), boundaries of all drainage sub-areas, contours at intervals not exceeding 6.5 feet (2 m), site layout including proposed streets and lots, locations of proposed storm drainage system(s) and stormwater management facilities, location of outfalls or connections into existing systems, hydrologic and hydraulic data table and any other information required by the Town Engineer.

5.6 Recommended Coefficient of Runoff Values for Various Selected Land Uses

Description of Area	Runoff Coefficients
Business, Downtown	0.75 to 0.95
Business, Neighbourhood	0.50 to 0.70
Residential, Single Unit	0.30 to 0.50
Residential, Multi-unit Detached	0.40 to 0.60
Residential, Multi-unit Attached	0.60 to 0.75
Residential, Suburban	0.25 to 0.40
Residential, ½ Acre Lots or More	0.25 to 0.40
Apartment Dwelling Areas	0.50 to 0.70
Industrial, Light	0.50 to 0.80
Industrial, Heavy	0.60 to 0.90
Parks and Cemeteries	0.10 to 0.25
Playgrounds	0.20 to 0.40
Rail Yards	0.20 to 0.40
Unimproved	0.10 to 0.30

5.6.1 It is often desirable to develop a composite runoff coefficient based on the percentage of different types of surfaces in the drainage area. This procedure is often applied to typical "sample" blocks as a guide to selection of reasonable values of the coefficient for an entire area. Coefficients with respect to surface type, currently in use are:

Character of Surface	Runoff Coefficients
Street, Asphalt	0.70 to 0.95
Street, Concrete	0.80 to 0.95
Drives and Walks	0.75 to 0.85
Roofs	0.75 to 0.95
Lawns, Sandy Soil – Flat, 2%	0.05 to 0.10
Lawns, Sandy Soil – Average, 2% to 7%	0.10 to 0.15
Lawns, Sandy Soil – Steep, 7%	0.15 to 0.20
Lawns, Heavy Soil – Flat, 2%	0.13 to 0.17
Lawns, Heavy Soil – Average, 2% to 7%	0.18 to 0.22
Lawns, Heavy Soil – Steep, 7%	0.25 to 0.35

5.6.2 The coefficients in these two tabulations are applicable to storms of 5 to 10 year frequencies. Less frequent, higher intensity storms will require the use of higher coefficients because infiltration and other losses have proportionally smaller effect on runoff.

5.6.3 Winter Runoff Coefficient is recommended to be 0.80 for all areas and surfaces with summer coefficients less than or equal to 0.80.

5.6.4 Source: Hydrology, Federal Highway Administration, HEC No. 19, 1984.

5.7 Easements Within Future Development

General

5.7.1 All storm drainage shall be carried by either an unconfined natural watercourse, an excavated ditch or a storm sewer.

5.7.2 All excavated ditches and storm sewers within a subdivision shall be located either within a street right-of-way or on an easement in favor of the Town. The minimum width of an easement shall be 20 feet (6.1 m).

5.7.3 Where subdivision storm drainage flows onto abutting land other than through a natural watercourse or a right-of-way then an easement in favor of the Town shall be provided.

5.7.4 Where a need is identified by the Town Engineer to accommodate future upstream development, and where no future street reserve is available, a drainage right-of-way or an easement in favor of the Town shall be provided.

5.7.5 Natural watercourses shall not be carried in roadside ditches or piped roadside storm drainage systems.

Discharge to Adjacent Properties

5.7.6 All storm drainage shall be self-contained within the subdivision boundaries, except natural run-off from undeveloped areas.

5.7.7 All run-off from the developed limits of a subdivision must be directed to either a natural watercourse or storm drainage system owned by the Town.

5.7.8 Discharge of run-off to adjacent properties other than in a natural watercourse shall be prohibited unless the developer obtains consent in writing from the adjacent property owner(s) and drainage easements over this property are provided in favor of the Town.

5.8 Piped Storm Drainage System Components

Pipe Materials

5.8.1 All storm pipe 15" (375 mm) in diameter or smaller shall be PVC DR35. All storm pipe 18" (450 mm) in diameter or larger shall be concrete to CSA A 257 .2 65 D.

Velocity in Storm Sewer

5.8.2 The minimum design velocity for storm sewers shall be 2 fps (0.6 m/s). Consideration shall be given to initial minimum cleansing velocity for phased development.

5.8.3 The maximum design velocity for storm sewers shall be 15 fps (4.5 m/s) for pipes up to and including 30" (750 mm) in diameter. The maximum design velocity for storm sewer pipes greater than 30" (750 mm) in diameter shall be 20 fps (6 m/s).

5.8.4 The Manning Formula shall be used for pipe design.

Pipe Size

5.8.5 The minimum diameter for a storm sewer main shall be 12" (300 mm).

5.8.6 The minimum diameter for a catch basin lead shall be 10" (250 mm).

5.8.7 Pipe sizes shall not decrease in the downstream direction unless approved by the Town Engineer.

Depth of Sewers and Laterals

5.8.8 The minimum depth for a storm sewer main and laterals located within the street right-of-way shall be 5 feet (1.5 m).

Manholes

5.8.9 Manholes shall be installed at all changes in grade or alignment, at all intersections and at intervals not exceeding 400 feet (120 meters). The minimum internal diameter of a manhole shall be 42 inches (1050 mm).

Service Laterals

5.8.10 All laterals from the storm sewer main to the property line shall be provided by the developer or owner and shall have a minimum grade of 2.0 percent.

5.8.11 Storm sewer laterals of 6 inch (150 mm) diameter or less shall be PVC DR 35 (green) from main to property line.

Catch Basins

5.8.12 Catch basins shall be installed at the curb of the street and shall be adequately spaced to prevent ponding on the street and to prevent water from entering on or flowing in the travel lanes during storm events corresponding to the design of the Minor Drainage System. In no case shall the spacing of the catch basins exceed 330 feet (100 meters). Catch basin leads shall be connected to a storm drainage main at a manhole.

Inlets

5.8.13 Vertical grates shall be installed at inlets.

Outfalls

5.8.14 The design of outfalls shall take into consideration such factors as public safety, erosion control, and appearance. Horizontal grates shall be installed at outfalls.

Ditches/Open Channel Drainage System

5.8.15 Ditches /open channels shall have adequate capacity for the 1 in 100 years storm.

Velocity in Channels

5.8.16 To prevent erosion, the maximum velocity during a 1 in 100 year storm event in ditches or open channels shall not exceed the following values:

Channel	Mean Channel Velocity FPS (m/s)
Fine Sand	1.5 (0.46)
Coarse Sand	2.5 (0.76)
Fine Gravel	6.0 (1.83)
Earth, Sandy Silt	2.0 (0.61)
Earth, Silt Clay	3.5 (1.07)
Earth, Clay	4.0 (1.22)
Grass-lined Earth, Bermuda Grass, Sandy Silt	6.0 (1.83)
Grass-lined Earth, Bermuda Grass, Silt Clay	8.0 (2.44)
Grass-lined Earth, Kentucky Blue Grass, Sandy Silt	5.0 (1.52)
Grass-lined Earth, Kentucky Blue Grass, Silt Clay	7.0 (2.13)
Poor Rock (Usually Sedimentary)	10.0 (3.05)
Soft Sandstone	8.0 (2.44)
Soft Shale	3.5 (1.07)
Good Rock (Usually Igneous or Metamorphic)	20.0 (6.10)

Culverts

5.8.17 The size of culverts shall be as shown on the engineering drawings with a minimum 20" (500 m) depth of bury for any culvert. The minimum size for any culvert shall be 10" (250 mm).

5.8.18 Culverts other than driveway culverts shall be designed for the 1 in 100 year peak flow with a headwater depth not greater than the diameter of the pipe.

5.8.19 Storm sewer outfalls and culverts greater than 50 feet (15 m) in length require inlet and outlet grating.

5.8.20 All culverts shall be reinforced concrete pipe to ASTM C76-M or CAN/CSA A257.2.

Roof Drains

5.8.21 Roof drains shall discharge on the ground surface and shall not be connected to a storm drainage system.

Foundation Drains

5.8.22 Where a buried storm drainage system exists, foundation drains will normally be connected to the storm sewer by laterals. The invert of the lateral at the property line must be at least 2 feet (61 0 mm) above the top of the main at the point of connection.

5.8.23 Where a buried storm drainage system does not exist, Section 9.14 of the National Building Code of Canada, latest revision, shall apply.

5.8.24 Under no circumstance shall foundation drains direct stormwater to the street surface, sidewalk or adjacent property.

5.9 Erosion and Sediment Control

5.9.1 An Erosion and Sediment Control Plan shall be provided in compliance with Provincial regulations, and a copy of the plan must be submitted to the Town Engineer. The plan shall address measures during construction of streets, services, and houses, as well as long term measures after the completion of development.

5.9.2 The Erosion and Sediment Control Plan including control measures, shall comply with the Erosion and Sedimentation Control Handbook for Construction Sites as prepared by the Nova Scotia Department of the Environment.

5.9.3 During construction, surface water flows across the construction site must be minimized. Exposed soils within ditches and on cut and fill slopes shall be permanently stabilized by hydroseeding or equivalent within two weeks after final grading is complete. Temporary stabilization measures shall be used to prevent erosion of exposed soils during construction and prior to reaching finished grades. These measures are required to prevent downstream sedimentation of watercourses and storm damage systems.

5.9.4 Long term environmental protection measures to be addressed in the subdivision design may include but are not limited to:

(a) minimization of erosion and sediment transport; and

(b) protection of outfall areas; and

(c) utilization of wetland areas for filtration of stormwater run-off; and

(d) minimization of disruption to natural watercourses.

5.10 Inspections and Testing

General

5.10.1 Sewers and forcemains shall be tested in accordance with the requirements of the Standard Specification for Municipal Services prepared by the Nova Scotia Road Builders Association and the Nova Scotia Consulting Engineers Association. The Town Engineer shall be notified at least forty-eight (48) hours in advance of all proposed tests. Tests shall be performed in the presence of the Town Engineer, or their representative.

Manholes and Catch Basins

5.10.2 Manholes and catch basins shall be inspected by the Town upon completion of construction and again prior to the end of the maintenance period.

5.10.3 All manholes and valve chambers shall be tested for leakage using either a hydrostatic or air vacuum method.

5.10.4 Any part of the system failing the above tests or found deficient shall be repaired, retested and inspected to the satisfaction of the Town Engineer at the expense of the subdivider.

Deflection

5.10.5 Sewers shall be tested for deflection after trenches are backfilled and compacted.

Testing Leakage

5.10.6 Leakage test shall be in accordance with the requirement of the Standard Specifications for Municipal Services prepared by the Nova Scotia Road Builders Association and the Nova Scotia Consulting Engineers Association.

Testing Video Inspection

5.10.7 Closed circuit video inspections shall be carried out at the following times:

(a) at completion of construction and prior to subdivision endorsement of acceptance of the work by the Town; and

(b) two months prior to the end of the maintenance period.

5.10.8 A colour camera shall be used for video inspections. Color digital video files and written reports shall be provided in forms acceptable to the Town Engineer.

6 Public Streets

General

6.1.1 This Part specifies the requirements for all public streets in the Town of Lunenburg.

6.1.2 A street shall consist of the wearing surface, road bed and all slopes, ditches, channels, waterways and structures necessary for proper drainage and protection.

6.1.3 The design and location of all streets, sewers, water mains, electrical, telephone and such utilities located within the right-of-way of the public street shall be in accordance with the appropriate specification(s) and must be approved by the Town Engineer prior to their construction.

6.1.4 With the exception of street cross sections, the Town Engineer may consider variances to these specifications.

6.2 Street Classification and Characteristics

6.2.1 Schedule A provides three classes of public streets applicable to development within the Town of Lunenburg.

6.2.2 The Subdivision By-law regulates the minimum lot sizes and development character. The lot size and the development character may dictate the appropriate street classification and characteristics. The following criteria shall be considered in determining which design and construction standard will apply to a particular development:

(a) where practicable, the Lower Volume class shall be preferred over the Local class, which shall be preferred over the Minor Collector class;

(b) a design brief prepared by the developer's consultant shall be submitted addressing the design intent including rationalization of the selected street type and length. The design brief shall address issues such as capacity, parking and maintenance; and

(c) the final decision on the street classification and characteristic and parking allowances shall be made by the Town Engineer.

6.3 Design Criteria

General

6.3.1 This section covers the more common aspects for design and construction of public streets within the Town of Lunenburg. In cases where this section needs to be expanded or additional specifications are required, the "Geometric Design Guide for Canadian Roads and Streets", the "Manual of Uniform Traffic Control Devices for Canada" in the latest edition as published by Transportation Association of Canada (TAC), and the Standard Specifications for municipal services as prepared by the- Nova Scotia Road Builders Association and the Nova Scotia Consulting Engineer's Association shall be used. Specific design criteria are listed throughout these Specifications.

Design Speed

6.3.2 Design speed shall be in accordance with Schedule A.

6.3.3 A design speed of 30 to 50 km/hr will be used for all public streets unless the intended use of the street requires a higher design speed as determined by the Town Engineer.

Connections to Adjacent Lands

6.3.4 Streets must be laid out where reasonably possible in prolongations of other streets either in the same subdivision or in adjacent subdivisions.

6.3.5 In all subdivision designs, an acceptable right-of-way access to adjacent vacant properties and to watercourses must be provided and deeded to the Town. The access street right-of-ways should be located to maximize development potential of adjacent lands but in no case shall be more than 200 metres (657 feet) apart.

6.3.6 Where a subdivision is being designed adjacent to a subdivision with previously deeded access right-of-ways, the subdivision design shall utilize this right-of-way to connect the two subdivisions unless, in the opinion of the Town Engineer, such connection would prejudice an effective road layout for the subdivision under design.

6.3.7 Where a roadway can be extended to service adjacent or future development, a right-of-way shall be provided and approved by the Town Engineer.

Maximum Block Length and Pedestrian Connections

6.3.8 Block lengths shall not exceed the "Maximum distance between intersections" in Schedule 'A'.

6.3.9 Where any street exceeds a length of 150 metres (500 feet) between intersections, acceptable pedestrian right-of-ways to adjacent vacant properties, streets, and watercourses must be provided and deeded to the Town.

6.3.10 The pedestrian right-of-ways shall be a minimum of 3 metres (10 feet) in width and shall either be located approximately at the mid-point of the length of the road or at a location that would connect to pedestrian right-of-ways on adjacent lands, if any.

6.3.11 Where a subdivision is being designed adjacent to a subdivision with previously deeded pedestrian right-of-ways, the subdivision design shall utilize this right-of-way to connect the two subdivisions unless, in the opinion of the Town Engineer, such connection would prejudice an effective layout for the subdivision under design.

Right-of-Way

6.3.12 The minimum street right-of-way width shall be in accordance with Schedule A or as determined by the Town Engineer.

6.3.13 Any property susceptible to damage as a result of construction must be within the right-of-way. All cut or fill slopes which will not be eliminated by changes in lot elevations must be included within the right-of-way.

Street Layout

6.3.14 Unless there are unique circumstances, the minimum length of a street considered for acceptance as a public street shall be 500 feet (152 m).

6.3.15 Cul-de-sacs shall not be used when the subdivision can be effectively serviced by other street layouts. All cul-de-sacs must end in a permanent or temporary turn around area as approved by the Town Engineer. The grade of the turning area shall not exceed 4%. Cul-de-sacs shall be graded to drain from the centre of the cul-de-sac to the curb.

6.3.16 The maximum permanent cul-de-sac length where a walkway is located at the end of the cul-de-sac and connects to another street shall be 500 feet (152 m). Otherwise the maximum length shall be 330 feet (100 m) measured from the intersection of the cul-de-sac's centreline between the street-line of the intersecting street to the centre of the cul-de-sac.

6.3.17 Boulevards will not be permitted in residential subdivisions.

6.3.18 Guardrails are required on fills 10 feet (3 m) or greater (unless a slope of 6: 1 can be provided) and in other hazardous areas. Details of guardrail construction and location are to be provided to the Town Engineer for approval.

6.3.19 Sign installation including stop signs, street signs and all other required signs shall be the responsibility of the developer and shall be installed in accordance with the approved street design prior to conveyance of the street to the Town.

Intersections

6.3.20 Intersection location and minimum curb radius for streets shall be in accordance with Schedule A.

6.3.21 Where public streets meet existing provincial highways, the intersection must be approved by the Provincial Department of Transportation and Active Transit.

6.3.22 All intersecting streets must intersect at an angle of 70 to 90 degrees for a minimum distance of 100 feet (30 m) from the intersection measured from the respective center lines.

6.3.23 Offset intersections will not be permitted. A maximum of four streets will be permitted at an intersection.

Driveways

6.3.24 Driveway widths shall be in accordance with the following table:

	Minimum Driveway Width*	Maximum Driveway Width*	Curve Radius
Residential	10 ft (3 m)	16 ft (5 m)	0 ft (0 m)
Commercial	23 ft (7 m)	33 ft (10 m)	0 ft (0 m)
Industrial	33 ft (10 m)	40 ft (12 m)	20 ft (6 m)

*Residential and commercial driveway widths are measured at curb or edge of pavement. Industrial driveway widths are measured at street line.

Sidewalks

6.3.25 Sidewalks, constructed in accordance with the "Typical Sidewalk Section", are required as identified in Schedule 'A'.

Horizontal Alignment

6.3.26 Horizontal alignment shall be in accordance with Schedule A.

6.3.27 Tangent distances between horizontal reverse curves shall not be less than 20 m.

6.3.28 Tangent distances between horizontal curves turning the same way shall not be less than 40 m.

Vertical Alignment

6.3.29 Vertical alignment shall be in accordance with Schedule A.

6.3.30 The grade of a street at an intersection shall not exceed 4% for at least 66 feet (20 m) measured from the shoulder of the intersecting street.

6.3.31 Local streets shall not be superelevated unless there are safety or drainage concerns.

6.3.32 Curb elevations at intersections, critical grade locations and bulbs of cul-de-sac's shall be shown on the drawings at a minimum 10 ft (3 m) spacing.

Design Limits

6.3.33 Where streets are required to service future or adjacent property the design shall include sufficient detail to illustrate that the extension is compatible with adjacent topography and can be constructed in accordance with this specification.

Construction Limits

6.3.34 All street accesses to adjacent property must be constructed to the property lines.

Access

6.3.35 A maximum of 25 lots may receive final approval prior to a second access being provided.

Stopping Sight Distance

6.3.36 Stopping sight distance shall be in accordance with Schedule A Minimum stopping and turning sight distances shall be as defined by the TAC Geometric Design Guide.

Bridges

6.3.37 Bridges shall be designed and constructed to Canadian Standards Association (CSA) specification "S6 Design of Highway Bridges".

Extension of Existing Street

6.3.38 Where a proposed extension to an existing street increases traffic volumes to a degree that a traffic study requested by the Town Engineer and carried out at the Town's expense warrants improvements be made to an existing street then the developer shall pay for these improvements.

6.4 Inspection and Testing

Notification

6.4.1 A preconstruction meeting shall be required before construction work begins on any public streets. Inspections may be carried out at any time, however, inspection reports by the developer's engineer shall be provided at the following stages:

(a) after clearing and grubbing prior to earthwork; and

(b) after installation of piped systems including services prior to subgrade work; and

(c) after compaction of the subgrade prior to placing gravels; and

(d) after compaction of each type of gravel prior to paving; and

(e) after compaction of each type of asphalt; and

(f) prior to the Town taking over the streets.

Reporting

6.4.2 All results of laboratory and field density tests shall be submitted to the Town Engineer.

Subgrade

6.4.3 Subgrade material shall be placed and compacted to the specified minimum density attained using the "Control Strip" method. Additional guidance on the Control Strip method may be found in the DOT Standard Specification for Highway Construction and Maintenance (April 1996), Division 2, Earthworks.

6.4.4 At least one field density test shall be taken for every 300 feet (90 m) of street subgrade. Testing frequency is subject to the direction and approval of the Town Engineer and may be altered based on street conditions.

Soft Spots

6.4.5 All "soft spots" in the subgrade shall be removed to full depth and replaced with approved backfill.

Trenches

6.4.6 Pipe bedding, cover and backfill in trenches shall be to the depth and width indicated in the details. Field density tests shall be taken within a section of trench to determine the level of effort required to achieve the specified compaction for each of the following:

(a) pipe bedding; and

(b) pipe cover material; and

(c) trench backfill excluding final 12 inches (300 mm) to subgrade; and

(d) final 12 inches (300 mm).

6.4.7 Compaction within trenches may proceed using the compactive effort determined for each of the above provided there is no change in materials, equipment or site conditions. Such a change will require re-determination of the compactive effort. Quality control testing of compaction within trenches shall be as required for site soil conditions or as directed by the Town Engineer.

Gravels

6.4.8 At least one field density test shall be taken for every 100 feet (30 m) of roadway gravels for each gravel lift.

Moisture Content

6.4.9 Moisture content of gravels, subgrade and trench backfill materials must be controlled to obtain the specified compaction.
Asphalt Concrete

6.4.10 Prior to paving, the developer shall provide the Town Engineer with a letter signed by a Professional Engineer which states that the aggregates(s) and asphalt cement has been sampled and tested, and that the asphalt concrete mix design meets the specification.

6.4.11 A minimum of one series of tests per day or for each 500 tonnes of asphalt concrete shall be performed. The series of tests shall include all of the following:

(a) Marshall Stability, kN; and

(b) Marshall Flow, x 0.25 mm; and

(c) Voids in Mineral Aggregate (VMA), %; and

(d) Air Voids, %; and

(e) Asphalt Cement Content,%; and

(f) Gradation of Extracted Aggregate.

6.4.12 There shall be at least one field density test per day for each 550 tons (500 tonnes) of asphalt concrete placed. Each lift for every individual street shall have at least one field density test taken.

6.4.13 Tests shall conform to the NS Department of Transportation Active Transit specifications. All test results shall be forwarded to the Town Engineer prior to paving.

Curbing

6.4.14 At least one set of concrete test cylinders (3 cylinders - 6 inch x 12 inch) shall be taken for every 328 feet (100 m) of curbing and tested for compressive strength at 7 days and 28 days.

6.5 Street Construction

6.5.1 Contract specifications shall be developed in conjunction with "Standard Specifications for Municipal Services" as published by the Nova Scotia Road Builders Association & Consulting Engineers of Nova Scotia Joint Committee on Contract Documents. The following specification shall take precedence where there is a conflict with the Standard Specification for Municipal Services:

6.5.2 Streets shall be constructed including pavements in accordance with this section. Cost of paving is borne by the Town of Lunenburg.

Clearing and Grubbing

6.5.3 All brush, trees and cuttings shall be removed. In no case shall cleared materials be buried in the street right of way.

6.5.4 All grubbed materials under the street right of way shall be removed. In no case shall grubbed material be buried in the street right of way.

Right of Way

6.5.5 The right-of-way shall be left properly drained and should the work, as performed, create pockets of isolated water holes, this drainage condition shall be rectified by the subdivider at their expense.

Subgrade

6.5.6 Topsoil, peat and other unsuitable materials under the roadbed must be removed prior to placing embankment material. Rock cuts shall be excavated to at least 1 foot (300 mm) below the subgrade and backfilled with material satisfactory to the Town Engineer. Water pockets shall not be left in the bottom of rock cuts. All cuts or embankment must be backfilled with graded material approved by the Town Engineer. The top 12 inches (300 mm) of subgrade must be free of rocks larger than 6 inches (150 mm) in any dimension.

6.5.7 The subgrade must be well drained and compacted using the method described in Subsection 6.4.3. Any unsuitable material including soft or yielding clay material shall be removed, replaced with suitable material and compacted.

Sub-base and Base Gravels

6.5.8 The sub-base course shall conform to Gravel Type 2, Division 3, Section 7 of the Nova Scotia Department of Transportation and Active Transit Standard Specifications. The sub-base course must be applied to compacted thickness of not less than 12 inches (300 mm).

6.5.9 The base course shall conform to Gravel Type 1, Division 3, Section 7 of the Nova Scotia Department of Transportation and Active Transit Standard Specifications. The base course must be applied to a compacted thickness of not less than 6 inches (150 mm).

6.5.10 Compaction of sub-base and base gravels shall be via the control strip method and field density test described in Subsections 6.4.4 and 6.4.8 respectively.

Shoulder Gravels

6.5.11 Shoulder gravels shall conform to Gravel Type 1 S, Division 3, Section 7 of the Nova Scotia Department of Transportation and Active Transit Standard Specifications. Shoulder gravels must be applied to compacted thickness of 6 inches (150 mm).

Asphalt Paving

6.5.12 Cost of paving is borne by the Town of Lunenburg.

6.5.13 Prior to paving, the developer shall provide the Town Engineer with a letter signed by a Professional Engineer which states that the aggregate(s) and asphalt concrete have been duly sampled and tested, and that the asphalt concrete to be manufactured from these ingredients has been duly designed to achieve the specified properties. The letter will list the test results for aggregate and asphalt. The Town Engineer may also require the letter to state that the hot mix asphalt concrete plant conforms to the Nova Scotia Department of Transportation and Active Transit Standard Specifications.

6.5.14 The asphalt concrete shall conform to Division 4, Section 4, of the Nova Scotia Department of Transportation and Active Transit Standard Specifications and be placed in two lifts. The lower course of Class "B" asphalt must be applied to a compacted thickness of not less than 2.0" (50 mm). The upper course of Class "C" asphalt must be applied to a compacted thickness of not less than 1.5" (40 mm).

7 Road Signage

7.1 Road Signage Standards

7.1.1 All road signage, signals and markings shall be in accordance with the Manual of Uniform Traffic Control Devices for Canada manual and the Nova Scotia Traffic Signs Regulations.

7.1.2 All road signage shall be placed in the right-of-way, subject to approval by the Town Engineer. Signage shall not be placed in the municipal right-of-way without the prior approval of the Town Engineer.

7.2 Stop Signs

7.2.1 Stop signs shall be placed within 5 metres of all intersections, at the minor leg approaches, at the developer's cost. Intersections with equal traffic for all approaches may be designated as a four way stop, subject to approval by the Town Engineer.

7.3 Traffic Signals

7.3.1 If traffic volumes indicate electrified traffic signals are necessary, a traffic signal warrant shall be submitted for approval by the Town Engineer.

7.4 Road Names

7.4.1 All road names shall be subject to approval by the Civic Address Coordinator prior to final approval being given by the Development Officer.

7.5 Road Name Signage

7.5.1 All roads are required to have road name signage placed on each road intersection, at the developer’s cost.

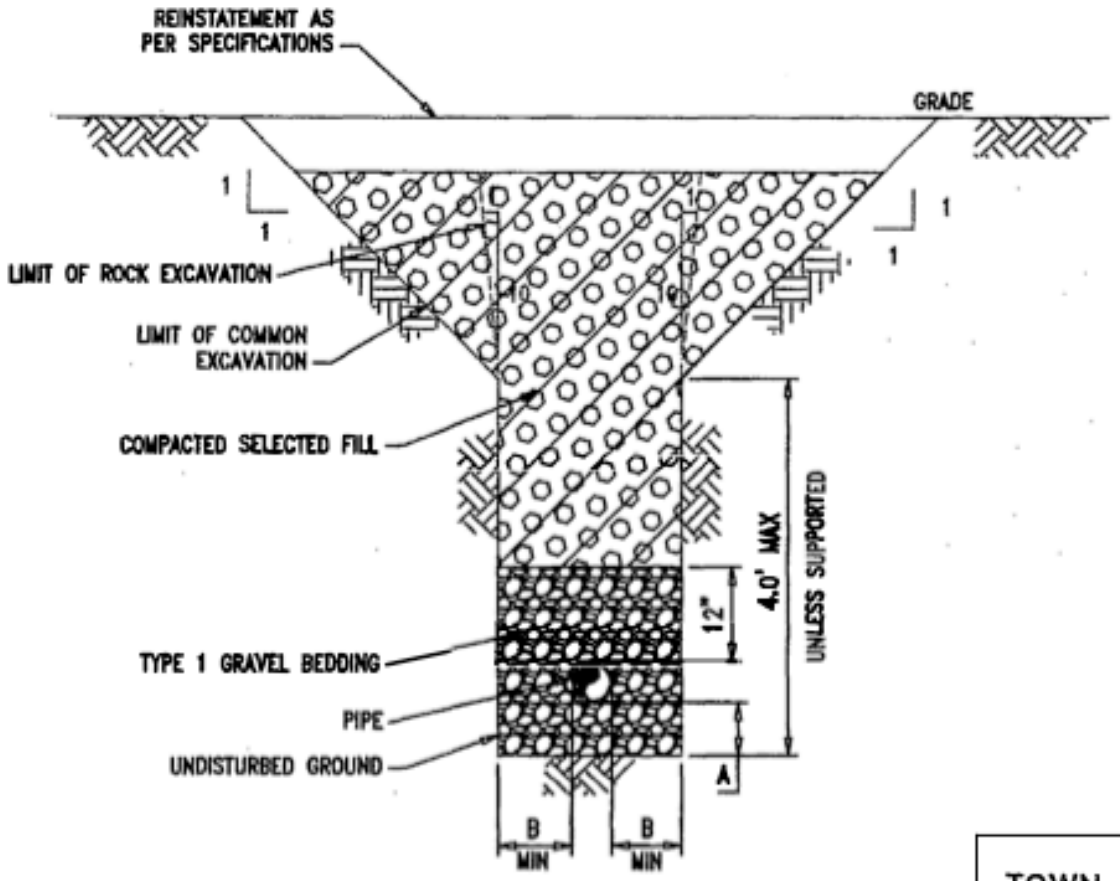
7.6 Other Road Signage

7.6.1 Other directional, speed rating and cautionary signage shall be placed in the right-of-way, as warranted, in the sole discretion of the Town Engineer and at the developer’s cost.

Schedule 'A'

Characteristic	Minor Collector	Local – 50 km/h	Low Volume – 30 km/h
Traffic services & function	Traffic movement of equal importance with land access	Land access first consideration, traffic access second consideration	Aesthetics first, land access second, traffic third
Maximum number of lots or dwelling units	n/a	n/a	n/a
Maximum distance between intersections	365 m	200 m	120 m
Maximum street length	n/a	n/a	n/a
Parking	Permitted on both sides	Permitted on one side	Permitted on one side
Sidewalks	Required on both sides	Required on one side	Required on one side
Bicycle lane	Required	Not required	Not required
Average daily volume	Up to 3,000	Less than 1,000	Less than 300
Average running speed	30 – 50 km/h	30 – 50 km/h	15 – 30 km/h
Vehicle types	All types with truck limits	Passenger and service vehicles, with limits on large vehicles	Passenger and service vehicles
Design speed (km/h)	50	50	30
Right-of-way width	20 m to 25 m	16 m to 20 m	13 m to 16 m
Minimum travel lane width	4.5 m	3.0 m	3.0 m
Minimum grade	1%	1%	1%
Maximum grade	8%	10% *	10% *
Minimum centreline radius	See TAC	100 m	30 m
Minimum sight distance	85 m	65 m	45 m
Typical road cross section	Cross-section 1	Cross-section 2	Cross-section 3
Minimum centreline distance between intersections • Same side of street • Opposite side of street	 150 m 60 m	 75 m 45 m	 60 m 45 m
Minimum K factors • Crest • Sag	 See TAC See TAC	 7 12	 2 4
Minimum curb radius	10 m	7.5 m	7.5 m

* A 12% grade may be permitted by the Town Engineer under exceptional circumstances.
TAC = Transportation Association of Canada Geometric Design Guidelines



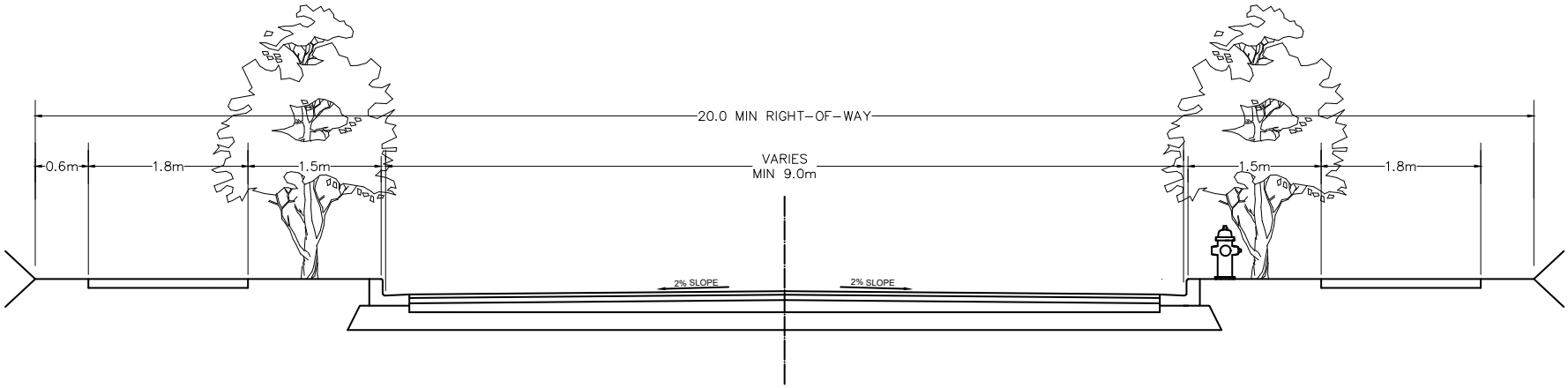
NOTES

1. ALL DIMENSIONS ARE IN IMPERIAL UNITS
2. LETTERED DIMENSIONS BASED ON STANDARD SPECIFICATIONS FOR MUNICIPAL SERVICES

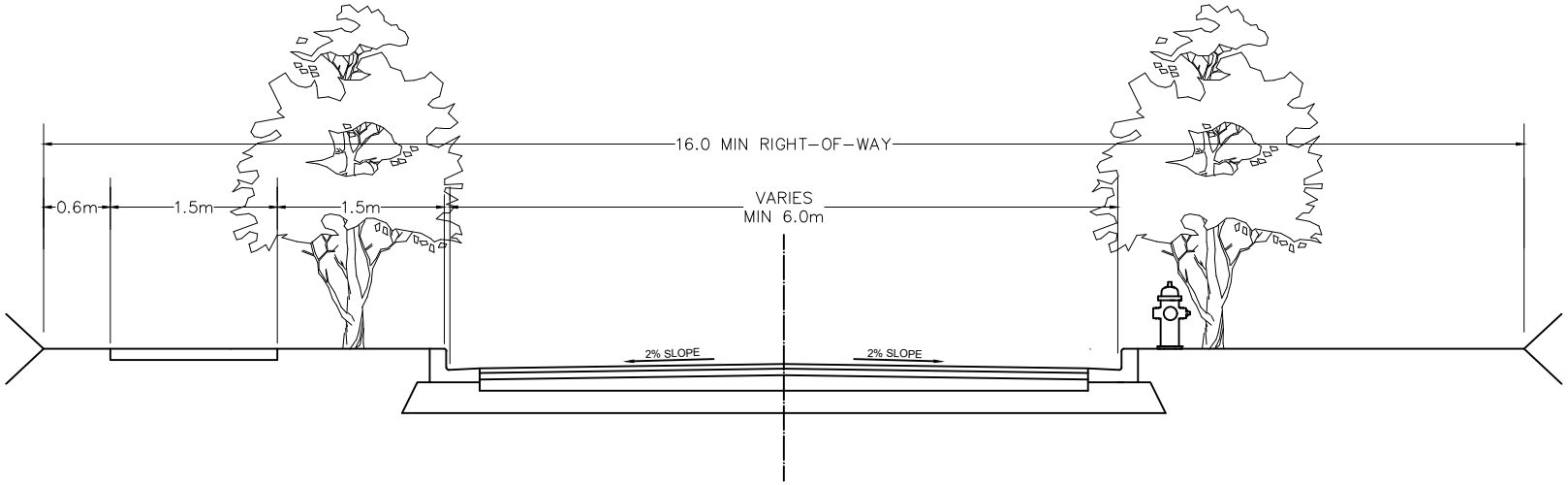
TOWN OF LUNENBURG

TYPICAL
TRENCH DETAIL

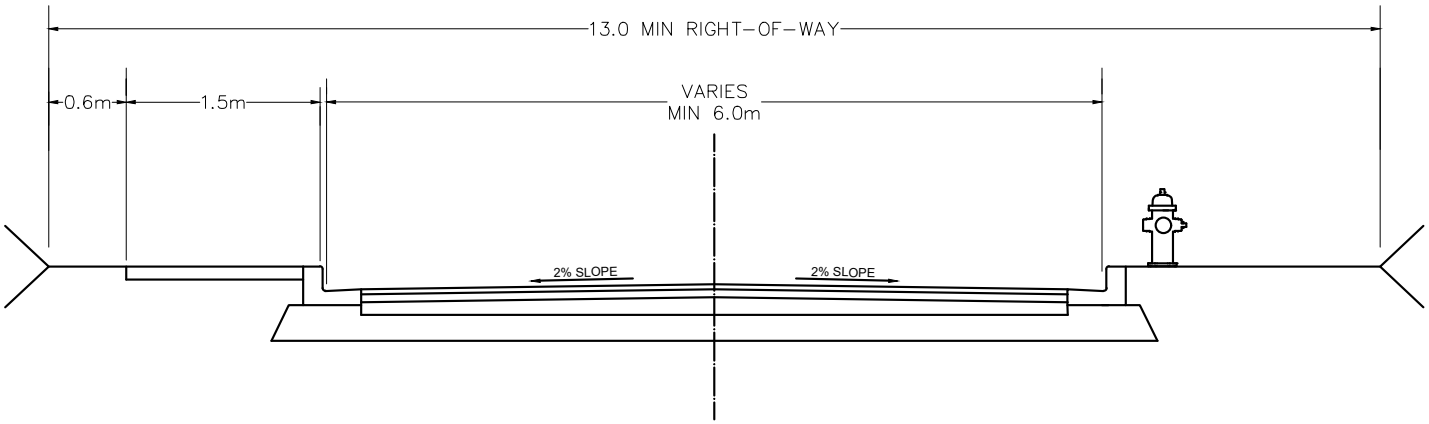
January 2007



1 TYPICAL MINOR COLLECTOR CROSS SECTION
20m ROW, 9m PAVED TRAVEL LANE
Scale: NTS
upto 3000 vehicles daily

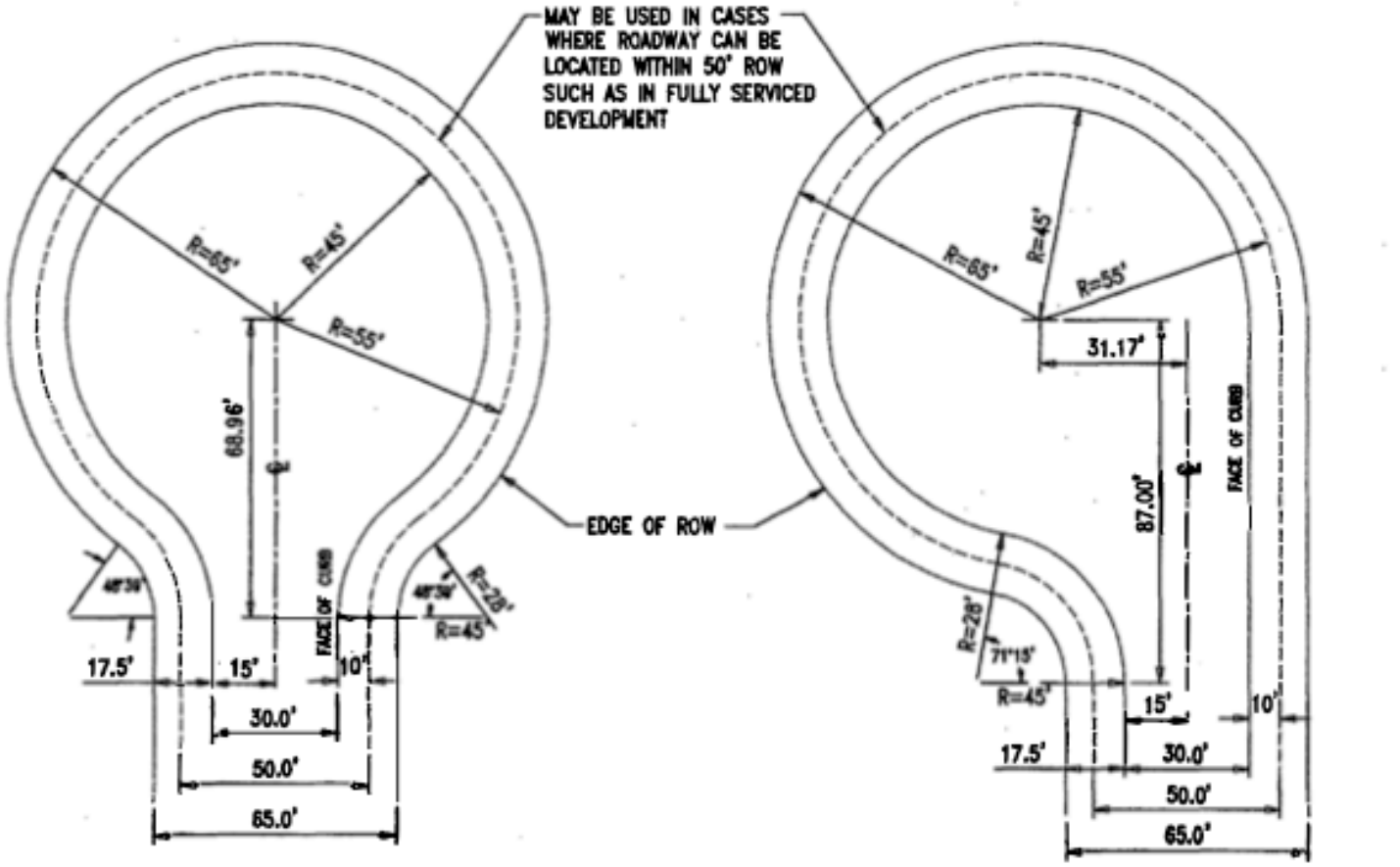


2 TYPICAL LOCAL 50 km/hr CROSS SECTION
16m ROW, 6m PAVED TRAVEL LANE
Scale: NTS
upto 1000 vehicles daily



3 TYPICAL LOCAL LOW VOLUME CROSS SECTION
13m ROW, 6m PAVED TRAVEL LANE
Scale: NTS

upto 300 vehicles daily



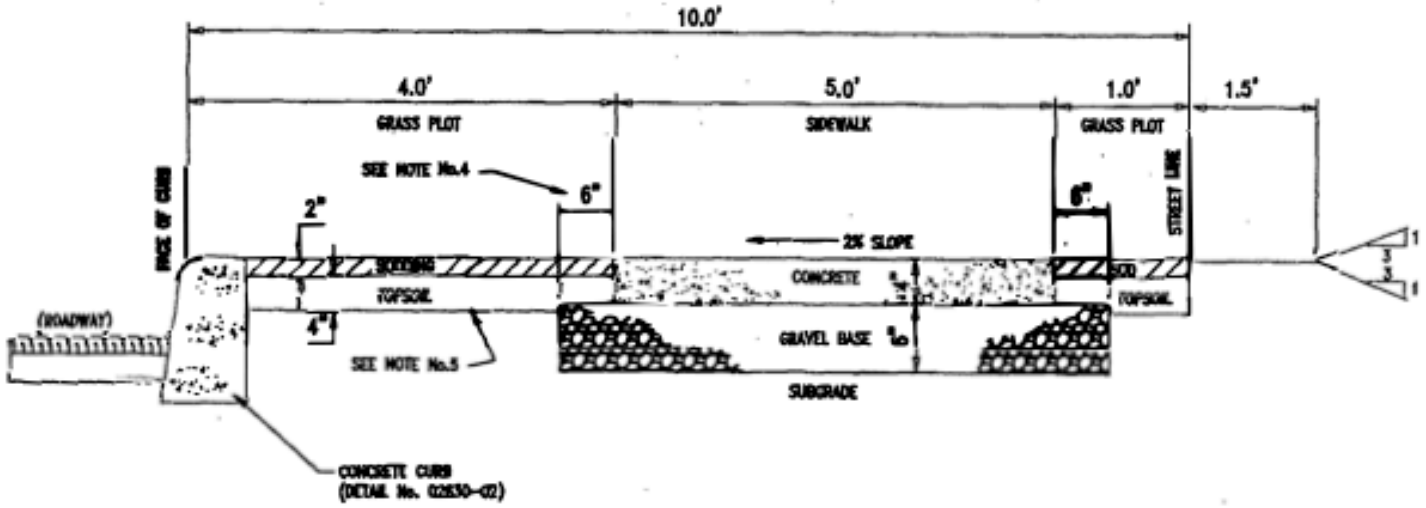
NOTES

1. ALL DIMENSIONS ARE IN IMPERIAL UNITS

TOWN OF LUNENBURG

STANDARD CUL-DE-SAC

January 2007



NOTES

1. NORMAL THICKNESS OF CONCRETE SIDEWALK TO BE 4.0"
2. THICKNESS OF CONCRETE SIDEWALK THROUGH DRIVEWAY AREA TO BE 6.0"
3. 152X152 MW 18.7 X MW 18.7 (WELDED WIRE FABRIC) TO BE USED IN ALL COMMERCIAL DRIVEWAYS
4. THE BASE COURSE SHALL EXTEND 6.0" MINIMUM ON EACH SIDE OF THE SIDEWALK STRUCTURE
5. TOPSOIL TO BE TREATED WITH FERTILIZER AND LIME
6. SIDEWALK ABUTTING COMMERCIAL AREAS SHALL HAVE FULL WIDTH AND BE 6.0" IN DEPTH
7. ALL DIMENSIONS ARE IN IMPERIAL UNITS
8. CONCRETE: 5000 PSI, 0.4 WATER TO CEMENT RATIO, 5% TO 8% ENTRAINED AIR

TOWN OF LUNENBURG

TYPICAL SIDEWALK SECTION

January 2007