

MUNICIPAL SERVICES SYSTEMS GENERAL SPECIFICATION

PURSUANT TO THE SUBDIVISION BY-LAW



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1.0 INTRODUCTION / GENERAL REQUIREMENTS

This document has been prepared for use with and shall be read in conjunction with the "Standard Specification for Municipal Services" as published by the Nova Scotia Road Builders Association, the Nova Scotia Consulting Engineers Association and the Joint Committee on Contract Documents. In case of discrepancy, the more stringent requirement shall apply.

These design standards and guidelines have been prepared for setting minimum design and construction standards for Municipal Services Systems within the Municipality of the County of Antigonish; to list and suggest limiting values for items upon which an evaluation of such designs will be made by the reviewing authority; and to establish uniformity of practice in the Municipality. A complete documentation of all parameters relating to the design and construction of municipal services is beyond the scope of this document; however, an attempt has been made to touch upon the parameters of greatest importance and to present the policies and accepted procedures of the Municipality.

These Municipal Services Systems General Specifications (Specifications) shall apply to all developments proposing municipal sanitary sewer, water and storm drainage systems and proposed municipal streets.

The purpose of this document is to provide guidance for Design Engineers in the provision of Municipal Services Systems meeting these criteria, but also consistent with cost effective installation, operation and maintenance. The design of these services, when submitted to The Municipality of the County of Antigonish must be under the seal of a Professional Engineer in accordance with the *Engineering Profession Act, R.S., c. 148, s. 1*.

This document is not intended to eliminate the necessity for detailed design, rather it is intended to provide minimum standards for the materials, design criteria and method of construction to be utilized in the installation of municipal services. Further, it is not the intention of the Municipality to stifle innovation. Where, in the judgment of the Design Engineer, variations from this document are justified or required and where the Design Engineer can show that alternate approaches can produce the desired results, such approaches will be considered for approval. In considering requests for variations from these design criteria, the Director of Engineering Services (DES), or designate, in conjunction with the Director of Planning for the Municipality of the County of Antigonish, shall take into consideration such factors as safety, nuisance, system maintenance, capital costs, operational costs, life cycle costs, environmental issues, and natural topography. All variations to these design criteria will be filed by the Development Officer.

Notwithstanding the consideration for approval from the DES, all Municipal Services Systems designed shall comply with the latest edition of the Nova Scotia Department of Transportation & Public Works "Specifications for Subdivision Roads in Urban and Rural Areas", "Nova Scotia Standards and Guidelines Manual for the Collection, Treatment and Disposal of Sanitary Sewage" and they shall have all approvals to construct from the Nova Scotia Department of the Environment and Labour (NSDOE&L). The most stringent requirements shall prevail among standards.

Each submission shall be accompanied by a statement from a Professional Engineer that the submission is in accordance with these Specifications except, if there are variations, the Design Engineer shall indicate clearly, in all appropriate documents and plans included with the submission, the specific variances from the design standards identified in these Specifications. Also, where the Design Engineer uses standards other than those outlined in this document, all appropriate documents and plans shall indicate clearly those areas of difference.

Acceptance by The Municipality of the County of Antigonish of the design of proposed Municipal Services Systems does not relieve the Design Engineer of the responsibility for proper design, nor does it imply that the Municipality has checked the design exhaustively for compliance with this document. The Design Engineer retains full responsibility and liability for his/her work as a Professional Engineer. Where the Municipality has accepted a design which does not comply with these standards and where the Design Engineer has not brought variations from this document to the attention of the DES, the provisions of this document still stand.

All service systems shall conform to this document as well as any more stringent requirements established by other authorities having jurisdiction within the Municipality of the County of Antigonish. In addition to these design criteria, and in any case where this document requires expansion or clarification, the latest revisions of all applicable and relevant codes and standards shall be used for reference by the Design Engineer. These documents include, but are not limited to, the latest editions of:

"Standard Specification for Municipal Services", prepared by the Nova Scotia Road Builders Association and the Nova Scotia Consulting Engineers Association

"Nova Scotia Standards and Guidelines Manual for the Collection, Treatment and Disposal of Sanitary Sewage", prepared by the Nova Scotia Department of the Environment

Nova Scotia Department of Transportation & Public Works Specifications for Subdivision Roads in Urban and Rural Areas

Subdivision Bylaw for the Municipality of the County of Antigonish

American Water Works Association Standards

"Water Supply for Public Fire Protection", prepared by the Fire Underwriters Survey-Insurers Advisory Organization (IAO)

National Fire Protection Association (NFPA)

Hydraulic Institute Standards

Canadian Standards Association (CSA)

National Building Code (NBC) of Canada

National Plumbing Code (NPC) of Canada

National Fire Code (NFC) of Canada

Canadian Electrical Code (CEC)

Underwriters Laboratories of Canada (ULC)

National Electrical Manufacturing Association (NEMA)

All contract documents prepared for municipal services within the Municipality of the County of Antigonish shall contain a clause requiring the Applicant and the Applicant's contractors and sub-contractors to carry out all work in compliance with all applicable Municipal, Provincial and Federal Regulations, including, but not limited to, the Nova Scotia *Occupational Health and Safety Act, 1996, c. 7, s. 1*.

Any available recorded engineering drawings of municipal services will be provided to the Design Engineer for information only. Design Engineers are responsible for verifying the information in the field prior to any detailed design.

No municipal services or streets shall be constructed until the design has been submitted to the Development Officer and approved by the DES as part of the municipal approval process. The DES decision shall be final and binding in matters of design and construction. No alternatives to the construction of the design are permitted unless approved in writing by both the Design Engineer and the DES.

All permits and approvals from the Nova Scotia Departments of Environment and Transportation & Public Works and other applicable regulatory authorities shall be obtained by the Applicant or his/her agent. Copies of the approved permits and approvals shall be submitted for consideration by the DES prior to Tentative Approval as part of the municipal approval process. Further information on submission requirements is included in Section 3.0 of this document.

Upon Tentative Approval, a meeting between the Municipality of the County of Antigonish and the Applicant's contractor and Design Engineer (or other Professional Engineer who will be inspecting the construction) is required prior to commencing construction of all services being turned over to the Municipality. Construction documents must be submitted to the Development Officer in accordance with Section 3 and must include all pertinent requirements stipulated in the Municipality's approval documents or required by other agencies.

Prior to receiving Final Approval, a reproducible copy of the original recorded drawing (reviewed and revised as per the Municipality's comments) and three paper copies will have to be delivered to the Municipal Office.

The Municipality of the County of Antigonish will periodically revise the design criteria, guidelines and specifications contained in this document to conform with advances and improvements in engineering practices. The changes will be noted in a revision record and

will be available to users of this document. It is the responsibility of the Design Engineer to remain current with revisions to this document.

2.0 DEFINITIONS

“Approval” means an approval of the Director of Engineering Services (DES). The decision of the DES will be final and binding in all matters of design and construction. However, the DES does not certify any installations, procedures, equipment, or materials nor does he/she approve or evaluate testing laboratories. Approvals will be based on compliance with these Specifications and/or other appropriate standards as indicated throughout this document. Tentative Approval and Final Approval are as set out in the Municipality of the County of Antigonish Subdivision Bylaw;

“Act” means the Municipal Government Act, 1998, c. 18, s. 1 and amendments thereto;

“Agreement” means a contract between the subdivider and the Municipality which describes the responsibilities of each party with respect to the subdivision and servicing of land;

“Area of land” means any existing lot or parcel as described by its boundaries, except in Sections 19 and 21;

“Arterial road” means a road intended to move a relatively large volume of traffic at medium to high speeds used where traffic movement is the primary consideration and land access secondary;

“Base course” means the crushed rock or aggregate which is placed immediately upon the sub-base course;

“Clearwater lateral” means the pipe which conveys clear water from foundation drainage systems to a public storm sewer or Clearwater sewer on a public street;

“Collector road” means a road intended to collect traffic from local streets and move it to the arterial, used where traffic movement and land access are of equal importance;

“Council” means the Municipal Council of the Municipality of the County of Antigonish;

“Department of Environment” means the Nova Scotia Department of the Environment & Labour or its successors;

“Department of Transportation” means the Nova Scotia Department of Transportation and Public Works or its successors;

“Design Engineer or Designer or Engineer” means the Professional Engineer representing the Applicant, who has affixed his/her professional seal to the Engineering drawings, plans, and specifications for the proposed development and/or is the Professional Engineer who is

responsible for ensuring the services are constructed to meet and satisfy the approved design. This person must be registered and/or licensed to practice engineering, and must be in good standing in the Province of Nova Scotia;

“Developer or Applicant” means the owner of the area of land proposed and includes anyone acting on his/her behalf with his/her written consent;

“Development Officer” means that person appointed by Council pursuant to the Municipal Government Act who has the power and duty to administer this By-law;

“Diameter” means the nominal internal diameter of the pipe unless noted otherwise;

“Director of Engineering Services (DES)” means, in these Specifications, where there is a reference to the ‘Director of Engineering Services’ (DES), it shall mean either the DES appointed by the Municipality or, where no DES has been appointed, that Professional Engineer, licensed to practice in Nova Scotia, retained from time to time by the Municipality to perform the functions of a DES herein. The DES or designated engineer may, with the approval in writing of the Municipality, authorize a representative to act in his or her absence. The DES or designated engineer reports to the Clerk Treasurer for the Municipality;

“Director of Planning” means the professional planner appointed by or acting on behalf of the Municipality of the County of Antigonish, to perform planning functions, and includes a person acting under the supervision and direction of the planner as defined herein;

“Drainage plan” means a detailed Management plan, including, but not limited to drawings and calculations of storm water runoff and the courses and channels of it, including floodplains, for one or more parts of an area of drainage for all lands tributary to, or carrying drainage from, land that it proposed to be subdivided;

“Equivalent value” means cash or facilities, services, or other value in kind related to parks, playgrounds and similar public purposes or any combination thereof, determined by the Municipality to be equal to the value of the land required to be transferred to the Municipality for parkland purposes;

“Feeder main” means a water main which typically receives flow from transmission mains or from pressure control facilities (i.e. booster pumping stations or pressure reducing valves) and which supplies water to several branch mains (distribution mains). The feeder main provides a significant carrying capacity or flow capability to a large area;

“Floodplain” means the low lying area adjoining a watercourse that is subject to flooding, as defined in the *Municipal Government Act* and includes:

- (a) “Floodway” meaning the inner portion of a flood risk area where the risk of flooding is greatest, on average once in twenty years and where flood depths and velocities are greatest.

- (b) “Floodway Fringe” meaning the outer portion of a flood risk area, between the floodway and the outer boundary of the flood risk area, where the risk of flooding is lower, on average once in one hundred years, and floodwaters are shallower and slower flowing.

“Frontage” means the lot frontage measured as required by the Land Use By-law in effect for the area of land proposed to be subdivided;

“Highway” means the whole right-of-way which is reserved for use in constructing the roadway and its appurtenances, the boundaries being determined by the Municipality of the County of Antigonish;

“Inspection” means a field inspection by the Applicant’s or Owner’s Engineer at various stages of construction;

“Island” means an area of land completely surrounded by water at low tide;

“Local Road” means a road which has the main function of providing land access;

“Lot” means any parcel to be created by the filing of a plan of subdivision;

“Manual” means the Municipal Service Systems General Specifications Pursuant to the Subdivision By-law for the Municipality of the County of Antigonish.

“Municipality” means the Municipality of the County of Antigonish.

“Municipal services systems” include sanitary sewer collection and treatment systems and water distribution and treatment systems, storm sewers and subdivision roads which are, or are to be, owned, operated and maintained by the Municipality;

“Private road” means any road which is not public shown on a plan of subdivision which extends to and has access to a public street and where not totally located within the area of land being subdivided, the private road shall have an easement for right-of-way and access which is assignable and perpetual and which has been granted clearly by deed, will, Crown grant or other registerable instrument, registered in the Registry of Deeds for this Municipality;

“Professional Engineer” means a Professional Engineer who is a member in good standing of the Association of Professional Engineers of Nova Scotia;

“Province” means Her Majesty the Queen in right of the Province of Nova Scotia;

“Provincial Regulation” means the requirements and provisions of the Province of Nova Scotia contained in any Provincial Statute or in any Regulation or Order made pursuant to the authority of any Statute of Nova Scotia;

“Public sewer system” means any sewer system which is owned by the Municipality;

“Public street” includes any street or road owned and maintained by the Municipality or the province; and

- (a) “municipal public street” means any street or road owned and maintained by the Municipality; and
- (b) “provincial public street” means any street or road owned and maintained by the Department of Transportation excluding designated controlled access highways pursuant to Section 20 of the *Public Highways Act R.S., c. 371, s. 1*;

“Public water system” means any water system which is owned by the Municipality;

“Public Water Utility or Water Utility” means the water utility controlled by the Municipality of the County of Antigonish;

“Public Works” means the Public Works Department of the Municipality of the County of Antigonish;

“Registry of Deeds” means the office of the Registrar of Deeds for the County of Antigonish;

“Right-of-way easement” means an easement for right-of-way and access unrestricted in use extending to and having access to a public street, and where not totally located within the area of land proposed to be subdivided, the right-of-way easement shall be assignable and perpetual and clearly granted by deed or easement registered in the Registry of Deeds for this Municipality, or declared to exist for the benefit of the land proposed to be subdivided by order of a court of competent jurisdiction, and in either case the easement shall:

- (a) if created or declared to have been created prior to August 6, 1984, have a minimum width of 3 meters (9.8 feet), or
- (b) if created or declared to have been created on or after August 6, 1984, have a minimum width of 6.1 meters (20 feet);

“Roadbed” means the portion of the roadway extending from shoulder line to shoulder line, in other words, the sub grade and shoulders considered as a unit;

“Roadway” means the portion of highway included between the outside lines of gutters or side ditches including all the appertaining structures, and all slopes, ditches channels, waterways etc. necessary for proper drainage and protection;

“Sanitary sewer” means a sewer system receiving and carrying liquid and water-carried wastes and to which storm, surface or ground waters are not intentionally admitted;

“Sanitary sewage” means the spent water from a community consisting of liquid conveying solids from residential, industrial, institutional and commercial buildings but excluding storm

water or surface run-off and groundwater. It does not include contaminated liquid wastes or sewage at concentrations greater than those commonly found in domestic sewage;

“Sanitary sewage collection system” means the system consisting of all pipes, mains, equipment, buildings and structures for collecting and pumping of sanitary sewage (including trunk sewers and pumping stations) operated by the Municipality of the County of Antigonish. It is designed to collect and convey sanitary sewage from its point of origin to a disposal or treatment location;

“Service easement” means an allotment of land required to maintain and repair municipal services. In the event that sanitary and/or water services are installed outside of public rights-of-way (ROW), the Applicant shall provide a service easement in favor of the Municipality. The service easement shall be constructed to provide access by maintenance vehicles including service trucks and heavy equipment;

“Set back line” means a line drawn parallel to the boundary of a highway, road or street which is offset the setback distances required by the Municipality;

“Sewer lateral or service lateral” as used throughout this document is synonymous with Building Service Connection as defined by the Municipality. Sanitary sewer lateral means the pipe which conveys sanitary sewage from the property line to the main sewer;

“Sewer” means pipe or conduit for carrying sanitary sewage, groundwater, storm water or surface run-off and includes all sewer drains, storm sewer, clear water sewers, storm drains and combined sewers;

“Storm water” means water from precipitation of all kinds, and includes water from the melting of snow and ice, groundwater discharge and surface water;

“Storm water system” means a method or means of carrying storm water, including ditches, swales, sewers, drains, canals, ravines, gullies, pumping stations, retention ponds, streams, watercourses, floodplains, ponds, springs, creeks, streets or private roads, roadways or driveways;

“Storm sewer or storm sewer system” means the system consisting of all pipes, mains, ditches, equipment and structures for collecting and pumping storm water and surface runoff water, excluding sewage, operated by the Municipality. It is designed to collect and convey storm runoff from its point of origin to its point of discharge into a natural drainage system. The system includes the collection of Clearwater from foundation drainage systems;

“Street” means the entire width between the boundary lines of a street, road or highway and includes a public thoroughfare in an urban setting with buildings or residential dwellings more or less continuously housed on each side of it along its limits;

“Street line” means the limit of the public road right-of-way (ROW);

“Sub-Base course” means the crushed rock aggregate which is placed immediately upon the sub grade;

“Sub divider” means the owner of the area of land proposed to be subdivided or consolidated and includes anyone acting with the owner’s written consent;

“Subdivision” means the division of any area of land into two or more parcels and includes a re-subdivision and a consolidation of two or more parcels;

“Subdivision road” the whole right-of-way which is reserved for use in constructing the roadway including all appertaining structures, roadbed, gravels, asphalt, slopes, ditches and channels required for proper drainage and protection;

“Sub grade” means the portion of the roadbed upon which the sub-base course is to be placed;

“Surveyor” means a registered member in good standing of the Association of Nova Scotia Land Surveyors;

“Wastewater” means any liquid waste containing animal, vegetable, mineral or chemical matter in solution or suspension carried from industrial sectors;

“Watercourse” means a lake, river, stream, ocean or other body of water as defined in the *Municipal Government Act*;

“Water system or distribution system” means the system consisting of water mains, water service laterals from the water mains to property lines and appurtenances carrying and distributing potable water for domestic and/or fire protection purposes and includes any pumping stations, pressure control facilities and reservoirs, vested in or under the control of, the Municipality;

“Water service lateral” means pipe that conveys water from a water main to the street line or the limit of a service easement;

“Wearing surface” means the exposed material placed directly upon the base course which comprises the traveling surfaces.

3.0 SUBMISSION REQUIREMENTS

This section is intended to assist the Engineer, acting on behalf of the applicant for subdivision approval, prepare a submission for the approval of municipal services. This section must be read in conjunction with the Subdivision Bylaw for the Municipality of the County of Antigonish.

3.1 TENTATIVE APPROVAL

A copy of the permit to construct from Nova Scotia Department of Environment and Labour for services under their jurisdiction will be required prior to Tentative Approval. An application for tentative approval of municipal services in addition to the minimum requirements of the Subdivision By-law, must also conform to the following:

3.1.1 SANITARY SEWER SYSTEMS

.1 General

Plan indicating tributary service areas, existing sanitary sewer system, and proposed sanitary sewer system. The proposed sewer system shall include: manhole locations, size of mains, flow direction, and connection point(s) to the existing system.

Technical Specifications are required and contract documents if applicable.

.2 Gravity Systems

- Plan and profile drawings. Scale to be at least 1:500 Horizontal (1"=50'), 1:50 Vertical (1"=5').
- Cross sections and detail drawings.
- Design summary in tabular form with the following design information:
 - population density
 - peak flow
 - design flow
 - pipe size
 - slope
 - minimum and maximum flow velocity
 - depth of flow

.3 Pump Station and Force main

Detail drawing for each lift station giving pump data, invert elevations for gravity inlet, overflow, and force main, float elevations, base elevation, top elevation, wet

well size, bypass piping arrangement, and other relevant details, system and pump curves.

Design information in tabular form with the following design information:

- minimum, average, and peak flow rates
- Pipe size and velocity in force main
- Pump cycle time.

3.1.2 WATER SYSTEMS

Plan indicating existing and proposed water system, including pipe diameter and material, valve location, and hydrant location.

Technical Specifications are required and contract documents if applicable.

Plan and Profile drawings. Scale to be at least 1:500 Horizontal (1"=50'), 1:50 Vertical (1"=5').

Design information in tabular form with the following design information:

- population density
- domestic demand
- fire flow requirements
- maximum and minimum static pressures under normal operating conditions
- residual pressures under fire flow conditions.
- easements or right of way necessary to carry out the proposed work

3.1.3 STORM DRAINAGE SYSTEMS

Plan indicating the contributing area, the area tributary to each inlet, and the existing and proposed storm drainage system. A report showing the calculation of flows and required storage for retention and detention ponds.

Technical Specifications are required and contract documents if applicable. Plan and profile drawings 1:500 Horizontal (1"=50'), 1:50 Vertical (1"=5').

Cross sections and detail drawings.

Subdivision lot grading plans and plans indicating minimum basement elevations for lots which may be prone to flooding and/or water damage.

Design information in tabular form with the following design information:

- runoff rates at each inlet from minor and major rainfall events

- design flow from minor and major rainfall events
- pipe, culvert or channel size
- minimum and maximum flow velocity from minor and major rainfall events
- depth of flow in channels from minor and major rainfall events
- easement or rights of way necessary to carry out the proposed work

Assessments of impact on services from upstream development and downstream storm water capacity.

Erosion and Sedimentation control measures if applicable.

3.1.4 MUNICIPAL STREETS

Plan and profile drawings indicating the following:

- Existing and proposed profiles of road centre line.
- Proposed grades (%)
- Horizontal and vertical curve data sufficient to ensure compliance with these specifications.
- Detail showing proposed road cross section elements including right of way width to accommodate cut and fill operations.
- Spot elevations of any watercourse, prominent rock formation, areas subject to flooding and other natural features within or immediately adjacent to the proposed street Right of Way.
- Sizes of roadway and driveway culverts

3.2 FINAL ACCEPTANCE

This section specifies the submission to be made for review at the Final Approval Stage. All services are to be approved by the DES. The Development Officer will not approve a Final Plan of Subdivision with proposed sanitary sewer, water and storm drainage systems and municipal street(s) until the services have been approved by the DES.

3.2.1 GENERAL

Digital “as-built” drawings in AutoCAD[®] compatible format and reproducible “as-built” drawings stamped by a Professional Engineer with three paper copies.

Summary of service installation costs for each of the services.

Easement documentation including property description and plan.

Warranty deeds and registration costs for all property to be transferred to the Municipality, including property descriptions and plans.

Statutory Declaration indicating that all labour and materials used in the construction of the subdivision have been paid in full.

Operation and Maintenance Manuals.

Maintenance deposit in the amount of 10% of the cost of water and sewer services and roads, to be held for a period of 12 months from the date of final approval.

3.2.2 SANITARY SEWER SYSTEMS

Video inspection and report in a format approved, in advance, by the DES.

Engineer approved Shop Drawings

Pipe test report

Pump Station startup report. Startup to be carried out in the presence of DES or his designate.

Professional Engineer's Certification of Inspection.

3.2.3 WATER SYSTEMS

Records of water distribution system hydrostatic leakage tests and certification of compliance as per NSDOE&L permit to construct.

Engineer Approved Shop Drawings

Professional Engineer's Certification of Inspection.

Acceptable Bacteriological test results.

3.2.4 STORM DRAINAGE SYSTEMS

Engineer approved Shop Drawings

3.2.5 MUNICIPAL STREETS

3.2.5.1 Requirements

Before the constructed roads are approved and accepted for listing, the Municipality must receive confirmation from the Nova Scotia Department of Transportation & Public Works that all their requirements have been met. In addition a certification shall be required from a Professional Engineer confirming the roads and drainage systems within the subdivision have been constructed in accordance with the approved specifications and plans and these Specifications. Submissions must include:

- Particle Size Analyses, Fractured Faces, Absorption, LA Abrasion, Plasticity Index and Micro-Deval for base and sub-base gravels
- Compaction tests results on sub-grade, sub-base, and base courses at a minimum of every 50 meters for each lift of material placed.
- Test results for asphaltic concrete paving, mix design, compaction results.
- Test results for curb and gutter construction including tests on Sub grade, sub-base, base course materials and concrete tests.
- As-built drawings of the road construction.

3.2.5.2 Listing Procedure

When the preceding specifications have been satisfactorily adhered to, as determined by the DES, the DES then will recommend to the Development Officer that the proposed municipal street(s) be approved. The Development Officer will not approve a Final Plan of Subdivision with proposed municipal street(s) until the street(s) have been approved by the DES. It is the approval of the Final Plan of Subdivision that officially lists the street(s) in the subdivision. The request should be accompanied by six (6) copies of a final plan showing the entire subdivision, its boundaries, and road and drainage layout. The developer will also have a deed prepared deeding all rights-of-way to the Municipality.

4.0 SANITARY SEWAGE SYSTEM

4.1 SCOPE

The sanitary sewage collection system must meet the requirements of the Municipality before the system will be considered for takeover. The following are minimum requirements to consider in the system design and are intended to provide a directive to the Design Engineer responsible for the design and construction of Municipal Services Systems in the Municipality of the County of Antigonish.

This section specifies the requirements for a central sanitary sewer collection system. A sanitary sewer consists of main lines, laterals, pressure sewers and appurtenances (including manholes and lift stations) owned and maintained by the Municipality. Sanitary sewage is defined as the wastewater from residential, industrial, institutional and commercial buildings within a community but excluding storm water runoff or ground water.

In addition to these design criteria, all sanitary sewage systems shall conform to the Nova Scotia Department of the Environment Standard and Guidelines for the Collection, Treatment and Disposal of Sanitary Sewage. No systems shall be constructed until the design has been approved by the DES and by the Nova Scotia Department of the Environment and Labour.

4.2 DESIGN REQUIREMENTS

4.2.1 GRAVITY SYSTEMS

4.2.1.1 General

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. Any 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 in the calculated flows for the system being designed.

With respect to depth of cover and grade of sewer mains, the design of the system shall take into consideration possible future extensions so that, wherever practical, those mains shall be installed at sufficient depth to service adjoining lands.

The sanitary sewage system shall be designed utilizing the standard criteria outlined below unless actual flow measurement has been conducted:

- (i) Design shall be based on an appropriate population density according to land use.

-
- (ii) Average Dry Weather Flow (QA) shall be calculated on the basis of an allowance of 340 liters per person per day (75 Imperial Gallons per person per day).
 - (iii) Design Peak Flow shall be calculated on the basis of an allowance of 1490 liters per person per day (328 Imperial gallons per person per day) plus an infiltration allowance of 56 liters per day per millimeter diameter per kilometer of pipe (500 Imperial gallons per day per inch diameter per mile of pipe).

4.2.1.2 Pipe

Polyvinyl Chloride (PVC), SDR 35 shall be used for sanitary sewer main installations in the Municipality, unless other wise approved by the DES.

4.2.1.3 Hydraulic Design

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 is to be calculated using the "Manning Formula" or an appropriate nomograph. A Manning Roughness coefficient (n) equal to 0.010 shall be used for PVC pipe.

Under Design Peak Flow conditions from the tributary area when fully developed, sanitary sewage flow velocities shall be a minimum of 0.6 meters per second (2 feet per second) and a maximum of 4.6 meters per second (15 feet per second).

4.2.1.4 Minimum Pipe Size

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

4.2.1.5 Minimum Slope

Sanitary sewer mains shall have a minimum slope of 1 percent. Under special conditions slopes less than 1 percent may be permitted. Slopes less than 1 percent will be considered only 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 0.5 percent. Sewer laterals shall have minimum slopes of 2 percent.

4.2.1.6 High Velocity Protection

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

4.2.1.7 Depth

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

The depth of sanitary sewer mains shall not normally exceed a maximum of 4.5 meters (14 feet). 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 5.5 meters (18 feet) with DES approval. To minimize future maintenance costs, all services 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.

The minimum depth of sanitary sewer mains shall not be less than 1.5 meters (5 feet) without DES approval. The depth of the sanitary sewer laterals shall not be less than 1 meter (3 feet). In general, sewer mains shall be sufficiently deep so as to receive sewage from basements and to prevent freezing.

4.2.1.8 Location

Where possible all sanitary sewer pipe and appurtenances shall be located within a street right-of-way owned by the Municipality or the Nova Scotia Department of Transportation and Public Works. If approved by the DES, sanitary sewer mains may be installed within an easement granted in favor of the Municipality. 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 6 meters (20 feet).

All sanitary sewer pipes shall be located as close as possible to the center line of the street or easement. Depending upon the length and location of the easement, the DES may require a travel way to be provided within the easement for access and maintenance purposes.

Where a need is identified by the DES to accommodate future upstream lands naturally tributary 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.

4.2.1.9 Alignment

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

4.2.1.10 Manholes

A manhole is to be provided on a sanitary sewer at any change in pipe size, slope or horizontal alignment and/or at all pipe intersections. The interval between manholes is not to exceed 120 meters (400 feet). 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 for pipes of similar diameters shall be:
 - (i) Straight run - 30 mm (0.10 feet)
 - (ii) Deflections up to 45 degrees - 30 mm (0.10 feet)
 - (iii) Deflections 45 to 90 degrees - 60 mm (0.20 feet)
- (b) The crown of a downstream pipe shall not be higher than the crown of an upstream pipe.
- (c) A drop manhole shall be constructed when the vertical drop between pipe inverts in the manhole exceeds 900 mm (3 feet).
- (d) Drop Manholes shall be with an:
 - (i) exterior drop when the manhole is 1050 mm (42 inches) diameter or;
 - (ii) interior drop for manholes larger than 1050 mm (42 inches) and as per L. E. Shaw Limited design or approved equal.

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

All sanitary sewer manholes are to be positioned so as to minimize the infiltration of surface water or ground water. Manholes shall not be located at or near the following locations:

- (a) Drainage ditch or swale invert
- (b) Roadway gutters or low points

In some situations where manholes cannot be easily relocated from the areas noted above, the use of berms and/or water-tight frames and covers may be permitted by the DES.

4.2.1.11 Service Laterals

Minimum size lateral piping shall be 100 mm (4 inches) in diameter. For laterals greater than 100 mm (4 inches), connection to the sewer main shall be made by installing a manhole on the sanitary sewer main. All laterals shall be constructed with white PVC SDR 28 pipe conforming to CSA standards.

All service laterals shall be installed according to the following provisions:

- (a) In any new subdivision a single sanitary sewer lateral shall be provided by the developer to each existing or potential lot at the time of installation of services. The lateral shall extend from the main to the property line.

- (b) Lateral connections to the main shall be made using properly engineered saddle or tee.
- (c) The lateral shall be laid at a minimum slope of 2 percent.
- (d) Service laterals with total length greater than 30 meters (100 feet) shall be installed complete with a wye type clean-out in locations approved by the DES.
- (e) The depth-of sanitary sewer laterals shall not be less than 1 meter (3 feet) within the street right-of-way.
- (f) Lot owners must obtain a sewer connection permit from the Municipality before connecting into the system.
- (g) All sewer laterals shall be capped at the lot line and a 50x100 mm (2x4) wooden marker indicating depth of bury and marked "SEWER".

4.2.1.12 Joints

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

4.2.1.13 Groundwater Movement

The designer 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 at services lateral trenches may be required for low lying lots.

Trench relief drains shall be incorporated in the design at valleys.

4.2.2 PUMPED SYSTEMS

4.2.2.1 General

Pumping stations shall be provided when, in the opinion of the Engineer and DES, a gravity system is neither possible nor economically feasible.

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 should remain fully operational and accessible during the 1 in 25 year flood.

During preliminary location planning, consideration should be given to the potential of emergency overflow provisions and as much as practically possible the avoidance of health hazards, nuisances and adverse environmental effects.

Unless otherwise approved by the DES, all pumping stations, pumps, and force mains shall be designed for the ultimate sanitary sewer flows from the tributary drainage area as described in Section 4.2.1. In the selection of pumps, both present and future conditions shall be considered, and pump overloading situations avoided.

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.

4.2.2.2 Pumping Stations

.1 Wet Well Size

Wet wells are to be designed in accordance with the pump manufacturer's recommendations. For any pumping station, the wet well shall be of sufficient size to allow for a minimum of a fifteen minute cycle time for each pump. For a duplex station the volume in cubic feet between pump start and pump stop shall be 0.50 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.

.2 Pump Manufactures

The following pump manufactures are approved for use in sewage pumping stations in the Municipality. Other pump manufacturers may be considered, by the DES, as an approved equal.

- (a) Submersible pumps shall be manufactured by "ITT Flygt".
- (b) Self priming pumps shall be manufactured by "Gorman Rupp".

Submersible Pumps shall be designed to minimize the deposition of solids in the wet well using flush valves manufactured by ITT Flygt or approved equal (one hydraulically operated flush valve per pumping station).

Pumps shall be designed specifically for pumping raw, unscreened, domestic sanitary sewage (non-clog, solids handling type). All pumps shall be solids handling type complete with electric motors.

.3 Emergency Overflows

Each pumping station shall be provided with an emergency overflow arrangement acceptable to both the DES and NSDOE&L. 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 a surcharge in the drainage system to which it is connected from flooding the wet well of the pumping station.

In addition, all lift stations shall be provided with an emergency bypass valve chamber.

To prevent or minimize overflows, each pumping station shall be designed with a retention capacity calculated on the basis of Peak Design Flow for a duration related to frequency and length of power outages for the area.

In the absence of reliable data regarding the frequency and length of power outages, minimum retention capacity of 2 hours at Average Daily Flow shall be provided. An auxiliary power supply which meets the requirements of the DES may be used as a substitute for retention capacity at the pumping station.

.4 Safety Precautions

The pumping station and appurtenances shall be designed in such a manner to ensure the safety of operations, 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.

Equipment that starts automatically shall be suitably designed to ensure that the operators 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.

.5 Phase Development

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 problem and that pumping equipment will not operate too infrequently based on the manufacture's recommendations.

.6 Pump Selection

Pumping equipment is to be selected to perform at maximum efficiencies under normal operating conditions.

Pumping stations, wet wells and dry wells are to be designed such that all pumps will operate under a continuous positive prime condition during the entire pump cycle. System head calculations and curves shall be provided for the extreme operating conditions of high and low water levels in the wet well, as well as the normal operating range in the wet well (medium water level). The curve representing the normal operating conditions shall be used to select the pump and motor, however, the pump and motor shall be proven to be capable of operating satisfactorily over the full range of operating conditions.

.7 Surcharge

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

.8 Flow Velocities

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

- (a) Minimum cleansing velocity of 0.8 meters per second (2.6 feet per second).
- (b) Maximum velocity of 1.5 meters per second (5 feet per second) for suction lines and 2.4 meters per second (8 feet per second) for discharge lines.

Regardless of the above conditions, piping less than 100 mm (4 inches) in diameter is not acceptable, unless otherwise approved by the DES.

.9 Piping

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

Threaded flanges 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.

.10 Inlet Arrangements

Only one inlet shall be permitted. If more than one inlet pipe flows into the wet well, a manhole shall be provided outside of the lift station to collect the flow from contributing mains.

.11 Hydraulic Analyses

A hydraulic transit 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.

.12 Valves

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

.13 Ventilation

Continuous gravity ventilation may be acceptable for submersible pumping stations provided that maintenance crews carry suitable portable ventilation equipment when visiting the site. Ventilation system for self-priming pumping stations must meet approval by the DES.

.14 Access and Removal

Adequate access hatchways and doorways shall be provided. All pumping stations shall be provided with an acceptable device for the removal of pumps and motors for repair and maintenance. Submersible pumps shall be readily removable and replaceable without dewatering the wet well or disconnecting any piping in the wet well.

Lift hatches must be able to be “locked-in” in the upright position.

A non-corroding working platform shall be constructed in the wet well of each submersible station to provide access to check valves and gate valves. The platform shall be set on a concrete lintel cast integrally with the station walls. Alternatively, a separate valve chamber shall be provided.

All locks shall be keyed alike to the Municipality standard system.

.15 Pumping Arrangements

All pumping stations shall have a minimum of two pumping assemblies. If only two pumps are provided, they each shall have the same capacity, with each pump 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 any one unit out of service, the remaining two 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 two pumps operating simultaneously.

.16 Electrical

Electric motors less than .013 watts (10 horsepower) shall be 208 volt, 3 phase; electric motors .013 watts (10 horsepower) and larger shall be 600 volt, 3 phase.

Single phase pumps will be permitted only if in the opinion of the DES three phase power is not feasible.

All pumping station control equipment is to be mounted in a CSA Type 3 enclosure. The Municipality is currently examining the possibility of introducing Supervisory Control and Data Acquisition (SCADA) system for its pumping stations.

Until such time as the Municipality has introduced SCADA in its system, the Design Engineer should verify control options with the DES.

Electrical service from the transmission main to the control panel and between the control panel and the pumping station shall be by way of 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 must be adequately sealed to protect against corrosion from harmful gases.

.17 Site Considerations

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. The ownership of this property shall be deeded to the Municipality. 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 100 mm (4 inches) and no more than 150 mm (6 inches) above the finished grade of the pumping station lot. All exposed areas shall be sodded.

.18 Operations and Maintenance Manual

Three copies of the pumping station operations and maintenance manual must be prepared in a form acceptable to the DES, and provided to the DES prior to acceptance of the pumping station. This manual must contain at least the following:

- (a) System description
- (b) Design parameters, system hydraulics and design calculations (including curves)
- (c) As constructed civil, mechanical and electrical drawings
- (d) Pump literature, pump curves and operating instructions
- (e) Manufacturer's operation and maintenance instructions of all equipment
- (f) Name, address, and telephone number of all equipment suppliers and installers
- (g) Information on guarantees/warranties for all equipment. All special tools and standard spare parts for all pumping station equipment are to be provided by the contractor prior to acceptance of the system by the DES.

4.2.2.3 Forcemain

.1 Pipe

PVC SDR 26 and Ductile Iron Class 52 pipe are approved for use for all sanitary sewer force mains in the Municipality.

The hydraulic losses in the force main shall be calculated using the Hazen-Williams Formula or an appropriate nomograph assuming a roughness coefficient of $C = 120$ for any type pipe material.

.2 Limiting Velocities

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

.3 Minimum/Maximum Depths

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

.4 Slope

Force main slope does not significantly affect the hydraulic design or capacity of the pipeline itself. Under no circumstance, however, shall any forcemain be installed at zero slope. Zero slope installation makes line filling and pressure testing difficult, and promotes accumulation of air and wastewater gases.

.5 Location

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

.6 Termination

Force mains should enter the gravity sewer system at a point not more than 0.6 meters (2 feet) above the flow line of the receiving manhole. A 45 Degree bend may be considered to direct the flow downward.

.7 Valves

To prevent air locks in the pipe, automatic air relief and vacuum valves shall be located in a manhole at all high points of the forcemain system or in such other locations as directed by

the DES. Blow offs should be provided at all low points in the forcemain system as directed by the DES.

.8 Changes in Direction

Any change in direction which is in excess of the pipe joint deflection, tolerance shall require a suitable fitting as approved by the DES. 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 20MPa (3000 psi). 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 DES.

5.0 WATER DISTRIBUTION SYSTEM

5.1 SCOPE

This section specifies the requirements for a central 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 carry and distribute an adequate supply of potable water for domestic, institutional, commercial, industrial and fire protection purposes.

Reference standards and organizations supported by these specifications include:

- "Water Supply for Public Fire Protection" prepared by the Fire Underwriters Survey- Insures Advisory Organization (IAO)
- National Fire Protection Association (NFPA)
- American Waterworks Association(AWWA)
- Canadian Standards Association (CSA)
- National Building Code (NBC)
- National Plumbing Code (CPC)
- Underwriters Laboratories of Canada (ULC)

In addition, all water distribution systems shall conform to any requirements established by the Nova Scotia Department of the Environment and Labour. No system shall be constructed until the design has been approved by the DES and by the Nova Scotia Department of the Environment and Labour.

Water quality is monitored and maintained by the Municipality, and the system must be designed such that the quality is maintained and distributed to the customers at an adequate pressure to supply their needs.

5.2 DESIGN REQUIREMENTS

.1 System Requirements

Water distribution systems shall be designed to accommodate fire flow plus maximum daily demand unless otherwise approved by the DES. Hydraulic analysis of any system shall be carried out by the Design Engineer using the Hydraulic Grade Line for that particular Serviceable Area.

Fire flow demand shall be established in accordance with the latest requirements contained in "Water Supply for Public Fire Protection, a Guide to Recommended Practice", as prepared by the Fire Underwriter's Survey Insures Advisory Organization.

Water distribution systems shall be designed to accommodate the following water demands:

- (a) Average daily demand: 410 liters per capita per day (90 Imperial Gallons per capita per day).
- (b) Maximum daily demand: 615 liters per capita per day (135 Imperial Gallons per capita per day).
- (c) Maximum hourly demand: 1025 liters per capita. per day (225 Imperial Gallons per capita per day).

Water distribution systems shall be designed for a gross population density of 45 persons per hectare (18 persons per acre). In developments where the anticipated population exceeds or is anticipated to exceed the population density of 45 persons per hectare (18 persons per acre) or in areas of commercial or industrial development, the domestic demand shall be adjusted accordingly. The design population or assumed domestic demand must be clearly specified in the calculations submitted for review and approval.

.2 Minimum / Maximum Pressure

Water distribution systems shall be designed and sized such that during a fire flow condition a residual positive pressure of 150 kPa (20 psi) is maintained at all points in the water system.

For any water system extension, it is desirable to maintain minimum residual water pressure of 275 kPa (40 psi) at all points along the distribution mains in the water system during maximum hourly demand conditions. Maximum water pressure during minimum demand periods shall not exceed 620 kPa (90 psi) unless approved otherwise by the DES.

Calculations to determine residual water pressure shall be based on the Hydraulic Grade Line of the water distribution system.

.3 Pipe

PVC DR18 and Ductile Iron Class 52 pipe are approved for use for all water mains in the Municipality.

The Hazen-Williams Formula *or* an appropriate nomograph using a pipe friction factor of $C = 120$ for PVC and $C = 100$ for ductile iron shall be used in the design calculations of the water distribution system.

.4 Limiting Velocities

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

.5 Looping

Water distribution systems shall be designed to providing looping of water mains as frequently as road or easement layout permits.

.6 Minimum Sizes

The water distribution system shall be sized as outlined in the above clauses. However, in no instance shall the main be:

- (a) Smaller than 150 mm (6 inches) in diameter for looped lines.
- (b) Smaller than 200 mm (8 inches) in diameter for dead-end lines in excess of 90 meters (300 feet) in length.

.7 Over sizing

Over sizing of water mains to accommodate the water supply requirements of future off-site development may be required as instructed by the DES.

.8 Minimum/ Maximum Cover

All water mains shall be designed with a minimum cover of 1.5 meters (5 feet) in common material or at suitable depth to prevent freezing of either the water main or the services. In no situation is the depth of cover over the water main to exceed 2.4 meters (8 feet) unless approved by the DES.

The depth of cover shall be measured from the design grade at finished surface to the crown of the pipe line.

.9 Location

All water pipe shall normally be laid as follows:

- (a) in a separate trench;
- (b) in the same trench located at one side with a minimum horizontal separation 300 mm (12 inches) from the gravity sewer main and on a bench of undisturbed earth;

- (c) in either case the elevation of the top (crown) of the gravity sewer main is at least 300 mm (12 inches) below the bottom (invert) of the water main. Where a water main must be installed paralleling a gravity sewer main and at a lower elevation than the gravity main the water main must be installed in a separate trench. The soil between the trenches must be undisturbed.

All water pipe and appurtenances shall be located within a street right of way owned by either the Municipality or the Nova Scotia Department of Transportation and Public Works or within an easement, of minimum 6 meter (20 foot) width granted in favor of the Municipality. Depending on the length and location of the easement, the DES may require a travel way to be provided within the easement for access and maintenance purpose. Water mains shall be installed as close as possible to the centerline of the easement.

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

.10 Valves

All connections to an existing water system shall be valved so that the system can be isolated by the valve at the start of the extension. The connection to the existing water system must be coordinated through the Municipality.

All water system valves shall be mechanical joint, double disc, or resilient seal gate valves and shall conform to AWWA standards. All valves must be accessible through valve boxes or chambers.

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

- (a) Where required to adequately isolate sections of the water system as determined by the DES.
- (b) Four valves per cross section, one on each leg of cross.
- (c) Three valves per tee section, one on each leg.
- (d) One valve per 400 meters (1320 feet) of water main where there are no intersections.

.11 Trench Drainage Relief Systems

The designer 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. Water mains installed in a single trench or in areas where sanitary sewer and/or storm sewer mains are not installed shall

require a "Trench Drainage Relief System" to lower the hydraulic grade line of the groundwater in the trench below the invert of the water main.

.12 Changes in Direction

Any change in direction which is in excess of the pipe joint deflection tolerance shall require a suitable fitting as approved by the DES. 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 20 Mpa (3000 psi).

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 is not permitted unless used in conjunction with a thrust block and of a design acceptable to the DES.

Gradient restraint anchor blocks for pipes installed at grades steeper than 16% shall be provided.

Approved thrust restraint shall be provided for valves on PVC pipe over 150mm (6 inches) diameter.

Thrust blocks shall be provided for service lateral connections over 100 mm (4 inches) diameter.

.13 Fire Hydrants

Fire hydrants shall be provided at spacing in accordance with the requirements as contained in the latest revision of the publication "Water Supply for Public Protection". In no case shall the maximum spacing exceed 150 meters (500 feet). The following are desirable hydrant locations:

- (a) At high points of the water main profile unless an automatic air release valve is required at that location.
- (b) At low points of the water main profile.
- (c) At intersections of roads.
- (d) Near middle of long blocks.
- (e) At the end of dead-end streets or cul-de-sacs greater than 90 meters (300 feet) in length.
- (f) at the approximate centre of a lot.

All fire hydrants shall be McAvity M67 or approved equal and shall be equipped with two standard 2 1/2 inch (63.5 mm) hose nozzles and one FD pumper nozzle with an outside diameter of 4-15/16 inches (125.41 mm).

Fire hydrant laterals shall have a minimum diameter of 150 mm (6 inches), shall be provided with a gate valve and the hydrant is to be plugged.

.14 Air Relief and Vacuum Valves

Air relief valves and vacuum valves shall be installed in a manhole at all significant high points in the distribution system and at such other locations as required by good engineering design practice and as approved by the DES .

.15 Service Lateral

All services shall be installed with a minimum cover of 1.5 meters (5 feet) in common material or a suitable depth to prevent freezing of the service. Where that depth is not achievable a method of insulating, approved by the DES, may be used to achieve the equivalent depth of burial. In no case will the depth of burial be less than 1 meter (3 feet).

All water distribution system laterals from the main line to the property line shall be provided by the developer or the property owner. A single service lateral is to be supplied to each existing lot or potential future lot which could be created under the zoning in effect at the time of installation of services. Whenever possible, services laterals shall not be installed in private driveways or other traveled areas.

In order to avoid high friction losses in service piping, the maximum length of any 20 mm (3/4 inch) diameter service lateral shall be limited to 55 meters (200 feet) from the curb stop to the house. Services longer than 55 meters (200 feet) shall require at least 25 mm (1 inch) diameter piping.

For services which are longer than 20 meters (66 feet), the number of compression couplings used is to be kept to a minimum. Compression couplings shall not be used within 1.5 meters (5 feet) of the foundation of any serviced building.

All water service connections between the corporation stop and curb stop shall be a minimum of 19 mm (3/4 inch) in diameter, type "k" copper.

Services for future development are to be brought to the property line, capped, and marked with a 50mm x 100mm (2"x4") member marked "WATER".

.16 Backflow Prevention Devices

Backflow prevention devices are required on new services if there is a risk of contamination of the potable water supply. Backflow devices shall be installed in accordance with the

applicable standard specifications on the following types of services:

- Industrial and commercial buildings.
- Apartment buildings larger than four units.
- Sprinkler services lines.

6.0 STORM WATER MANAGEMENT

6.1 SCOPE

This section specifies the requirements for a storm drainage system. A storm drainage system is a system which receives, carries, and regulates flows in response to rain and snow which include overland flow, sub-surface flow, groundwater flow, and snow melt.

The following design objectives are to be followed for the design of storm drainage systems in the Municipality of the County of Antigonish:

- Prevent loss of life and protect structures and property from damage due a major storm event.
- Provide for safe and convenient use of streets, lots, and other improvements during and following storm events.
- Preserve natural watercourses and minimize the long term effect of development on receiving watercourses and groundwater.
- Convey stormwater from upstream and on-site sources and mitigate the adverse effects of such flow on downstream properties.

In addition to the following specifications, all storm drainage systems shall meet the requirements of the Nova Scotia Department of the Environment and Labour. No system shall be constructed until the design has been approved by both the DES and the Nova Scotia Department of the Environment and Labour.

6.2 DESIGN APPROACH

6.2.1 Storm Drainage Systems

A Minor Drainage System consists of ditches, swales, driveway culverts, subsurface interceptor drains, curb & gutter, catch basins, pipes, manholes and laterals.

A Major Drainage System consists of ditches, roadways, roadway culverts, open channels, retention ponds, floodplains, and natural water courses.

6.2.2 Downstream Drainage Systems

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 by the design engineer 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.

The effect on downstream development will be assessed by the Design Engineer based on this investigation. Mitigative measure may be required to alleviate any adverse downstream impacts.

6.2.3 Design Storm Frequencies

.1 Minor Systems

- (a) Driveway culverts and other minor drainage systems shall be designed based on a design storm frequency of 1 in 5 years, except high value commercial and business areas.
- (b) High value commercial and business areas shall be designed based on a design storm frequency of 1 in 10 years.

.2 Major Systems

- (a) Roadways, road cross culverts, and other major drainage systems shall have a 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.
- (b) For design purposes the capacity of a natural watercourse including a flood plain 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.

6.3 METEOROLOGICAL DATA

Meteorological data will vary depending on the design methodology used. All meteorological data must be supplied by Atmospheric Environment Service, Environment Canada, or other similar government agency approved by the DES.

6.4 DESIGN METHODOLOGY

The designer shall indicate the design methodology used. Techniques generally accepted are listed below:

6.4.1 Rational Method

The Rational Method can be used for the calculation of peak runoff rates for drainage basins up to and including 260 hectares (640 acres) in area. It may be used for preliminary design of systems serving larger areas.

This method shall not be used for the design of storage facilities.

Where run-off from an area that includes a significant proportion of undeveloped land is to be determined, winter run-off conditions must be determined, and the worst case used in design. For winter conditions, rainfall data from the AES official weather station nearest Antigonish County will be applied.

6.4.2 Other Methods

Other methods such as those described in the US Soil Conservation Service Technical Report 55, 1975 (SCS TR 55) may be used if approved by the DES.

6.4.3 Storage Facilities

Stormwater storage facilities shall be designed using the Storage-Indication method. The design storm and inflow hydrograph must be developed using accepted methods.

Where a structure is designed to accommodate a design storm frequency less than 1 in 100 years, an emergency spillway capable of discharging the 1 in 100 year overflow from the structure must be provided.

The overflow spillway shall discharge into a watercourse or major storm drainage system capable of receiving and carrying the 1 in 100 year discharge from the structure, in addition to its rate of discharge prior to the spillway.

Information must be supplied regarding maintenance and safety issues of a stormwater storage facility complete with long term maintenance and replacement costs. All storage facilities shall be designed and constructed in accordance with Section 6.5.6.

6.5 DESIGN REQUIREMENTS

6.5.1 Location

No storm drainage is to be carried on, through, or over private property within a subdivision. All storm drainage shall be carried by either an unconfined natural watercourse, excavated ditch, or piped storm drainage system.

All excavated ditches and storm sewers within a subdivision shall be located either within a right of way or on an easement in favor of the Municipality. The minimum width of an easement is 6 meters (20 ft).

Where subdivision storm drainage flows or is directed onto abutting land other than through a natural watercourse, a right of way or easement in favor of the Municipality must be provided.

Where a need is identified by the Design Engineer to accommodate future upstream development, and where no future road reserve is available, a drainage right of way or an easement in favor of the Municipality must be provided.

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

6.5.2 Discharge to Adjacent Properties

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

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 Nova Scotia Department of Transportation and Public Works or the Municipality.

Discharge of run-off to adjacent properties other than in a natural watercourse, where approved by the Nova Scotia Department of Environment and Labour, is prohibited unless the developer obtains consent in writing from the adjacent property owner(s), and drainage easements are provided in favor of the Municipality. The written consent must be filed with the Municipality and filed in the Registry of Deeds along with the appropriate easements.

6.5.3 Buried Storm Drainage Systems

Storm sewer pipes shall be designed to carry, without surcharging, the peak rate of storm flow.

.1 Velocities

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

The maximum design velocity for storm sewer shall be 4.6 meters/second (15 fps) for pipes up to and including 760 mm (30") in diameter. The maximum design velocity for storm sewer pipes greater than 760 mm (30") in diameter shall be 6.1 meters/second (20 fps).

.2 Pipe Size

The minimum diameter for a storm sewer main shall be 300 mm (12"). The minimum diameter for a catch basin lead shall be 250 mm (10").

Pipe sizes shall not decrease in the downstream direction unless approved by the DES.

.3 Depths

The minimum depth for a storm sewer main located within the road right of way is 1.5 meters (5 ft.). The minimum depth for storm or clear water laterals at the property line is 1 meter (3 ft.).

.4 Manholes

Manholes shall be installed at all changes in grade or alignment at all intersections and at intervals not exceeding 120 meters (400 feet).

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

.5 Service Laterals

All laterals from the main to the property line shall be provided by the developer or owner and shall have a minimum grade of 2 percent. The depth of laterals shall not be less than 1 meter (3 feet) within the right-of-way.

Laterals for future development shall be brought to the property line, capped, and a marker stake 50 x 100 mm (2"x4") placed. Depth to lateral should be indicated and should be marked "STORM".

.6 Catch Basins

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 system. In no case shall the spacing of the catch basins exceed 100 meters (330 feet).

Catch basin leads shall be connected to a storm drainage main at a manhole.

.7 Inlets

Vertical grates shall be installed at inlets.

.8 Outfalls

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

6.5.4 Ditches/Open Channel Drainage System

Roadway ditches shall conform to the standard cross section for local subdivision roads, and shall have adequate capacity for the 1 in 100 years storm.

.1 Velocities

The maximum velocity during a 1 in 100 years storm event in ditches or open channels shall not exceed the values which will cause erosion.

.2 Culverts

All culvert sizes shall be indicated on design drawings. The minimum size for any culvert shall be 450 mm (18").

The minimum depth of bury for any culvert is 500 mm (20"). Culverts shall be designed for the 1 in 100 year peak flow with a headwater depth not greater than the diameter of the pipe.

Roadway and driveway culverts generally do not require grating. Storm sewer outfalls and culverts greater than 26 meters (85 feet) in length require inlet and outlet grating.

All culverts shall be either corrugated steel pipe (CSP) to CAN3-G401-M galvanized, or reinforced concrete pipe to ASTM C76-M or CAN/CSA A257.2, as defined in the Standard Municipal Services Specifications unless alternate types are approved by the DES.

6.5.5 Minor Drainage System Connections

.1 Roof Drains

Roof drains shall discharge on the ground surface directing water away from the building and shall not be connected to a storm drainage system or foundation drainage system.

.2 Foundation Drains

Where a buried storm drainage system exists, foundation drains will normally be connected to the main by laterals. The invert of the lateral at the property line must be at least 610 mm (2 feet) above the top of the main at the point of connection.

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

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

Foundation drain pipes shall be clearly identified with color code.

6.5.6 Retention Structures

For safety purposes stormwater retention structures must be enclosed by a 2 meter (6 foot) chain link fencing system approved by the DES.

6.6 EROSION AND SEDIMENT CONTROL

An Erosion and Sediment control plan shall be provided in compliance with Provincial regulations and a copy submitted to the DES. The plan shall address measures during

construction of roads, services and houses, as well as long term measures after the completion of development.

During construction, surface water flows across the construction site must be minimized.

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

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

- protection of wetlands and waterways in accordance with Nova Scotia Department of Environment and Labour Guidelines
- minimization of erosion and sediment transport.
- protection of outfall areas
- utilization of wetland areas for filtration of stormwater run-off minimization of disruption to natural watercourse.

7.0 MUNICIPAL STREETS

7.1 SCOPE

This section specifies the requirements for design of all Municipal Public Streets within the Municipality of the County of Antigonish.

A Municipal Public Street consists of the road bed structure and all slopes, ditches, channels, waterways and appertaining structures necessary for proper drainage and protection.

7.2 GEOMETRIC DESIGN SPECIFICATIONS

Design: “The Function of locating roads and building lots relative to topographical features constitutes the practice of engineering as defined by the Engineering Profession Act of Nova Scotia. Therefore, the design of subdivisions and their services when submitted to the Municipality must be over the **Seal of a Professional Engineer.**”

7.2.1 General

.1 Design Standards

These specifications are to cover the more common aspects of design encountered in subdivision development. In cases where these specifications need to be expanded or additional specifications are required, the "Geometric Design Standards for Canadian Roads and Streets" as published by Transportation Association of Canada shall be used as a guide. In general, a design speed of 50 km/hr. will be used for all subdivision roads unless a higher design speed is required by the DES.

Street designs should recognize and/or incorporate natural features such as watercourses, wet areas, habitats, and rock outcrops.

Street names which will duplicate or be confused with the names of existing streets on roads in the same community of the proposed subdivision shall not be used.

Street signs shall be installed in the material, size, color and location stipulated by the Municipality.

.2 Construction Season

The normal completion date for streets and related works constructed within a subdivision is to be November 30 of each year in order to allow for inspection and approval by the DES. Street construction will not normally be approved from December 1 to May 1, or during such time as spring weight restrictions are administered on highways in the Municipality.

.3 Construction Requirements

The sub grade must be well drained and compaction tests shall be taken by a third party testing firm, approved by the DES. Any unsuitable material including soft or yielding material shall be removed, replaced with suitable material, and compacted.

In addition to the specific requirements identified in this section, all Municipal streets must be constructed in accordance with the following:

- (a) Roots, stumps, limbs, moss, sod and other organic or deleterious material shall not be placed in roadway fills or allowed to remain under roadway fills.
- (b) The minimum road surface top width shall be 10 meters (33 feet) and shall be contained entirely within the right of way.
- (c) The minimum travel surface width shall be 7.3 meters (24 feet)
- (d) The travel surface shall have a Sub-base and a base course of crushed, screened gravel. The Sub-base course shall conform to Gravel Type 2, Division 3, Section 2 of the Nova Scotia Department of Transportation and Public Works Standard Specifications. The sub-base course must be applied to a compacted depth of not less than 250 mm (10 inches).

The Base Course shall conform to Gravel Type 1, Division 3, Section 2, of The Nova Scotia Department of Transportation and Public Works Standard Specifications. Base course shall be applied to a compacted depth of not less than 150 mm (6 inches).

Compaction of Sub-base and Base gravels shall be verified by a third party testing firm, approved by the DES.

- (e) Asphalt Cement in accordance with NSDOT&PW Standard Specifications Division 4, Section 4 for Class “C” Asphalt Concrete.
- (f) Fully serviced streets constructed within a 15 meter (50 feet) right of way must be coated with an Asphalt Concrete in accordance with NSDOT&PW Standard Specifications Division 4, Section 4 for Class “C” Asphalt Concrete.
- (g) The developer shall be responsible for the following:
 - Arranging for complete inspection and testing of the installation of a street at various stages as approved by the DES.
 - Giving reasonable notice to the DES of the proposed test date, site and time.

- Allowing the DES to inspect the installation at any stage or to verify or confirm any required test.

7.2.2 Right-of-Way

.1 Minimum Widths

The minimum right-of-way width will normally be 20 m (66 feet). In most cases this right-of-way will be sufficient. However, in certain instances, the Municipality may require a greater width of right-of-way to facilitate traffic, construction and/or maintenance requirements.

A 15 meter (50 feet) Right of Way may be accepted by the Municipality where the Municipal street is fully serviced with curb, gutter, asphalt, sewer, water and stormwater systems.

.2 Drainage

Any property susceptible to damage as a result of construction must be within the right-of-way. All slopes (either in cuts or fills), which will not be eventually eliminated by changes in lot elevations, must be included within the right-of-way. All back slopes steeper than 3:1 sloping to the bottom of the ditch shall be included in the right-of-way.

.3 Acceptable Accesses

An acceptable right-of-way access to adjacent property must be provided and deeded to the Municipality. These access roads must not be more than 400 m (1310 ft) apart. These access roads will be located along the boundary in such a manner as to not prejudice development of adjacent land. The Municipality may require construction of cul-de-sac, in accordance with Section 7.2.3.2, rather than leaving provision for future access and/or temporary turning areas.

7.2.3 Road Layout

.1 General

Roads must be laid out where reasonably possible in prolongations of other roads, either in the same subdivision or in adjacent subdivisions. Unless there are unique circumstances, the minimum length of road considered for takeover by the Municipality will be 150 m (500 ft).

.2 Cul-de-Sacs

All cul-de-sacs must end in a permanent or temporary turn around area as approved by the DES. The grade of the bulb of a permanent cul-de-sac shall not exceed 4%. The maximum length of a cul-de-sac shall be 230m (750 ft). In areas lacking any existing or planned streets with which to connect, the cul-de-sac shall include prolongations, in accordance with Section 7.2.2.1, extending to adjoining parcels in locations where future street connections appear to be feasible. Where no future vehicular traffic connection is feasible, wherever possible, the end of cul-de-sacs shall include a 6 meter (20 ft.) access to abutting properties to provide potential access for emergency vehicles, municipal sewer and water services, as well as pedestrian traffic.

.3 Boulevards

Boulevards may be permitted in residential subdivisions.

.4 Guard Rail

Guard Rails are required on fills greater than 3 m (10 ft) or greater (unless a slope of 6:1 can be provided) and in other hazardous areas.

7.2.4 Intersections

.1 Intersections with Provincial Highways

Where subdivision roads meet existing classes of provincial highways, the minimum distance between these intersections shall be:

Local Roads 100 m (330 ft) Collector Roads 150 m (500 ft) Arterial Roads 300 m (1000 ft) and shall be located in such a manner as to satisfy sight distance requirements.

Within the subdivision the minimum distance between intersections of local roads will be 75 m (250 ft) measured centre line to centre line.

.2 Intersections with Local Subdivision Roads

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

.3 Offset Intersections

Minimum distance between offset intersections shall be 50m (165 ft).

7.2.5 Vertical Alignment

.1 Grades

Straight or gently rolling grades with proper vertical curves are required to provide adequate stopping sight distance in accordance to Nova Scotia Department of Transportation and Public Works. In all cases a profile will be required, showing proposed grades. In general a grade of 6% will be considered to be the maximum allowable, however, in difficult circumstances grades up to 8% may be approved. Grades in excess of 8% will only be approved in exceptional circumstances and with prior approval by the Municipality. The minimum grade shall be 0.5%. Grades at intersections shall not exceed 2% for at least 15 m (50 ft.) measured from the shoulder of the intersecting road.

.2 Vertical Curves

The vertical curve length for both sag and crest curves shall not be less than the minimum values specified by Nova Scotia Department of Transportation and Public Works.

.3 Side Slopes

Side slopes in cuts will be a minimum of 2:1 (horizontal to vertical) and 1:4 in rock cuts or as otherwise required. All embankment slopes will be 2:1 or as otherwise required should the material be less stable than normally experienced.

7.2.6 Horizontal Alignment

.1 Horizontal Curves

Horizontal curves will have a minimum horizontal curve radius of 90 m (300 ft). Horizontal curves on collector roads shall be super elevated according to the values set out by Nova Scotia Department of Transportation and Public Works: Two thirds of the super elevation shall be developed at the beginning and end of the curve, in accordance with the Transportation Association of Canada (TAC) manual.

7.3 INSTALLATION OF A DRIVEWAY ENTERANCE

All driveway entrances shall be installed in accordance with NSDOT&PW Driveway Entrances policy, procedure number PR5000.

The applicant is responsible for all aspects of construction, including but not limited to the supply of culvert pipe and backfill materials, rip rap, labour, and traffic control. Work may

be done by the applicant or a contractor engaged by the applicant, however, ultimate responsibility for installation rests with the applicant.

The applicant must notify the Department of Public Works Road Maintenance Supervisor when work is to commence. Once the driveway is completely installed, the applicant must notify the Department, to arrange for an inspection. If the Department is not satisfied with the installation, the applicant will be notified of the deficiencies and asked to correct them. A reinspection then will be required.

If the driveway is not installed properly after two inspections, the Municipality reserves the right to remove the entrance.

In addition, the applicant shall:

1. Save and hold harmless the Municipality against any and all claims for personal injury and/or property damage of whatsoever nature, both during and after the execution of work covered by this section, where, in the opinion of the Municipality, any such claim arises from the execution of the work.
2. Bear ALL damage costs during the laying of the pipe or other work undertaken to the road shoulders, curbs, ditches, culverts, pavements and other installations and all subsequent damage costs to the road/street that are, in the opinion of the Municipality, attributable to the work under this section.
3. Provide that on completion of the work, the road shoulder shall be left in a neat condition and dressed with gravel containing no stones of 20 mm (3/4 inch) in largest dimension.
4. Carry out the work in every respect satisfactory to the Municipality.